Transport Roads & Maritime Services

Oxley Highway to Kempsey EPBC 2012/6518

Condition 8 Annual Report

Document control

File name	16 0822 OH2K DoTE CoA 8 Annual Report July 2015 - July 2016
Report name	Oxley Highway to Kempsey EPBC 2012/6518 Condition of Approval 8 Annual Report 22 July 2015 – 21 July 2016
Revision number	2

Revision history

Revision	Date	Description	Approval
1	August 2016	Draft	
2	October 2016	Final	RMS
3			

Contents

1 Introduction

1.1. Purpose of this document

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

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

This report covers the second period from 22 July 2015 to 21 July 2016.

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

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

1.2. Project staging

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

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

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

1.3. Modifications to the Conditions of Approval

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

2 Conditions of Approval

2.1. Condition 1

Condition 1

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

Roads and Maritime is undertaking a progressive review of the total clearing area for the Oxley Highway to Kempsey project, incorporating the clearing for all three stages. Construction works, and hence clearing, for the Sancrox Interchange stage of the project is complete. The K2K and OH2Ku stages of the project have minor clearing remaining, including fence line clearing and clearing for utilities.

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

Table 1 Clearing quantities as at July 2016

EPBC Species	Total clearing	EPBC Condition 1
Koala	196.0470	211
Grey-headed flying fox	206.1330	232
Spotted-tail Quoll	196.1925	215
Giant-barred Frog	2.8352	7.7

2.2. Condition 2

Condition 2

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

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

Condition 2

removal of vegetation occurring in that area to ensure that the area is free of the Koala, Giant-Barred Frog, Grey-headed Flying-fox and Spotted-tail Quoll.

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

f. Clear key milestones, monitoring, performance indicators, corrective actions and timeframes for the completion of all actions outlined in the plan.

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

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

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

2.3. Condition 3

Condition 3

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

a. The **fauna crossings** must:
   - **i.** be **effective** for the Koala, Spotted-tail Quoll and/or Giant Barred Frog (the relevant species targeted to use the **fauna crossing**);
   - **ii.** provide dry passage up to a 1 in 100 year Average Recurrence Interval (ARI) event for **dedicated fauna crossings** and up to a one in 1 year 72 hour ARI event for **combined fauna crossings**;
   - **iii.** include a minimum of 11 **dedicated fauna crossings** and 30 **combined fauna crossings** for the project;
   - **iv.** not increase in length more than 10 per cent from the lengths provided in Schedule 2 of this notice, and not reduce in width and height from the values provided in Schedule 2 of this notice without the written consent of the **Minister**;
   - **v.** be bridges in **areas that are likely to benefit** the Giant-Barred Frog.

b. If a change to the **fauna crossing** design is proposed that does not meet the parameters described in Condition 3a), the person taking the action must:
   - **i.** provide evidence to the **Minister** that these will remain **effective** for the Koala, Spotted-tail Quoll or Giant-Barred Frog (as relevant for the **fauna crossing**) for the **Minister's** written approval prior to **commencement** of the **stage** relevant to that fauna crossing; or
   - **ii.** provide written evidence to the **Minister** detailing how the

Condition 3

resulting loss in connectivity will be compensated for with increased connectivity for the impacted species. This must be approved in writing by the **Minister,** prior to **commencement** of **stage 2** and **stage 3**.

c. **Fencing** must be constructed at a minimum the locations identified in Schedule 3 of this notice.

Detailed design for all fauna crossings on the project is now complete and all fauna crossings comply with the parameters listed in Condition 3(a). As such, no submissions have been made to the Minister in accordance with Condition 3(b).

Detailed design for Stage 2, Oxley Highway to Kundabung, is complete and no changes to culvert design parameters have been made during this reporting period. As such, the current fauna crossing design is as per Table 2 in Oxley Highway to Kempsey EPBC 2012/6518 Condition of Approval 8 Annual Report 22 July 2014 – 21 July 2015.

No changes have been made to the design parameters listed in Schedule 2 of the EPBC approval for Stage 3, Kundabung to Kempsey. None of the fauna crossings in Schedule 2 fall within Stage 1, Sancrox Traffic Arrangement.

Fencing will be constructed at a minimum at the locations identified in Schedule 3 of the approval. The installation of permanent fauna fencing has commenced in some areas, where it can be constructed without impeding construction works. Temporary fauna fence has also been constructed where there has been determined to be a potential risk of fauna strike during construction or where minor gaps exist between sections of permanent fauna fence, until the permanent fence can be completed. These areas include:

- Ch. 21500 – 21800 (northbound)
- Ch. 21500 – 21650 (southbound)
- Ch. 24400 – 24700 (northbound)
- Ch. 25000 – 25950 (southbound)
- Ch. 25800 (northbound)
- Ch. 26200 – 26450 (northbound)

Additional permanent fauna fence is also proposed to be installed at the following locations:

- Ch. 2630 – 2980 (southbound) (subject to landowner agreement on design)
- Ch. 3150 – 3340 (southbound) (subject to landowner agreement on design)
- Ch. 3340 – 3418 (southbound)
- Ch. 8520 – 8800 (northbound)
- Ch. 18050 – 18470 (southbound)
- Ch. 18250 – 19500 (northbound)
- Ch. 19180 – 19500 (southbound)

2.4. Condition 4

Condition 4

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

a. The baseline data collected from surveys undertaken by a **suitably qualified expert** on the Koala, Spotted-tail Quoll and Giant-Barred Frog within all habitat areas outside areas to be cleared of vegetation for the proposed action, that are likely to contain these species and that are likely to be adversely impacted by the action (as determined by a **suitably qualified expert**).The data must address the densities, distribution, habitat use and movement patterns of these species;

b. The methodology to be implemented for the ongoing monitoring of road kill, the species densities, distribution, habitat use and movement patterns, and the use of **fauna crossing** during construction and operation of the action, including the timing, and duration of the methodology;

c. Goals and performance indicators to measure the success of proposed **fauna crossings**, which must be specific, measureable, achievable, realistic and timely (SMART), and be compared against baseline data described in condition 4a)

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

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

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

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

2.5. Condition 5

Condition 5

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

a. the identification of the portions of the lands described as the "Proposed Biodiversity Offset Areas" in the Map at Schedule 1 of this notice that are necessary to achieve the outcomes required by the *Environmental Offsets Policy 2012* (or subsequent

Condition 5

published revisions). This must include **offset attributes**, **shapefiles**, textual descriptions and maps to clearly define the location and boundaries of the offset area(s);

b. the results of targeted field surveys within the offset sites (undertaken at any ecologically appropriate time of the year) to assess and describe habitat suitability and presence / absence of individuals in relation to the Koala, Grey-headed Flying-fox, Spotted-tail Quoll and Giant Barred frog;

c. an assessment of the baseline population for the Koala, Spotted-tail Quoll, Giant-Barred Frog, and Grey-headed Flying-fox which are detected within the offset area during field surveys;

d. a description of the current **quality** (prior to any management activities) of the offset area(s) identified in Condition 5a with reference to the Koala, Spotted-tail Quoll, Giant-Barred Frog, and Grey-headed Flying-fox;

e. an assessment demonstrating how the offset area(s) achieve the outcomes required by the *Environmental Offsets Policy 2012* (or subsequent published revisions) and user guide;

f. Should the offset sites identified in 5a not be sufficient to achieve the outcomes required by the *Environmental Offsets Policy 2012* (or subsequent published revisions) and user guide, as determined in writing by the **Minister**, the person taking the action must provide further suitable offset sites and include these as part of the **BOMP**;

g. information about the Koala, Grey-headed Flying-fox, Spotted-tail Quoll, Grey-headed Flying-fox, and Giant Barred frog (in relation to ecology, biology and conservation status) to inform appropriate management actions;

h. targeted management actions, regeneration and revegetation strategies to be undertaken on the offset area(s) to improve the ecological quality of these areas for the Koala, Grey-headed Flying-fox, Spotted-tail Quoll and Giant Barred frog

i. clear performance objectives for management actions that will enable maintenance and enhancement of habitat within the offset area, as well as contribute to the better protection of individuals and / or populations of Koala, Spotted-tail Quoll, Giant-Barred Frog, and Grey-headed Flying-fox onsite;

j. anticipated timeframes for achieving performance objectives.

k. performance and completion criteria for evaluating the management of the offset area, including contingency actions, criteria for triggering contingency actions and a commitment to the implementation of these actions in the event that performance objectives are not met;

l. a program to monitor and report on the effectiveness of these measures, and progress against the performance and completion criteria;

m. details of who would be responsible for monitoring, reviewing, and implementing the **BOMP**.

n. a description of funding arrangements or agreements including work programs and responsible entities;

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

The approved BOMP must be implemented.

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

2.6. Condition 6

Condition 6

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

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

2.7. Condition 7

Condition 7

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

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

2.8. Condition 8

Condition 8

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

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

The 2015/16 annual report was published to the project website and evidence of proof of the date of publication send to the Department in an email dated 22 October 2015. The 2015/16 report, and this report once published, can be found at the following link:

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

2.9. Condition 9

Condition 9

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

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

2.10. Condition 10

Condition 10

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

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

2.11. Condition 11

Condition 11

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

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

2.12. Condition 12

Condition 12

If the person taking the action wishes to carry out any activity otherwise than in accordance with

Condition 12

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

Roads and Maritime has submitted an update of the Ecological Monitoring Plan to the Department for approval on 3 May 2016. Approval from the Department remains outstanding. Some aspects of the revised plan have already been implemented, due to the provisions of the previous plan having been found to be unachievable. This has been discussed with the Department as part of the submission of the updated EMP, and was considered preferred to the alternatives, which included, for example, accessing private land for surveys without landowner permission.

The approved versions of the Flora and Fauna Management Plans are currently being implemented, as no updates to these plans have been submitted to the Department for approval.

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

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

2.13. Condition 13

Condition 13

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

Noted.

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

2.14. Condition 14

Condition 14

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

Commencement of the action occurred on 22 July 2014.

2.15. Condition 15

Condition 15

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

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

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

3 Biodiversity Offset Management Plan

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

Roads and Maritime is currently responding to comments from the Department on the BOMP. Responses to these comments are currently being finalised, and the BOMP is due to be re-submitted shortly.

4 Ecological Monitoring Plan

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

Table 2 Ecological monitoring requirements during the last reporting period

Species monitored	Timing
Koala	Spring/Summer
Giant Barred Frog	Spring, Summer and Autumn
Road kill	Daily during, and one month post, clearing
	Weekly during construction
Pre-Clearing / Clearing	Pre- and during clearing

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

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

Table 3 EPBC monitoring reports in Appendix B

Species monitored	Report title in Appendix B
Giant Barred Frog spring, summer and autumn monitoring	Giant Barred Frog 2015-16 Monitoring Report Oxley Highway to Kempsey Pacific Highway Upgrade
Road kill construction monitoring conducted in this reporting period	Road Kill Report 2015/16 Oxley Highway to Kempsey Pacific Highway Upgrade
Koala Spring/Summer (Year 1) monitoring	Koala Monitoring – Year 1 Surveys Oxley Highway to Kempsey Pacific Highway Upgrade

Table 4 outlines the monitoring requirements for the remainder of Year 2 (2016) that did not fall within this reporting period, and as such will be reported in the 2016/17 annual report.

Table 4 Remaining monitoring requirements for Year 2

Species monitored	Timing
Giant Barred Frog	Spring
	Summer
Koala	One monitoring event in Spring / Summer

Clearing for Stage 2 and Stage 3 is ongoing (with Stage 2 clearing (clearing of the western side of the alignment following traffic switches onto the new southbound carriageway) commencing for both stages of the project in August 2016). As such, the report detailing the results of the pre-clearing and clearing monitoring and mitigation measures will therefore be prepared at the completion of all clearing, and is likely to be included in the 2016/17 annual report.

5 Flora and Fauna Management Plans

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

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

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

The Stage 1 Flora and Fauna Management Plan does not have a separate table for EPBC management measures, and as such Appendix A focusses on the relevant EPBC measures in Table 5.1. Note that the construction of Stage 1 was completed in November 2015.

Appendix A Flora and Fauna Management Plans

Stage 1: Sancrox Traffic Arrangement

ID	Measure / Requirement	Resources needed	When to implement	Responsibility	Reference	Compliance Status
FF1.	Training will be provided to all project personnel, including relevant sub-contractors on flora and fauna requirements from this plan through inductions, toolboxes and targeted training. Flora and fauna training requirements will be as per Section 6.2 of this plan.		Pre-construction	ESR	CoA B.31(b)(iii) G36 Sections 6.9 and 6.10 Appendix F – Pre-clearing Checklist Appendix G – Working Around Trees Guidelines Appendix H – Fauna Handling and Rescue Procedure Appendix I "Unexpected Threatened Species /EECs Procedure Appendix J – Weed and Plant Pathogen Management Plan	Training is provided to all project personnel through the induction, which includes fauna mitigation requirements. Toolboxes and targeted training is also undertaken for those personnel with specific environmental responsibilities, or those involved in activities with an environmental risk. Stage 1 was completed in November 2015. No training has been required since this time.
FF2.	Any works required outside the construction footprint verified in accordance with CoA B31(b)(i) will be referred to the Environment Manager for advice on further assessment and approval requirements in accordance with Section 7.2 of this plan and Section 3.7 of the CEMP. All construction activities that require the clearing of native vegetation shall comply with the requirements of the Department of the Environment Condition of Approval 1.		Construction – prior to any related works commencing	Site Engineer ESR	CoA B31(b)(i) G36 Section 6.9 DoTE CoA 12	Clearing is now complete on the project. All clearing complied with the requirements of the Department of the Environment Condition 1. No works have necessitated the need for an update to the FFMP, as outlined in Section 7.2 of the FFMP. There have been a number of general changes, as per Section 3.7.1 of the CEMP, which have been documented as consistent with the Project Approval. No modifications have been sought within the last reporting period. No additional ancillary facilities or stockpile sites have been proposed for assessment under Section 3.7.2 and 3.7.3 of the CEMP.
FF3.	In the event that threatened species or EECs are unexpectedly identified during construction the Unexpected Threatened Species /EECs Procedure will be followed.		Construction	ESR Site Engineer	CoA B31(b)(viii) Appendix I of this CFFMP	No unexpected threatened species or EECs have been identified on the project.
FF4.	A Project ecologist / suitably qualified expert will be appointed prior to the commencement of construction.		Pre-construction	Q & E Manager/ESR	B31(b)(iii)	The Project Ecologist (who meets the definition of a 'suitably qualified expert' in EPBC 2012/6518) was engaged on 13 May 2014. Construction commenced on 22 July 2014.
FF5.	The Ecological Monitoring Program will be implemented.	Ecological survey	Construction Operation	Q & E Manager/ESR	CoA B10 SoC F21 DoTE CoA 2 Clause 4.3.1 of this CFFMP Appendix H – Fauna Handling and Rescue Procedure Appendix I "Unexpected Threatened Species /EECs Procedure	See Section 4.
FF6.	The limits of clearing are to be clearly marked on all relevant work plans and protective fencing to mark these limits (ie 'no-go' areas) surrounding the construction footprint installed prior to vegetation clearing activities occurring. The limits of clearing will be marked in accordance with Guide 2 of the Roads and Maritime *Biodiversity Guidelines*.	Roads and Maritime Biodiversity Guidelines Roads and Maritime Practice Note: Clearing and Fauna Management – Pacific Highway Projects (May 2012)	Pre-Construction Then daily inspection during clearing and grubbing and weekly thereafter	Site Engineer ESR/Supervisor	EA SoC F2 CoA B31(b)(iii) G36 Section 6.9 G40 Section 2.4 DoTE CoA 2b and 2c	Clearing was completed during the previous reporting period, and the results reported in the Sancrox Post Clearing Fauna Management Report in Appendix B of the 2014/15 Annual Report.
FF7.	Prior to vegetation clearing, a suitably qualified ecologist will survey all areas to be cleared and will mark out any areas of significant vegetation (EECs, threatened species,) to be fenced and protected, in accordance with the		Pre-Construction	ESR Project Ecologist	CoA B31(b)(iii) DoTE CoA 2d *Appendix F: "Pre clearing*	Clearing was completed during the previous reporting period, and the results reported in the Sancrox Post Clearing Fauna Management Report in Appendix B

ID	Measure / Requirement	Resources needed	When to implement	Responsibility	Reference	Compliance Status
	methodology outlined in Section 4.3.1. Areas of weed infestation will also be identified and documented. These works will be limited to the time required to satisfactorily complete these activities.				*checklist"*	of the 2014/15 Annual Report.
FF8.	Seed will be collected from all areas of native vegetation to be cleared from the construction footprint prior to and during clearing and seed will be stored for use in revegetation works where feasible. Where sufficient seed cannot be collected from the alignment, local native seed would be purchased for landscaping. Seed will be stored in a cool, dry, vermin proof, air conditioned storage area at a temperature suitable to minimise deterioration of the seed		Pre-Construction	ESR Project Ecologist	CoA B31(b)(iii)	Landscaping has been completed on the project, and is currently being maintained. See previous annual report for discussion on seed collection.
FF9.	Native vegetation cleared from the construction footprint will be mulched and used along with retained topsoil for reuse in rehabilitation works and erosion control. Mulch and topsoil will not be stockpiled in 'no-go' areas and cleared vegetation will not be pushed into 'no-go' areas.	Roads and Maritime Environmental Direction No.25 – Management of Tannins from Vegetation Mulch	Construction	Site Engineer ESR/ Supervisor	EA CoA B31(b)(iii) SoC F5 Refer to CSWMP	Mulch was used extensively across the site for erosion and sediment controls including perimeter bunds. No mulch or topsoil was stockpiled in 'no-go' areas.
FF10.	Revegetation/rehabilitation of all areas disturbed as part of the Project that do not form part of permanent pavement or structures will be undertaken progressively during and following construction to maintain and enhance habitat, particularly in identified regional corridors and key habitat areas. Native revegetation and rehabilitation will be conducted between Ch. 140 – 900. Revegetation/rehabilitation would meet the following milestones: • On slopes 3:1 or flatter where earthworks requiring revegetation have been completed over an area exceeding one hectare, revegetation will be carried out within 14 days. • On slopes steeper than 3:1 where earthworks requiring revegetation have been completed over an area exceeding one hectare, revegetation will be carried out within 7 days. • Open drains will be revegetated within 7 days of excavation. Soil and erosion controls for any area will remain in place for six months or until 70% vegetation cover is achieved within the catchment of the controls. Non-compliance with these milestones would be addressed in accordance with the processes outlined in Section 8.6 of the CEMP. Completion of all landscaping works is a requirement of construction completion, currently scheduled to be 80 weeks after the commencement of the contract. This timeframe is subject to construction delays due to weather and other unforseen construction difficulties.		Construction	Site Engineer	G36 Clause 6.9 EA CoA B31 (b)(iii) SoC F5	Revegetation / rehabilitation of disturbed areas is complete throughout the project. See Image 1.
FF11.	Native and locally indigenous plants are to be used in the landscaping and revegetation areas.		Construction	Site Engineer ESR	EA SoC F5 Project landscape drawings	Native and locally indigenous plants were selected for revegetation to address Objective 2 of the Urban Design and Landscape Plan, which states: The landscaping should be integrated into the local vegetation character and communities by continuing bands and groups of existing vegetation. Landscaping works are complete, and are currently being maintained.
FF12.	Revegetation works will include planting of preferred food trees for native fauna, including appropriate eucalypt species for the Koala and Allocasuarina spp. for the Glossy Black-cockatoo, and winter flowering trees for birds and arboreal mammals.		Construction	ESR	EA DoTE CoA 2b Refer landscape drawings This CFFMP	Eucalypt species for the koala were included within the planting schedule, including Tallowwood and Forest Red Gum. *Allocasuarina torulosa* has been included within the tall shrub mix. Winter flowering trees for birds and arboreal mammals, such as gliders and flying foxes, were also included in the tree planting schedule.
FF13.	Weeds will be managed in accordance with the Weed Management Plan.		Construction	Site Engineer ESR	EA G36 Section 6.9 CoA B31(b)(iii) SoC F8 Appendix J - Weed and Plant Pathogen Management Plan DoTE CoA 2a	Plant & machinery is certified as being clean and free from weeds and pathogens when it arrives at site, through the Plant Pre-Commencement Checklist, and through certification letters from the plant subcontractors. Maintenance history reports also demonstrate that plant has been washed down. Weed control is being undertaken as part of the landscape maintenance and monitoring.
FF14.	Any threatened plants identified within and immediately adjacent to the limits of clearing will be located and tagged. Threatened plants in proximity to the footprint that are to be retained are to be fenced during construction and identified to	*Roads and Maritime Environmental Direction No.25 – Management*	Pre-Construction	ESR	EA SoC F9 DoTE CoA 2b	There are no known threatened plants within the vicinity of the Sancrox project.

ID	Measure / Requirement	Resources needed	When to implement	Responsibility	Reference	Compliance Status
	construction workers during site induction.	*of Tannins from Vegetation Mulch*			EWMS – Clearing and grubbing Appendix 3 – procedure for protecting threatened flora species and trees marked for preservation	
FF15.	If reasonable and feasible, threatened plant species that are to be directly impacted will be translocated to suitable habitat prior to vegetation clearing in consultation with EPA.		Pre-Construction	Project Ecologist ESR	EA SoC F10	There are no known threatened plants within the vicinity of the Sancrox project.
FF21.	The Nest Box Plan will be implemented.		Pre-Construction	ESR	EA CoA B7 SoC F16 Appendix A – Nest Box Plan	As per Section 4.1 of the Nest Box Plan, no nest boxes are proposed as part of the Sancrox Traffic Arrangement Project. However, land adjacent to Sancrox has been used to accommodate nest boxes for Stage 3 of the project.
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.		Pre-Construction Construction	Site Engineer ESR, Supervisor	EA CoA B31(b)(iii) Appendix F of this CFFMP Appendix I of this CFFMP DoTE CoA 2e	Clearing was completed during the previous reporting period, and the results reported in the Sancrox Post Clearing Fauna Management Report in Appendix B of the 2014/15 Annual Report.
FF24.	A suitably qualified expert will undertake preclearance surveys for native fauna immediately prior to clearing activities. Searches will be undertaken on nests, hollow bearing trees, logs, existing culverts and bridges. Searches will take place no earlier than 48 hours prior to the removal of vegetation occurring in that area to ensure that the area is free of the Koala, Grey-headed Flying-fox, Spotted-tail Quoll and other hollow dwelling species.	Roads and Maritime Practice Note: Clearing and Fauna Management – Pacific Highway Projects (May 2012)	Pre-Construction Construction	Project Ecologist	EA CoA B31(b)(i) Appendix H of this CFFMP DoTE CoA 2d	Clearing was completed during the previous reporting period, and the results reported in the Sancrox Post Clearing Fauna Management Report in Appendix B of the 2014/15 Annual Report.
FF26.	During the proposed clearing works, the Project Ecologist/suitably qualified expert or an experienced wildlife handler under the supervision of the Project Ecologist will be present to retrieve and provide appropriate care of any displaced fauna and release the fauna into adjacent habitats safe from construction work.		Construction	Site Engineer, ESR, Supervisor, Project Ecologist	CoA B31(b)(i) DoTE CoA 2d and 2e Refer to Appendix H "Fauna Handling and Rescue Procedure"	Clearing was completed during the previous reporting period, and the results reported in the Sancrox Post Clearing Fauna Management Report in Appendix B of the 2014/15 Annual Report.
FF27.	Clearing will be undertaken in accordance with the process described in Guide 4 of the Roads and Maritime Biodiversity Guidelines. A two-stage clearing process will be implemented in all areas supporting identified fauna habitat such as hollow bearing trees, habitat trees and bushrock. • Non-habitat trees will be removed before habitat trees, allowing fauna an opportunity to move from the habitat trees. • Habitat trees will be left overnight from the time of the felling of the non-habitat trees nearby; and • Felled (habitat) trees will be left for a short period of time (ie at least one hour) on the ground, to give any fauna remaining in the trees an opportunity to escape before further processing of the trees occurs. The Project Ecologist/suitably qualified expert or wildlife handler will inspect the felled trees for resident species or injured wildlife. These will then be treated or relocated.	Roads and Maritime Biodiversity Guidelines Roads and Maritime Practice Note: Clearing and Fauna Management – Pacific Highway Projects (May 2012)	Construction	ESR, Supervisor Project Ecologist	EA CoA B31(b)(iii) DoTE CoA 2d	Clearing was completed during the previous reporting period, and the results reported in the Sancrox Post Clearing Fauna Management Report in Appendix B of the 2014/15 Annual Report.
FF28.	Contact details for local NPWS officers, FAWNA, RSPCA, the Port Macquarie Koala Hospital and local veterinary hospitals will be maintained and kept at a convenient location on the Construction Site and must be available to the relevant management and supervisory personnel at all locations where clearing is being undertaken, to enable quick contact in the event of a fauna rescue.		Construction	Site Engineer, Supervisor, ESR Project Ecologist	SoC F14 DoTE CoA 2e	The Clearing and Grubbing Environmental Work Method Statement contains the contact details for the Port Macquarie Koala Hospital, FAWNA & the EPA. The EWMS is toolboxed to all relevant staff and readily accessible at the main site compound. Stage 1 was completed in November 2015. No toolboxing on this EWMS has been required since this time.
FF29.	Fauna exclusion fencing (e.g. floppy-top fencing) will be erected at locations identified in Schedule 3 of the Department of the Environment approval. Where fencing is installed after traffic is diverted onto the new Pacific Highway, but prior to construction completion, the fencing shall be monitored weekly. In the operational phase of the project, fauna fence is routinely inspected as part of general road maintenance asset inspection every three months.		Construction Operation (No fauna fencing identified in Sancrox Traffic Arrangement Project)	Site Engineer, Supervisor, ESR	EA SoC F19 DoTE CoA 3	No fauna exclusion fencing is being constructed as part of the Sancrox project. The fauna fencing shown in Schedule 3 of the Department of the Environment approval in the vicinity of the Sancrox project is part of Stage 3 construction works.
FF30.	Habitat features and resources for native fauna (such as hollow logs and bush rocks) will be distributed along the route of the Project where feasible and reasonable. Such relocation will be undertaken so as to limit damage to existing vegetation and would not occur in good condition remnant vegetation. This	Roads and Maritime Biodiversity Guidelines	Construction	Site Engineer ESR	EA SoC F4 DoTE CoA 3	Clearing was completed during the previous reporting period, and the results reported in the Sancrox Post Clearing Fauna Management Report in Appendix B

ID	Measure / Requirement	Resources needed	When to implement	Responsibility	Reference	Compliance Status
	measure will be implemented consistent with Guide 5 of the Roads and Maritime Biodiversity Guidelines.					of the 2014/15 Annual Report.
FF31.	The fauna connectivity measures outlined in the Department of the Environment Condition of Approval 3 shall be implemented.		Construction	Site Engineer, Supervisor, ESR	CoA B1, B2, B3, B4, B5 DoTE CoA 3	None of the fauna connectivity measures outlined in Condition 3 of the Department of the Environment approval fall within the Sancrox stage of the project.
FF32.	Permanent water quality control measures will be installed as early as possible in the construction program and at least prior to construction completion, currently scheduled to be 80 weeks after the commencement of the contract. This timeframe is subject to construction delays due to weather and other unforseen construction difficulties. Temporary controls will be installed in accordance with SW25.		Construction	Site Engineer	SoC F7 DoTE CoA 2b	Permanent water quality control measures have been installed as part of the finalisation of construction works.
FF33.	Waterways will be protected from sediment impacts during construction, in accordance with the SWMP mitigation measures included below (denoted by the 'SW' ID reference). Measures designed specifically to protect aquatic flora and fauna may include: Construction of temporary diversions.		Construction	Supervisor, Site Engineer-ESR	DoTE CoA 2b	No temporary waterway diversions were required during this reporting period.
FF35.	Existing trees, grasses and ground cover will be retained within 15 metres of watercourses until immediately before construction commences in that area (ie 48 hours). All trees in these areas will be felled manually, leaving grasses and small understory species wherever possible.		Construction	Site Engineer, Supervisor, ESR	G40 Clause 2.4 Note Class 3 Waterway only located in Sancrox Project area	Clearing was completed during the previous reporting period, and the results reported in the Sancrox Post Clearing Fauna Management Report in Appendix B of the 2014/15 Annual Report.
SW1	The potential for erosion during the construction of the Project will be appropriately managed in accordance with the measures contained within Managing Urban Stormwater: Soils and Construction Volume 1 (Landcom 2004) and Managing Urban Stormwater: Soils and Construction Volume 2D, Main Road Construction (DECC 2008b).		Pre-construction Construction	Site Engineer/ESR	G38 Good practice EA 20.3.4 CoA C17 CoA 2b, CoA 2c	The project prepared Progressive Erosion and Sediment Control Plans for each area of the site, in accordance with the Blue Book. Stage 1 was completed in November 2015. No Progressive Erosion and Sediment Control Plans have been required since this time.
SW10	The following EWMS will be prepared and implemented to manage soil and water impacts. EWMS for activities identified as having high environmental risk will undergo a period of consultation with EPA and DPI Fishing and Aquaculture. The EWMS is to provide detailed guidance on construction methodologies, with the input of construction personnel, to meet the requirements of the FFMP, specifically they detail the controls to be implemented, responsibilities, location and timing and detail on how to implement. Those marked with an asterisk below are those likely to be subject to consultation: • Temporary waterway crossings. • Site compound establishment. • Public road accesses and managing mud tracking. • Clearing and grubbing. • Sediment basin design, construction and management*. • Dewatering*. • Piling. Where in stream works are to take place, specific work method statements will be developed in consultation with relevant government agencies.		Pre-construction Construction	Supervisors/ESR	G38 SoC SGW4 CoA 2b	A specific environmental work method statement was not prepared for site compound establishment, however this was the subject of a specific Erosion and Sediment Control Plan. The management of mudtracking has been covered in the General Earthworks EWMS. All other environmental work method statements have been prepared and implemented as per the list in SW10. Stage 1 was completed in November 2015. The implementation of these EWMSs ceased at this time.
SW17	Works will be programmed to minimise the extent and duration of disturbance to vegetation.		Pre-construction Construction	Site Engineer/Site Supervisor	G38 SoC VAD4 and F5 CoA 2b	Works were programmed to minimise the extent and duration of disturbance to vegetation, including staged clearing and progressive rehabilitation.
SW25	Catch drains, contour and diversion drains across exposed areas will be installed within 24 hours and prior to forecast rain events following clearing, and re-established and maintained during topsoil removal and earthwork operations.		Construction	Supervisors	G38 CoA 2b	Erosion and sediment controls were progressively installed as per the erosion and sediment control plans, and re-established as required.
SW28	Erosion and sediment control structures will remain installed and maintained until sufficient vegetative cover is achieved (ie for a period of up to six months or until vegetation cover achieves 70%).		Construction	Supervisors	CoA 2c Good practice	Erosion and sediment controls that are currently installed, awaiting permanent vegetation stabilisation, have been in place for six months, and in addition, will remain in place until vegetation cover achieves 70%.
SW35	Where temporary crossings are required, these will be designed, constructed and maintained in accordance with Managing Urban Stormwater Soils and Construction Volumes 2A and 2D Main Road Construction (DECC 2008) and section 5.3.4 of the guideline Managing Urban Stormwater 4th edition March 2004, Volume 1 Soils and Construction and subject to the preparation of an		Construction	ESR/Site Engineer/Supervisors	G36 CoA B31d (iii) SoC F17 CoA 2b and 2c	Temporary waterway crossings were designed, constructed and maintained in accordance with this requirement. All temporary waterway crossings have been removed, following the finalisation of permanent culvert structures.

ID	Measure / Requirement	Resources needed	When to implement	Responsibility	Reference	Compliance Status
	EWMS identified in SW10 and SW34. Temporary crossings will: • Be 'fish friendly' with a lower section of the temporary crossing provided to act as an emergency spillway. • Be used for the shortest time required to complete their designed operational function and affected riparian vegetation will be rehabilitated as soon as possible to existing or better condition. • Use material that will not result in fine sediment material entering the waterway. Where rock crossings are used, the rock will be of suitable size to prevent/reduce the likelihood of the material being washed away in a storm or flood event, with large sized rock on the lower side of crossings where water velocity increases.					
SW36	Scour protection will be installed at the base of permanent and temporary drainage outlets, and will be integrated where feasible into current banks to minimise impacts.		Construction	Project Manager/Site Engineer	G36 G38 CoA B21c SoC SGW8 CoA 2b and 2c	Scour protection is installed at the base of temporary drainage outlets, where required to prevent erosion. All permanent drainage outlets have scour protection.
SW37	Drainage works will be stabilised against erosion by appropriate selection of channel dimensions, slope and lining, and the inclusion, if necessary, of drop structures and energy dissipaters.		Construction	Project Manager/Site Engineer	G38 CoA B21c CoA 2b	Onsite, drainage works can be found to be the appropriate width, depth and slope to prevent erosion, in accordance with the design. Post-operation amendments were made to two drains during this reporting period, where the design of the drains was insufficient to prevent erosion.
SW38	Culverts and permanent stream protection measures will be installed as early as possible in the construction program to facilitate transverse drainage during the early stages of construction.		Construction	Supervisors	G38 SoC F7 CoA 2b	Culverts and permanent stream protection measures are now complete across the project.
SW45	A number of temporary sedimentation basins for construction phase, will be converted to provide operational phase water quality management.		Construction	Project Manager/Site Engineer	EA 6.4.15, 13.4.1 CoA 2b	Operational phase water quality basins are not required, due to the proximity of sensitive receiving environments. As such, temporary sediment basins have been decommissioned and rehabilitated following use during construction.
SW50	Sediment basins will be retained for a minimum of six months or until a 70% vegetative cover is achieved in its catchment; other satisfactory controls are in place and approved by the EM or the basin is otherwise redundant.		Construction/post construction	Project Manager/Site Engineer	Good practice CoA 2b	All sediment basins were commissioned and decommissioned during the previous reporting period. A discussion on these basins can be found in the 2014/15 Annual Report.
SW65	Erosion and sediment controls will be inspected at least daily (with maintenance and/or modifications made as necessary). Inspections and/or maintenance during wet-weather maybe increased where necessary.		Construction	Supervisors	SoC GS1 Good practice CoA 2b	Informal inspections were undertaken daily during construction, by the environmental team and/ or the foreman/ leading hand. Inspections were conducted by the environment team weekly, and during and post-rainfall. Roads and Maritime and the Project Environmental Representative conducted fortnightly inspections, and agency representatives from the EPA and the Department of Primary Industries (Fishing and Aquaculture) conducted monthly inspections.
SW66	A Project soil conservation specialist will inspect the work areas, assess drainage and riparian conditions, prepare erosion and sediment control plans and provide advice to the Project team to maintain a high standard of erosion and sediment practices on site. Inspections will be undertaken typically on a fortnightly basis, or as required where high-risk activities are proposed, or where sensitive areas have the potential to be affected eg SEPP 14 wetland, heritage sites.		Pre-construction/Construction	Soil Conservation Specialist ESR	Good practice SoC GS1 CoA 2b	A project soil conservationist conducted weekly inspections of the site and prepared erosion and sediment control plans.
SW67	Watercourse bed and banks to be monitored weekly and post rainfall during construction for indications of instability. Attention to monitoring for channel erosion will be completed during and following higher than normal flow conditions. Protection measures will be installed should increase intensity or erosion be identified. Where increased intensity or erosion is identified that may have an impact on EPBC species or their habitat, these will be rectified within 5 days. If there is an immediate risk of impact on EPBC Act listed species, temporary rectification works will occur within 1 day.		Pre-construction/Construction	Soil Conservation Specialist ESR	EA 12.4.4 CoA B30e(ii) CoA 2b	Informal inspections were undertaken daily during construction, by the environmental team and/ or the foreman/ leading hand. Inspections were conducted by the environment team weekly, and during and post-rainfall. Roads and Maritime and the Project Environmental Representative conducted fortnightly inspections, and agency representatives from the EPA and the Department of Primary Industries (Fishing and Aquaculture) conducted monthly inspections. No increased intensity or erosion was identified during

ID	Measure / Requirement	Resources needed	When to implement	Responsibility	Reference	Compliance Status
						these inspections that required action / rectification.
FF37.	Washing procedures will be implemented to ensure that insect pests and their eggs/larvae are not present on equipment. The washing procedure will be undertaken in accordance with the process described in Guide 7 of the Roads and Maritime Biodiversity Guidelines.	Roads and Maritime Biodiversity Guidelines	Construction	Site Engineer, Supervisor, ESR	EA Appendix J of this CFFMP DoTE CoA 2a	Plant & machinery was certified as being clean and free from weeds and pathogens when it arrived at site, through the Plant Pre-Commencement Checklist, and through certification letters from the plant subcontractors. Maintenance history reports also demonstrated that plant had been washed down. Stage 1 was completed in November 2015. The implementation of washing procedures has not been required since this time.
FF38.	The spread of bacteria, viruses and diseases such *as Phytophthora cinnamomi*, amphibian chytrid fungus and beak and feather disease will be addressed through washing of equipment. The washing procedure will be undertaken in accordance with the process described in Guide 7 of the Roads and Maritime Biodiversity Guidelines.	Roads and Maritime Biodiversity Guidelines	Construction	Site Engineer, Supervisor, ESR	EA CoA B31(b)(iii) Appendix J of this CFFMP DoTE CoA 2a	Plant & machinery was certified as being clean and free from weeds and pathogens when it arrived at site, through the Plant Pre-Commencement Checklist, and through certification letters from the plant subcontractors. Maintenance history reports also demonstrated that plant had been washed down. Stage 1 was completed in November 2015. The implementation of washing procedures has not been required since this time.

Stage 2: Kundabung to Kempsey

EPBC CoA	Related Table 5-1 ID	Management Measure and/or Evidence of Compliance	Performance Indicator/Target	Timeframe	Responsibility	Compliance Status
CoA 2a.	FF13	Weeds will be managed in accordance with the Weed and Pathogen Management Plan (Appendix K).	**Performance indicator:** As per Weed and Pathogen Management Plan (Appendix K) **Performance target:** Completion of all mitigation measures outlined in the Weed and Pathogen Management Strategy within the prescribed timeframes.	As per Weed and Pathogen Management Plan (Appendix K).	Environmental Manager	A baseline noxious weed survey was conducted during the pre-construction surveys. The full results of which will be outlined in the Pre-Clearing / Clearing Report for this stage, to be included in the 2016/17 Annual Report (due to the fact that clearing is ongoing). All Class 3 noxious weeds identified during the survey (groundsel bush and coral tree) were sprayed in accordance with the Weed and Pathogen Management Plan, and recorded on weed spraying sheets. The Chytrid Fungus washdown procedure has been implemented at the known area of Chytrid infestation (Smiths Creek). This includes the washing down of both footwear and machinery entering this area using a disinfecting agent. Chytrid Fungus has also recently been identified at Pipers Creek, and as such, the procedure will be implemented in this area if required (construction works are largely complete in this area). Weed monitoring is part of the weekly environmental checklist.
	FF37	Washing procedures will be implemented to ensure that insect pests and their eggs/larvae are not present on equipment. The washing procedure will be undertaken in accordance with the process described in Guide 7 of the Roads and Maritime *Biodiversity Guidelines*.	**Performance indicator:** Washing procedures implemented in accordance with Guide 7 of the Roads and Maritime Biodiversity Guidelines. **Performance target:** All plant and equipment is washed in accordance with Guide 7 of the RMS Biodiversity Guidelines prior to exiting known areas of pathogens	Immediately prior to exiting known areas of pathogens.	Environmental Manager Project Ecologist / suitably qualified expert	All machinery is washed down at the main compound before it enters site, to prevent the spread of insect pests and larvae. This is recorded on the plant checklist as the plant arrives at site. Prior to leaving Smiths Creek and before moving to other areas of site, all plant and footwear are washed down with a disinfecting agent.
	FF38	The spread of bacteria, viruses and diseases such as *Phytophthora cinnamomi*, amphibian chytrid fungus, myrtle rust and beak and feather disease will be addressed using the processes described in Weed and Pathogen Management Plan (Appendix K).	**Performance indicator:** As per Weed and Pathogen Management Plan (Appendix K) **Performance target:** Completion of all mitigation measures outlined in the Weed and Pathogen Management Strategy within the prescribed timeframes.	As per Weed and Pathogen Management Plan (Appendix K).	Environmental Manager	The Chytrid Fungus washdown procedure has been implemented at the known area of Chytrid infestation (Smiths Creek). This includes the washing down of both footwear and machinery entering this area using a disinfecting agent. Chytrid Fungus has also recently been identified at Pipers Creek, and as such, the procedure will be implemented in this area if required (construction works are largely complete in this area). *Phytophthora cinnamomi* was found to be present across the entire length of the site. As such, the process described in the Weed and Pathogen Management Plan (which predominantly focuses on preventing the spread throughout the site) is not considered relevant. Despite this, machinery is washed down prior to it leaving site.
CoA 2b.	FF10	Revegetation/rehabilitation of all areas disturbed as part of the Project (that do not form part of permanent pavement or structures) will be undertaken progressively during construction to maintain and enhance key habitat areas in order to minimise the impact on Koala, Grey-headed flying fox, Spotted-tail Quoll and Giant Barred Frogs.	**Performance indicator:** Stabilisation of disturbed areas following completion of the works within that area. **Performance Target:** Stabilisation of all disturbed areas within 14 days of completion of the works within that area.	14 days after the completion of works within an area.	Environmental Manager Construction Manager Project/ Site Engineer	Revegetation/rehabilitation is being undertaken progressively throughout the site. See image 2.
	FF9	Native vegetation cleared from the construction footprint will be mulched and used along with retained topsoil for reuse in rehabilitation works and erosion control, as merchantable timber or for fauna habitat where appropriate.	**Performance indicator:** Use of timber as a result of clearing in rehabilitation works and erosion and sediment control (mulch), as merchantable timber or for fauna habitat, where appropriate. **Performance target:** Mulch is utilised for rehabilitation works in all areas nominated in the landscape plans and for erosion and sediment controls.	Daily (or as required).	Environmental Manager Construction Manager Project/ Site Engineer	Merchantable timber recovered from State Forest areas was transferred to the Forestry Corporation, and suitable fauna habitat was relocated to adjacent vegetation. Some timber was recovered for use as fauna furniture in combined and dedicated fauna underpasses. The remaining vegetation was mulched and the majority is being used for erosion and sediment control, landscape beds, and mixed with topsoil for revegetation works. The remaining portion of mulch has been stockpiled for later re-use, or transported offsite for re-use by a quarry operator for rehabilitation works.
	SW10	The development of Environmental Work Method Statements (EWMS) to provide detailed guidance on construction methodologies and will meet the requirements of the specifications and Conditions of Approval. They will detail the controls to be implemented,	**Performance indicator:** All works carried out in accordance with approved EWMS. AND	Prepared and provided to relevant parties10 days prior to commencement of the activity.	Environmental Manager Environmental Manager	Where Environmental Work Method Statements are required these are developed prior to the specific work activity commencing, and detail the controls to be implemented, responsibilities, location, timing and details on how to implement controls.

	responsibilities, location, timing and details on how to implement controls.	All high risk EWMS to be developed in consultation with relevant agencies. **Performance target:** 100% of works carried out in accordance with approved EWMS AND Relevant agencies consulted in the development of all high risk EWMS			To date, environmental work method statements have been developed for: • Early works • Surveying • Site compound establishment • Design, construction and decommissioning of sediment basins • Clearing, grubbing and mulching • Concrete batch plant establishment and operation • Managing Phytophtera • Sealing and paving • Temporary waterway crossings • Topsoil stripping and stockpiling • Working near waterways • Smiths Creek bridge demolition All high risk EWMSs have been subject to agency consultation, generally through ERG meetings.
SW17	Works will be programmed to minimise the extent and duration of disturbance to vegetation. This will include leaving clearing (undertaken by manual means) and initial earthworks in intermittent and permanent watercourses until subsequent works are about to commence.	**Performance indicator:** Vegetation retained in intermittent and permanent water courses until immediately before works are scheduled to commence. **Performance target:** 100% of vegetation is retained in intermittent watercourses until immediately prior to construction in those areas.	Immediately prior to works scheduled to commence. As detailed in location specific Progressive Erosion and Sediment Control Plans (PESCPs).	Superintendent Foreman Environmental Advisor	Works were programmed to retain vegetation in intermittent and permanent watercourses until subsequent works were about to commence. When clearing was conducted in these areas, the cut stump method was used to retain groundcover and stumps in situ until subsequent works were about to commence. The need to conduct cut stump tree clearing in this areas is detailed on the ESCPs.
SW25	Catch drains, contour and diversion drains across exposed areas will be installed immediately (i.e. within 24 hours and prior to forecast rain events) following clearing, and re-established and maintained during topsoil removal and earthwork operations.	**Performance indicator:** Installation of erosion and sediment controls following clearing. **Performance target:** 100% of the erosion and sediment controls on the ERSED plan installed within 24 hours or prior to forecast rain following clearing	Installed within 24 hours of clearing and prior to forecast rain events.	Superintendent Foreman Environmental Advisor	Erosion and sediment control plans are prepared progressively and regularly updated to reflect the stage of construction. Controls to be implemented during the clearing phase generally include windrowed vegetation and mulch, with priority around access to, and construction of, sediment basins. As such, these early erosion and sediment controls for the clearing phase were installed within 24 hours of clearing or prior to forecast rain, and then updated as the project moved into topsoil stripping. These controls have been reviewed during topsoil stripping and earthworks operations through the progressive erosion and sediment control plan process. Controls are then installed and maintained in accordance with the approved PESCP.
SW28	Erosion and sediment control structures will remain installed and maintained until sufficient vegetative cover is achieved. (i.e. 70% cover over 90% of the erodible catchment).	**Performance indicator:** All erosion and sediment controls maintained as 'Blue Book' requirements. **Performance target:** 100% of all erosion and sediment controls maintained to the 'blue book' standard.	Weekly inspection until there is 70% cover over 90% of the erodible catchment.	Superintendent Foreman Environmental Advisor	Erosion and sediment controls are not removed (unless to be upgraded, improved or replaced) until sufficient vegetative cover is achieved. The erosion and sediment control plans demonstrate this constant upgrading and improvement of controls, in accordance with the Blue Book.
SW35	Temporary crossings will: • Be used for the shortest time required to complete their designed operational function and affected riparian vegetation will be rehabilitated as soon as possible to existing or better condition. • Use material that will not result in fine sediment material entering the waterway. • Where rock crossings are used, the rock will be of suitable size to prevent/reduce the likelihood of the material being washed away in a storm or flood event, with large sized rock on the lower side of crossings where water velocity increases. • Pipes of sufficient size shall be used to provide fish passage in Class 1, 2 and 3 waterways. • Hydrocarbon booms shall be placed downstream of platforms and temporary crossings to intercept oil and grease.	**Performance indicators:** Temporary creek crossing EWMS to be developed in consultation with relevant agencies AND Temporary Creek Crossing EWMS meets the requirements of SW 35. **Performance targets:** No temporary creek crossing work to commence until relevant agencies have been consulted in development of the Temporary Creek Crossing EWMS. AND Temporary Creek Crossing EWMS contains and meets all the requirements of SW35	EWMS prepared and provided to relevant agencies at least 10 days prior to construction of temporary creek crossings commencing.	Environment Manager Temporary Works Manager	On this stage of the project, sacrificial pipes are being installed at a number of permanent watercourses that require a culvert crossing. This has allowed early removal of a number of temporary waterway crossings and significantly reduces the risk associated with maintaining clean water diversions through an active construction site. Pipe sizes in Class 1, 2 and 3 waterways have been agreed with the Department of Primary Industries (Fishing & Aquaculture) representative on site. Hydrocarbon booms are installed in Pipers, Smiths, and Stumpy Creeks and Maria River during active construction works. These are shown on the ERSED plans for this stage of works. See image 3. No temporary crossing work commenced until agencies were consulted on the EWMS (the EWMS was subject to consultation in October 2014 and work commenced in November 2014). The Temporary Creek Crossing EWMS contains all the requirements of SW35.
SW36	Scour protection will be installed at the base of permanent and temporary drainage outlets, and will be	**Performance indicator**: Scour protection installed at the base of	Prior to basin commission.	Foreman	Outlets of temporary controls are installed as per an approved design, or in accordance with Blue Book requirements, which includes scour protection.

	integrated where feasible into current banks to minimise impacts.	permanent and temporary drainage outlets. **Performance target:** All permanent and temporary drainage outlets have scour protection installed at the base		Environmental Advisor	For example, basins are designed in accordance with the blue book, and include scour protection on the outlets. All permanent drainage outlets will have scour protection. The construction of permanent drainage is ongoing.
SW37	Drainage works will be stabilised against erosion by appropriate selection of channel dimensions, slope and lining, and the inclusion, if necessary, of drop structures and energy dissipaters.	**Performance indicator:** Stabilisation of drainage works where required, by appropriate means. **Performance target:** Where required, all drainage work is stabilised by appropriate means.	Prior to any rainfall (events exceeding 10mm) event.	Foreman Environment Advisor	All clean water drainage works on the project are stabilised through measures such as geofabric and/ or plastic, rock, temporary cover crop, or through permanent revegetation or other permanent finishes such as concrete.
SW38	Culverts and permanent stream protection measures will be installed as early as possible in the construction program to facilitate transverse drainage during the early stages of construction.	**Performance indicator:** Installation of culverts and permanent stream protection measures. **Performance target:** All culverts and permanent stream protection measures are installed during the early stages of construction.	Prior to clearing within that catchment.	Foreman Environment Advisor	On this stage of the project, sacrificial pipes are being installed at a number of permanent watercourses that require a culvert crossing. This has allowed early removal of a number of temporary waterway crossings and significantly reduces the risk associated with maintaining clean water diversions through an active construction site. Additionally, permanent culvert structures are being prioritised in the early stages of construction. To date, all major box culverts are at least half complete (many due to traffic staging), with seven of the 15 major culverts completed. See image 4 & 5.
SW50	Sediment basins will be retained for a minimum of six months or until a 70% vegetative cover is achieved in its catchment; other satisfactory controls are in place and approved by the EM or the basin is otherwise redundant.	**Performance indicator:** All erosion and sediment controls maintained as 'Blue Book' requirements. **Performance target:** All erosion and sediment controls maintained to the 'blue book' standard.	Weekly inspection until there is 70% cover over 90% of the erodible catchment.	Environmental Manager	A number of sediment basins are still in place and in use on the project. In some instances basins have been removed prior to achieving 70% vegetation cover. However in all cases this was due to the basin being redundant (ie too high compared to the surrounding cut), or because the progress of earthworks allowed this basin to be diverted to a larger sediment basin nearby. Suitable erosion and sediment controls are implemented in place of these basins, as approved by the soil conservationist and the Environmental Manager through the PESCP process.
SW65	Erosion and sediment controls will be inspected at least daily (with maintenance and/or modifications made as necessary). Inspections and/or maintenance during wet-weather maybe increased where necessary.	**Performance indicator:** All erosion and sediment controls maintained as per 'Blue Book' requirements. **Performance target:** All erosion and sediment controls maintained to the 'blue book' standard.	Daily Visual Inspection Weekly Environmental Inspection Post Rainfall Inspection (where required)	Foreman Environmental Advisor	Informal inspections are undertaken daily during construction by the environmental team. Inspections are conducted by the environment team weekly, and during and post-rainfall. These inspections are captured on a weekly environmental checklist and provide to site teams for actioning. Roads and Maritime and the Project Environmental Representative conduct fortnightly inspections, and agency representatives from the EPA and the Department of Primary Industries (Fishing and Aquaculture) conduct monthly inspections. During these inspections poorly operating controls are identified and their replacement actioned as part of the inspection close-out process. Actions required to ensure controls are maintained to Blue Book standard, must be completed for the inspection report to be closed out.
SW67	Watercourse bed and banks to be monitored weekly and post rainfall during construction for indications of instability. Attention to monitoring for channel erosion will be completed during and following higher than normal flow conditions. Protection measures will be installed should increase intensity or erosion be identified. Where increased intensity of erosion is identified that may have an impact on EPBC species or their habitat, these will be rectified within 5 days. If there is an immediate risk of impact on EPBC Act listed species, temporary rectification works will occur within 1 day.	**Performance indicator:** Monitor instability in watercourse beds and banks. **Performance target:** All watercourse beds and banks inspected every week and after all rainfall **Performance indicator:** Rectification of identified increased intensity of erosion within watercourse beds and banks that may impact on EPBC species or their habitat. **Performance target:** All areas of increased intensity of erosion within watercourse beds and banks that may impact on EPBC species or their habitat rectified within 5 days or 1 day (immediate risk).	Weekly Environmental Inspection Post Rainfall Inspection (where required) Within 5 days or 1 day of identification depending on the risk.	Foreman Environmental Manager	Watercourse bed and bank monitoring is included in both informal inspections, and weekly, during and post rainfall environmental inspections by the environment team. Despite this, the inspection of watercourse bed and banks was not being documented on the weekly environmental inspection checklist. This has now been rectified. Despite this, no creek bed or bank instability has been noted to date during fortnightly Roads and Maritime or soil conservationist inspections. See SW65 for frequency of environmental inspections, which includes inspections both during and post rainfall events.

CoA 2c.	N/A	Measures to manage aquatic habitat on-site will be implemented as per the Giant Barred Frog Management Strategy (App C). These include: **3.2 Management Strategies** 1. Identification and protection of Giant Barred Frog habitat; 2. Pre-clearing Surveys to be implemented in four stages of: a. Early works when establishing site controls (i.e. clearing limits for clearing and grubbing) including ; b. Pre-clearing survey within 5 days of commencing the clearing and grubbing program; i. All Giant Barred Frogs captured will be relocated to the nearest side of the clearing limit: A permit is not required by NSW authorities for relocation of frogs and tadpoles). c. Clearing supervision during the clearing and grubbing program; and d. De-watering procedures within areas identified as Giant Barred Frog habitat (i.e. creek diversions). The dewatering process will be conducted in accordance with an Environmental Work Method Statement (EWMS) and the DECC (2008) Hygiene protocol for the control of disease in frogs Information Circular Number 6 (DECC 2008). All waterways and dams within those areas identified as Giant Barred Frog habitat will be subject to this dewatering process. Environmental Work Method Statement (EWMS) developed for all dewatering activities incorporating all measures outlined in section 3.2.2 iv of the GBF management strategy. Please note that the EWMS is a construction document and will be developed during construction. These will be developed by the environmental manager in consultation with the environmental review group (NSW EPA, fisheries, RMS and the JV) 3. Frog fencing in areas of Giant Barred Frog habitat considered in the context of: a. Temporary frog fencing; and b. Permanent frog fencing. 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. 5. Suitable land is identified within the Biodiversity Offset Package which contains a population of Giant barred Frogs. Note: The criteria for determining offset / compensatory habitat for the GBF will be contained in the Biodiversity Offset Management Plan and will comply with condition 5. **Monitoring of the Management Strategies** The monitoring program will be limited to Smiths Creek, Pipers Creek and Maria River. Between 1-2 reference sites will also be incorporated into this monitoring program. Alternative reference sites could include upstream locations where Smiths Creek Road crosses Smiths Creek and Old Coast Road where it crosses Pipers Creek. **Frequency of Surveys** The surveys will be undertaken in spring, summer and autumn following operation of the project, between Year	**Performance indicators:** Identify all known GBF habitat AND Implement frog fencing. AND All pre-clearance surveys undertaken by a suitably qualified ecologist as outlined in the definition provided in the EPBC approval. AND All pre-clearing surveys carried out within 5 days and no greater than 48hrs prior to clearing and grubbing activities within known GBF habitat. AND Project Ecologist / suitably qualified expert supervise clearing and grubbing operations in known areas of GBF habitat. AND Dewatering eWMS developed in consultation with the project ERG AND Implement frog fencing around known areas of GBF habitat AND Implement procedure following positive find of GBF AND Identification of suitable land within the Biodiversity Offset Package which contains a population of GBF's. AND As per GBFMP AND As per the Water Quality Monitoring Plan AND Surveys for GBF and habitat carried out. **Performance target:** 100% of the K2K sensitive area plans identify GBF habitat. AND All areas of known GBF habitat fenced at least 5 days prior to clearing commencing. AND All pre-clearing surveys carried out by a suitably qualified ecologist. AND All pre-clearing surveys carried out within 5 days and no greater than 48hrs prior to clearing and grubbing activities within known GBF habitat. AND All clearing and grubbing activities within known GBF habitat supervised by suitably qualified ecologist AND No dewatering works to commence until ERG is consulted on the Dewatering EWMS. AND	5 days prior to clearing in known areas of GBF habitat Within 5 days but no later than 48hrs of commencing clearing and grubbing in known areas of GBF habitat Daily in know areas of GBF habitat. 10 days prior to commencement of de-watering activities in known areas of GBF habitat 5 days prior to working in known areas of GBF habitat Immediately after positive finding GBF Prior to implementation of the Biodiversity Offset Package As per GBFMP As per the Water Quality Monitoring Plan Bi-annually during construction 5 days prior to clearing in known areas of GBF habitat Within 5 days but no later than 48hrs of commencing clearing and grubbing in known areas of GBF habitat	Environmental Manager Environmental Advisor Foreman Engineer RMS	Giant Barred Frog habitat was identified as part of the pre-construction surveys. Frog fencing was implemented in these areas at least 5 days prior to the commencement of any construction works in these areas. See Image 2. All pre-clearing surveys were undertaken by the Project Ecologist, who meets the definition a suitably qualified expert in EPBC 2012/6518. Pre-clearing surveys for the Giant Barred Frog were carried out on two non-consecutive nights at least 5 days prior to clearing. This will be detailed in the Pre-clearing/ Clearing report to be submitted as part of the 2016/17 annual report (due to the fact that clearing is ongoing). Pre-Clearing surveys for the Giant Barred Frog are then conducted no greater than 48 hours prior to clearing, and these surveys and any relocations are recorded on the Permit to Clear. This information will also be collated in the Pre-clearing/ Clearing report. All clearing within areas of known Giant Barred Frog habitat was supervised by the Project Ecologist. This is recorded on the Permit to Clear for these areas. A dewatering EWMS has been prepared in consultation with the ERG. Consultation took place in October 2014, and construction commenced in November 2014. There have been no unexpected finds of Giant Barred Frogs within the construction area to date. As such, the unexpected finds process has not been required to be implemented. Water quality monitoring has continued in areas of known Giant Barred Frog habitat, specifically Smiths Creek, Pipers Creek and Maria River. A number of results that exceed the trigger values (eg Pipers Creek turbidity in September 2015), were considered not attributable to construction, as a close look at the raw data indicated that the upstream values were very similar to the downstream values during these individual monitoring events. All other results not in accordance with a licenced discharge under the EPL have been within the trigger values outlined in this plan. As such no additional mitigation measures have been required to be implemented. See the Giant Barred Frog Monitoring Report in Appendix B for detailed water quality monitoring results. Giant Barred Frog monitoring is being conducted tri-annually during construction (to allow direct comparison with operational monitoring, which is tri-annually, rather than bi-annually). The results of this monitoring can be found in Appendix B.

		4 and Year 8 (i.e. 5 years; Table 4-1. Year 4 represents the commencement of operation of either stage of the project – Oxley Highway to Kundabung or Kundabung to Kempsey). A baseline survey will be undertaken prior to construction and consist of one survey in spring, summer and autumn (i.e. three surveys). This approach will provide cues on habitat use within and adjacent to the road corridor leading up to construction and provide the basis for comparing the overall performance of the project. The baseline survey and (survey report) is to be completed prior to the commencement of clearing and grubbing within 500 m of Giant Barred Frog habitat identified at Smiths Creek, Pipers Creek and Maria River. Baseline monitoring data for the GBF has been included in the updated Ecological Monitoring Program. Refer to App A of the CEMP for detailed maps of GBF habitat and 'no-go' zones. **Frog and Tadpole Surveys** Frog and Tadpole surveys provide an additional means to assess population structure and as to whether frogs are breeding at the site. The survey procedure is outlined in the GBFMP **Habitat Surveys** Habitat surveys provide an opportunity to measure changes in the receiving environment over the life of the monitoring program. Habitat data would initially be collected each year during the spring sampling period and the need for additional habitat monitoring would be subject to review. A water quality monitoring program is in place. Implementation of the program has commenced and will continue for the duration of construction. This program includes water quality monitoring in GBF habitat, specifically Smiths creek, Pipers Creek and Maria River. During construction, habitat and frog survey data would be collected each year biannually.	Fencing installed around all known areas of GBF habitat at least 5 days prior to commencing work in GBF habitat. AND All unanticipated discoveries of the GBF immediately follow GBF finds procedure AND Biodiversity Offset strategy contains population of GBF or suitable habitat. AND All mitigation measures carried out as specified in the GBFMP AND All mitigation carried out as specified in the Water Quality Monitoring Plan AND All surveys for GBF and GBF habitat completed bi-annually during construction.	Daily in know areas of GBF habitat. 10 days prior to commencement of de-watering activities in known areas of GBF habitat 5 days prior to working in known areas of GBF habitat Immediately after positive finding GBF Prior to implementation of the Biodiversity Offset Package As per GBFMP As per the Water Quality Monitoring Plan Bi-annually during construction	Environmental Manager Environmental Advisor RMS	
FF18	The measures identified in the Giant Barred Frog Management Plan will be implemented and include: Surveys will be undertaken 24 hours in advance of clearing to determine the presence of individuals within localised clearing areas in the form of a clearing survey. Frog fencing will be installed at least 5 days prior to the	**Performance indicators:** Surveys of GBF habitat undertaken in advance of clearing AND Frog fencing installed prior to the commencement of clearing in suitable areas. AND	24 hours prior to clearing 5 days prior to the	Environmental Manager Project Ecologist / suitably qualified expert	Pre-clearing surveys for the Giant Barred Frog were carried out 24 hours prior to clearing and are recorded on the Permit to Clear. Frog fencing was implemented in these areas at least 5 days prior to the commencement of any construction works in these areas. Pre-clearing permits for the installation of frog fencing demonstrate that this occurred at least 5 days prior to clearing in these areas (it was done prior to Stage 1 clearing). No dewatering is conducted into GBF habitat from another area of site;

	commencement of clearing in Giant Barred Frog Habitat Areas. Dewatering will be undertaken in accordance with the hygiene protocol described in CoA 2(a).	Dewatering undertaken in accordance with the hygiene protocol described in CoA 2(a). **Performance targets:** All surveys for GBF are completed prior to clearing GBF habitat AND All frog fencing installed around GBF habitat prior to clearing AND All dewatering of known GBF habitat undertaken in accordance with the hygiene protocol described in CoA 2 (a)	commencement of clearing As required		therefore no hygiene protocols have been required for this activity.
FF6, FF34	The limits of clearing are to be clearly marked on all relevant work plans and protective fencing erected to mark these limits (i.e. 'no-go' areas). Fencing will be installed 5 days prior to vegetation clearing activities occurring. Riparian and aquatic habitat (including known GBF habitat) will be protected from construction works through the installation of protective fencing prior to works commencing in the vicinity.	**Performance indicators:** The limits of clearing clearly marked on all relevant work plans and protective fencing erected to mark these limits. AND Installation of protective fencing around riparian and aquatic habitat. **Performance targets:** 100% of relevant work plans contain clearing limits, an protective fencing erected along all limits of clearing at least 5 days prior to clearing commencing in that area. AND All riparian and aquatic protection fencing installed at least 5 days prior to construction works commencing within the vicinity.	5 days prior to vegetation clearing activities occurring 5 days prior to vegetation clearing activities occurring near riparian and aquatic habitat	Project / Site Engineers Foreman / Leading Hands Environmental Manager	Clearing limits are marked on the sensitive area plans. The installation of clearing fencing occurred as part of the pre-construction surveys. Clearing fencing, including fencing to protect riparian, aquatic and Giant Barred Frog habitat, was installed in each area at least 5 days prior to clearing commencing in these areas (see above).
FF23	Removal of frog habitat along drainage lines will not be undertaken during wet weather (i.e. during or within 48 hours of rain events exceeding 10 millimeters).	**Performance indicator:** No removal of frog habitat along drainage lines during 'wet weather'. **Performance target:** All frog habitat removal to be completed during dry weather (i.e. not during or within 48 hrs of rain events exceeding 10 millimeters)	During or within 48 hours of rain events exceeding 10 millimetres.	Foreman/ Leading Hands Environmental Manager Project Ecologist / suitably qualified expert	No frog habitat was removed during wet weather. Clearing in Giant Barred Frog habitat areas during this reporting period was undertaken on the following dates: • Smiths Creek – 16/08/15, 05/03/16 & 15/07/16 • Pipers Creek – 29/08/15, 11/09/15, 16/12/15 & 10/02/16 • Maria River – none during this reporting period. Rainfall records during these times indicate that there was no rainfall exceeding 10mm during or within 48 hours of these dates.
FF33	Waterways (including known GBF habitat) will be protected from sediment impacts during construction, in accordance with the mitigation measures listed in the CSWMP and included within this table below (denoted by the 'SW' ID reference). Measures designed specifically to protect aquatic flora and fauna may include: • Installation of in stream sediment curtains • Construction of temporary diversions	**Performance indicator:** If required, installation of in stream sediment curtains AND If required, construction of temporary diversions **Performance targets:** Installation of sediment curtains in all streams where prescribed AND Installation of temporary diversions in all waterways, where prescribed	Any time prior to the commencement of in-stream works Any time prior to the commencement of in-stream works	Environmental Manager Project Soil Conservationist Foreman	In stream works are now complete at Pipers Creek. In stream sediment curtains, or similar (ie sandbag coffer dam structures) are currently installed for in-stream works at Smiths Creek as prescribed within the PESCP for this area. No in stream works are required at Maria River. A temporary diversion is also currently installed at Smiths Creek, as prescribed within the PESCP for this area. The PESCP for these works was reviewed by the ERG, who also regularly inspects the implementation of these works.
FF35	Existing trees, grasses and ground cover will be retained within 15 meters of watercourses (including known GBF habitat) until immediately before construction commences in that area (i.e. 48 hours). All trees in these areas will be felled manually, leaving grasses and small	**Performance indicator:** Retention of trees, grasses and groundcovers within 15 metres of watercourse **Performance target:** All vegetation within 15 metres of a watercourse	At least 48hrs prior to clearing operations within 15 meters of a watercourse	Environmental Advisor Foreman	Existing trees, grasses and groundcovers were retained within Pipers Creek and Smiths Creek until immediately prior to construction commenced in those areas. All trees in these areas were felled manually, and groundcovers retained where possible.

		understory species wherever possible.	retained until immediately prior to construction			Clearing is now complete in these areas. No clearing is required within Maria River.
	SW67	Watercourse bed and banks to be monitored weekly and post rainfall during construction for indications of instability. Attention to monitoring for channel erosion will be completed during and following higher than normal flow conditions. Protection measures will be installed should increase intensity or erosion be identified. Where increased intensity of erosion is identified that may have an impact on EPBC species or their habitat, these will be rectified within 5 days. If there is an immediate risk of impact on EPBC Act listed species, temporary rectification works will occur within 1 day.	**Performance indicators:** Completion of Weekly Environmental Inspection and Post Rainfall Inspection as required and following higher than normal flow conditions. AND Rectification of identified increased intensity of erosion within watercourse beds and banks that may have an impact on EPBC species or their habitat. **Performance targets** Completion of Environmental Inspections every week; and after all rain events, in all areas of work in and adjacent to watercourses AND All areas of increased intensity of erosion within watercourse beds and banks that may impact on EPBC species or their habitat rectified within 5 days or 1 day (immediate risk). .	Weekly Environmental Inspection Post Rainfall Inspection (as required). Within 5 days of identification (within one day when there is an immediate risk).	Environmental Advisor Environmental Advisor / Foreman	Watercourse bed and bank monitoring is included in both informal inspections, and weekly, during and post rainfall environmental inspections by the environment team. Despite this, these inspections are not being documented on the weekly environmental inspection checklist. This has now been rectified. No creek bed or bank instability has been noted to date during fortnightly Roads and Maritime or soil conservationist inspections. See SW65 for frequency of environmental inspections, which includes inspections both during and post rainfall events.
CoA 2d.	FF7	Prior to vegetation clearing, a suitably qualified ecologist will survey all areas to be cleared and will mark out any areas of significant vegetation (EECs, threatened species, riparian vegetation and mangroves) to be fenced and protected, in accordance with the methodology outlined in Section 4.3.1.	**Performance indicators:** Completion of Pre-Construction Surveys. AND Completion of Pre-Clearing Surveys. **Performance targets:** Completion of pre-construction surveys in all areas of clearing 20 days prior to clearing. AND Completion of pre-clearing surveys in all areas of clearing at least 24 hours but no greater than 48 hours prior to clearing.	20 days prior to clearing At least 24 hours but no greater than 48 hrs prior to clearing.	Environmental Manager Project Ecologist / suitably qualified expert	At least 20 days prior to clearing, the Project Ecologist (who is suitably qualified), completed the pre-construction survey and surveyed all areas to be cleared. The survey included: • Confirmation of the accuracy of the sensitive area mapping, which includes areas of significant vegetation. No additional areas were identified for protection • Noxious weed survey including, location of weed infestations, species of weed, weed class, patch size and weed mapping. The results of these surveys will be included in the Pre-Clearing & Clearing Report for Stage 2, which has not been prepared as clearing is still underway. This will be included in the 2016/17 annual report. The Project Ecologist also completed pre-clearing surveys in all areas to be cleared at least 24 hours, but no greater than 48 hours, prior to clearing in that area. These surveys are recorded on the Permit to Clear for each area, and will be collated in the Pre-Clearing / Clearing Report.
	FF24	A suitably qualified expert will undertake pre-clearance surveys for native fauna immediately prior to clearing activities. Searches will be undertaken on, hollow bearing trees, logs, existing culverts and bridges. Searches will take place no earlier than 48 hours prior to the removal of vegetation occurring in that area to ensure that the area is free of the Koala, Giant-Barred Frog, Grey-headed Flying-fox, Spotted-tail Quoll, Little Eagle and other hollow dwelling species.	**Performance indicator:** Completion of Pre-Clearing Surveys. **Performance target:** Completion of pre-clearing surveys in all areas of clearing at least 24 hours but no greater than 48 hours prior to clearing.	At least 24 hours but no greater than 48 hrs prior to clearing.	Environmental Manager Project Ecologist / suitably qualified expert	The Project Ecologist also completed pre-clearing surveys in all areas to be cleared at least 24 hours, but no greater than 48 hours, prior to clearing in that area. These surveys are recorded on the Permit to Clear for each area, and will be collated in the Pre-Clearing / Clearing Report. The surveys included hollow bearing trees, logs, existing culverts, and bridges. These surveys also ensured that the area to be cleared was free of the Koala, Giant-Barred Frog, Grey-headed Flying-fox, Spotted-tail Quoll, Little Eagle and other hollow dwelling species. Two Giant Barred Frogs were relocated during these surveys as part of Stage 2 clearing. Details of these relocations will form part of the Pre-Clearing/ Clearing Report for this stage of the project. This information is also recorded on the Permit to Clear.
	FF27	A two-stage clearing process will be implemented in all areas supporting identified fauna habitat such as hollow bearing trees, habitat trees and bushrock. • Non-habitat trees will be removed before habitat trees, allowing fauna an opportunity to move from the habitat trees. • Non-habitat trees will be removed at least 48 hours before habitat trees are removed (unless otherwise agreed by the EPA). • Felled (habitat) trees will be left for a short period of time (i.e. at least one hour except in instances approved by the Project Ecologist / suitably qualified	**Performance indicator:** Completion of two-stage clearing in identified fauna habitat. **Performance target:** Two-stage clearing conducted in all areas of fauna habitat.	At least 24 hours but no greater than 48 hrs prior to clearing.	Environmental Manager Project Ecologist / suitably qualified expert	All clearing was conducted in accordance with two stage clearing process. This is recorded on the Permit to Clear, and will be collated in the Pre-Clearing / Clearing Report.

		expert) on the ground, to give any fauna remaining in the trees an opportunity to escape before further processing of the trees occurs. The Project Ecologist/ suitably qualified expert or wildlife handler will inspect the felled trees for resident species or injured wildlife. These will then be treated or relocated. Relocated wildlife will be moved the shortest possible distance to improve the likelihood of survival given this area is probably within the animals home range.				
CoA 2e.	N/A	Procedures shall be implemented to ensure that fauna identified during pre-clearance surveys are treated and handled in an appropriate manner. These procedures are outlined in Appendix I of this CFFMP, the Fauna Handling and Rescue Procedure.	**Performance indicator:** Implementation of the Fauna Handling and Rescue Procedure (Appendix I of this CFFMP). **Performance target:** Implementation of the Fauna Handling and Rescue Procedure in all cases of identified fauna during pre-clearance surveys.	As required	Environmental Manager Project Ecologist / suitably qualified expert	Number and type of fauna rescued during pre-clearing surveys has been recorded on the Permit to Clear, and will be collated in the Pre-Clearing /Clearing Report. The Fauna Handling and Rescue Procedure was implemented for all fauna rescues during pre-clearing surveys.
	FF4	A Project ecologist/ suitably qualified expert specific to the known threatened species found on site will be appointed prior to the commencement of construction.	**Performance indicator:** Presence of project ecologist/ suitably qualified expert during construction activities which have the potential to impact upon known locations of GBF. **Performance target:** Project ecologist/suitably expert present during all construction activities that have the potential to impact upon known locations of GBF	Appointment prior to the commencement of construction.	Environmental Manager Project Ecologist/ suitably qualified expert	The Project Ecologist (who meets the definition of a 'suitably qualified expert' in EPBC 2012/6518) was engaged in June 2014. Construction of this stage of the project commenced in mid-November 2014. The Project Ecologist appointed has specific experience in a range of threatened species, including but not limited to Giant Barred Frogs, Quolls and Koalas. The Project Ecologist was present for all clearing works that have the potential to impact on known locations of GBF, as documented in each Permit to Clear.
	FF26	During the proposed clearing works, the Project Ecologist/ suitably qualified expert or an experienced wildlife handler under the supervision of the Project Ecologist / suitably qualified expert will be present to retrieve and provide appropriate care of any displaced fauna and release the fauna into adjacent habitats safe from construction work.	**Performance indicators:** Implementation of the Fauna Handling and Rescue Procedure (Appendix I). AND Presence of suitably qualified individual during clearing activities. **Performance target:** Implementation of the Fauna Handling and Rescue Procedure in all cases of identified fauna during all clearing works AND Suitably qualified individual present during all clearing activities	At all times during clearing activities.		The Project Ecologist was present during all clearing works conducted on the project to retrieve and provide appropriate care of any displaced fauna. Full detail of these works will be included in the Pre-Clearing / Clearing Report. All rescued fauna were released into adjacent habitat, at the discretion of the Project Ecologist, to ensure they remained safe from ongoing construction work.
	FF28	Contact details for the Project Ecologist / suitably qualified expert, FAWNA, the Port Macquarie Koala Hospital and local veterinary hospitals will be maintained and kept at a convenient location on the Construction Site and must be available to the relevant management and supervisory personnel at all locations where clearing is being undertaken, to enable quick contact in the event of a fauna rescue.	**Performance indicators:** Contact details of details for the Project Ecologist / suitably qualified expert, FAWNA, the Port Macquarie Koala Hospital and local veterinary hospitals placed on notice boards in main office and crib sheds. AND Contact details of details for the Project Ecologist / suitably qualified expert, FAWNA, the Port Macquarie Koala Hospital and local veterinary hospitals incorporated in the Clearing and Grubbing EWMS. **Performance targets:** Contact details for the Project Ecologist / suitably	Prior to the commencement of construction. Provided to the relevant parties 10 days prior to clearing.	Environmental Manager	Contact details for the Project Ecologist / suitably qualified expert, FAWNA, the Port Macquarie Koala Hospital and local veterinary hospitals can be found on notice boards at the main compound and crib sheds. These contact details are also included in the Fauna Handling and Rescue Procedure. The Clearing and Grubbing EWMS contains the contact details of the Project Ecologist, however has recently been noted not to contain the contact details of FAWNA, the Port Macquarie Koala Hospital and local veterinary hospitals. This has now been rectified.

			qualified expert, FAWNA, the Port Macquarie Koala Hospital and local veterinary hospitals placed on all notice boards in main office and crib sheds prior to clearing. AND Contact details of details for the Project Ecologist / suitably qualified expert, FAWNA, the Port Macquarie Koala Hospital and local veterinary hospitals incorporated in the Clearing and Grubbing EWMS prior to clearing.			
	FF22	Specific measures identified in the Pre-clearing checklist/Fauna Handling and Rescue Procedure will be followed. Specifically: • Clearing will be conducted in two stages (felling of non-habitat trees followed by habitat trees at least 24 hours later). • Felling of habitat trees within koala habitat will only be undertaken in the presence of a suitably qualified koala spotter.	**Performance indicators:** Clearing conducted in two stages (felling of non-habitat trees followed by habitat trees at least 24 hours later). AND Felling of habitat trees within koala habitat undertaken in the presence of a suitably qualified koala spotter. **Performance targets:** All clearing conducted in 2 stages (felling of non-habitat trees followed by habitat trees at least 24hrs later) AND Presence of a suitably qualified koala spotter present for all felling of habitat trees within koala habitat	All clearing activities.	Site Engineers Foreman Environmental Advisor Project Ecologist / suitably qualified expert	All clearing has been conducted in two stages in accordance with the Fauna Handling and Rescue procedure. This is recorded in the Permit to Clear and will be included in the Pre-Clearing / Clearing Report. Felling of all habitat trees, within and outside koala habitat areas, was conducted under the direct supervision of the Project Ecologist, who is considered to be a suitably qualified koala spotter.
CoA 2f.	N/A	Key milestones, monitoring actions, performance indicators and timeframes are identified in this table relating to Conditions 2.a and 2.e inclusive. All nonconformities identified during surveillance, monitoring, inspections and audits must be closed out and signed off within the timeframe agreed with the Principal, the Project Environmental Representative, and relevant Authorities. Written responses to non-conformities identified must be provided to: • The Principal, the Project Environmental Representative and relevant regulatory Authorities within 5 working days; except • Non-conformities identified in audits where a response must be provided within 7 working days.	**Performance indicators:** Compliance with all mitigation measures (including timeframes) outlined within this table and approved Construction Environmental Management Plan. AND All non-conformities be closed out and signed off within the timeframe agreed with the Principal, the Project Environmental Representative, and relevant Authorities **Performance targets:** Compliance with all mitigation measures outlined within this table (including timeframes) and approved CEMP AND All non-conformities closed out within the timeframe agreed with the Principal, the Project Representative and relevant authorities	As outlined in this table.	Environmental Manager RMS Project Environmental Representative	One non-conformity with the mitigation measures outlined in the Flora and Fauna Management Plan has been identified during this reporting period. The details of this non-conformity is as follows: 1. Non-conformance with FF24 in Table 3-3 of the FFMP, which requires a suitably qualified expert to undertake pre-clearance surveys for native fauna at least 48 hours prior to the removal of vegetation in that area. The incident, on Thursday 21 July 2016, involved the clearing of approximately 50m^2 for a future culvert outlet on a batter of the existing Pacific Highway. The area cleared was within the approved limits of clearing and was due to be cleared, however the appropriate procedure had not been followed. Clearing ceased immediately once the incident was identified. No fauna was injured and no habitat trees were cleared. The area was dominated roadside regrowth (see Image 6). The non-conformance was reported to the Department of the Environment on Tuesday 26 July 2016. A response was received from the department on Tuesday 23 August 2016. Both non-conformities were closed out within the timeframes agreed with Roads and Maritime, the Project Environmental Representative and relevant authorities through the incident classification and reporting procedure.
		For each non-conformance identified, a corrective/preventative action (or actions) must be implemented. In addition, any environmental management improvement opportunities can be initiated because of incidents or emergencies, monitoring and measurement, audit findings or other reviews. Improvement opportunities may also result in the implementation of corrective / preventative actions.	**Performance indicator:** Written responses to non-conformities identified provided to: • The Principal, the Project Environmental Representative and relevant regulatory Authorities; except • Non-conformities identified in audits **Performance target:** All identified non-conformities responded to in writing and provided to: • The Principal, the Project Environmental Representative and relevant regulatory	Provided to the Principal within 5 working days Non-conformances identified and recorded in Monthly audits.		For the non-conformity identified, the following corrective actions were implemented: 1. Clarification of procedures around hold point release to avoid confusion, and only providing a permit to clear once the hold point has been released. Additionally, training was provided to all relevant personnel, to reinforce these requirements. These corrective actions formed part of the response to the non-conformance, provided to Roads and Maritime by the JV through the incident reporting procedure / form. These corrective actions were communicated to relevant regulatory authorities through phone and email correspondence.

			Authorities; except • Non-conformities identified in audits			
		Corrective / preventative actions and improvement opportunities will be recorded and managed via the Project Commitments Register, or other suitable designated database. Details entered will include detail of the issue, action required and timing and responsibilities. The record will be updated with date of close out and any necessary notes. The database will be reviewed regularly to ensure actions are closed out as required. Procedures for rectifying any non-compliance identified during environmental auditing, review of compliance or incident management are also documented in the Compliance Tracking Program.	**Performance indicators** Up to date project commitments register, or other suitable designated data base. AND Non-compliances documented in the compliance tracking program. **Performance targets:** Project commitments register or other suitable designated data base kept up to date at all times. AND All non-conformances documented in the compliance tracking program	Quarterly (otherwise as required).		A database (Incident Register in iTWOcx) has been established to record all non-conformances and includes detail of the issue, action required and timing and responsibilities. All non-conformances are identified in the six-monthly compliance reports prepared as part of the compliance tracking program. Six-monthly reports have so far been prepared in March (July 2014 – January 2015), September 2015 (January 2015 – July 2015), March 2016 (July 2015 – January 2016), and September 2016 (January 2016 – July 2016) and provided to the EPA, DPI (Fishing & Aquaculture) and the Department of Planning & Environment. The reports are also available on the website at the following link: http://www.rms.nsw.gov.au/projects/northern-nsw/oxley-highway-to-kempsey/project-documents.html

Stage 3: Oxley Highway to Kundabung

ID	Management Action	Performance Indicator/Target	Monitoring/Timing	Responsibility	Compliance Status
General Measures					
EPBC 1 FF 1	Training will be provided to all project personnel, including relevant sub-contractors on matters of NES as identified in section 3.4.2.	**Performance indicator:** Induction of staff on NES matters prior to commencement of works on site. **Performance target:** 100% of all staff inducted on NES matters prior to commencement of work on site.	Site induction prior to work on-site	Environmental Manager	The induction is undertaken by all staff prior to the staff member commencing work. The induction room contains training resources including sensitive area plans, examples of different flagging tape and key environmental issues. Section 5.4 of the induction details flora and fauna requirements. Specifically: ❍ Report native fauna onsite and not to handle fauna ❍ All plant to be inspected and signed off as weed free. Need to clean down plant when changing location ❍ EWMS, staying within flagging tape, clearing permit, ecologist onsite during clearing, reporting koala sightings, Chytrid fungus washdown procedure. Induction includes an Environmental Induction Question sheet which all participants complete.
EPBC 2	Sensitive Area Plans showing site constraints (including matters of NES) shall be prominently displayed across the site. Sensitive Areas Plans form Appendix A6 of the CEMP.	**Performance indicator:** Display of Sensitive Area Plans at all primary and satellite compounds. **Performance target:** 100% of primary and satellite compounds have Sensitive Areas Plans displayed.	Prior to construction and for duration of construction.	Environmental Coordinators	A large full site sensitive area plan is provided within the training room at the main compound and is also available on the project drive, Environmental Manager's Office and design package EN01. In satellite compounds, sensitive area plans are available on the desks of the Foreman for those areas.
EPBC 3 FF 7	Prior to vegetation clearing, a suitably qualified ecologist/expert will survey all areas to be cleared and will mark out any areas of significant vegetation (EECs, threatened species, riparian vegetation and mangroves) to be fenced and protected. Areas of weed infestation will also be identified and documented. These surveys will be completed no later than 20 working days prior to the commencement of clearing and will be limited to the time required to complete these surveys.	**Performance indicator:** Completion of pre-clearing survey including mark-out of clearing extents and identification of weed infestation prior to construction. **Performance target:** Completion of pre-clearing survey prior to construction including mark-out of clearing extents and identification of weed infestation in 100% of clearing areas.	No later than 20 days prior to commencement of clearing.	Environmental Manager Project Ecologist Environmental Coordinators	At least 20 days prior to clearing, the Project Ecologist (who is suitably qualified), completed the pre-clearing survey and surveyed all areas to be cleared. The survey included: • Confirmation of the accuracy of the sensitive area mapping, which includes areas of significant vegetation. No additional areas were identified for protection • Noxious weed survey including, location of weed infestations, species of weed, weed class, patch size and weed mapping.
EPBC 4 FF4	A Project ecologist / suitably qualified expert (an individual with tertiary qualifications and/or a minimum of three years demonstrated experience relevant to the task in question) will be appointed prior to construction where matters of NES are involved.	**Performance indicator:** Appointment of project ecologist/suitably qualified expert. **Performance target:** Appointment of project ecologist/suitably qualified expert prior to commencement of works.	Prior to the commencement of construction	Environmental Manager	Dr David Rohweder is the Project Ecologist. David has 18 years ecological experience and holds a PHD in applied science. David was appointed in August 2014, works commenced on this stage of the project in early November 2014.
EPBC 5 FF 5	Lend Lease will implement the construction ecological monitoring requirements for matters of NES during the construction phase as stipulated within the Ecological Monitoring Program.	**Performance indicator:** Completion of construction ecological monitoring requirements. **Performance target:** Completion of construction ecological monitoring requirements in accordance frequency stipulated in the EMP.	Timing and roles identified as per table 19 of the Ecological Monitoring Program found in Appendix K. Giant Barred Frog Monitoring will occur bi annually throughout construction.	Environmental Manager/ RMS	See Section 4 and Appendix B.
EPBC 6 FF 6	The limits of clearing are to be clearly marked on all relevant work plans and protective fencing erected to mark these limits (i.e. 'no-go' areas).	**Performance indicator:** Inclusion of sensitive areas on Sensitive Area Plans and limits of clearing on clearing drawings AND Completion of pre-clearing survey including mark-out of clearing extents and identification of weed infestation prior to construction. **Performance target:** 100% Sensitive Area Plans identify sensitive areas and 100% of clearing drawings identify clearing extents.	Limits of clearing will be marked out prior to clearing commencing in that area. Fencing installed prior to vegetation clearing activities commencing in that area. Fencing and no-go signage inspected	Project / Site Engineers Foreman / Leading Hands Environmental Coordinators	Sensitive areas are shown on the sensitive area drawings and clearing limits are shown on ESCP, plans attached to pre-clearing permits, and on CT01 drawings (clearing drawings). All clearing extents were marked out in the field using clearing flagging prior to the commencement of clearing in these areas. See EPBC 3 for discussion on completion of the pre-clearing survey.

ID	Management Action	Performance Indicator/Target	Monitoring/Timing	Responsibility	Compliance Status
		AND Completion of pre-clearing survey prior to construction including mark-out of clearing extents and identification of weed infestation in 100% of clearing areas.	weekly, Until construction completion.		
CoA 2a.					
EPBC 7	Weeds will be managed in accordance with the management actions detailed in Section 7 of the weed and pathogen management plan (Appendix J)	**Performance indicator:** Completion of weed management actions outlined in Appendix J. **Performance target:** Completion of all weed management actions outlined in Appendix J in the timeframes specified.	As outlined in Appendix J.	Project / Site Engineers Foreman / Leading Hands Environmental Coordinators	Hire plant inspection reports are completed for all incoming plant and equipment onto the project. This includes a check for weed and pest infestation. Weed monitoring is documented in the weekly environmental inspection checklist. Weed mapping identifies areas of weed infestation and weed free areas. Topsoil outside of the high weed infestation areas has been identified for reuse Weed control is being undertaken as part of revegetation works.
EPBC 8 FF36	Washing procedures for plant and equipment will be in accordance with the process described for machinery in Table 8.1 of Appendix J.	**Performance indicator:** Wash down of plant and equipment before entering site. **Performance target:** 100% of plant and equipment are washed down before entering site.	All plant prior to use on site.	Project / Site Engineers Foreman / Leading Hands Environmental Coordinators	A vehicle wash down facility is provided at the workshop. Boot washdown facilities were available at areas of GBF habitat prior to hardstand tracks and parking areas being implemented. A boot washdown facility has recently been established at Barrys Creek as part of Stage 2 clearing (the western side of the highway following the traffic switch).
EPBC 9 FF37	The spread of bacteria, viruses and diseases such as Myrtle rust, *Phytophthora cinnamomi*, amphibian chytrid fungus and beak and feather disease will be addressed through washing of equipment. The washing procedure will be undertaken in accordance with the process described in Table 8.1 of Appendix J.	**Performance indicator:** Wash down of plant and equipment before entering site. AND Implementation of Chytrid Fungus wash down procedure in Appendix J. **Performance target:** 100% of plant and equipment washed down before entering site. AND Chytrid Fungus washdown procedure is implemented prior to the commencement of work in all areas required in the procedure.	All plant during construction prior to use on site. As outlined in Appendix J.	Project Engineers Foreman / Leading Hands Environmental Coordinators	See EPBC 8.
EPBC 10	Weed management training will be provided to key staff on-site.	**Performance indicator:** Provision of weed management training to key staff on site. **Performance target:** 100% of key staff provided with weed management training during construction.	Induction for all personnel prior to commencing work on site.	Environmental Manager	Weed management training is provided through inductions, which is compulsory for all staff prior to commencing work. Further training is provided to key staff (eg clearing contractors) via toolboxes on the EWMS.
EPBC 11 FF 9 FF10	Revegetation/rehabilitation of areas disturbed as part of construction of the project that do not form part of the permanent pavement or structures will be undertaken progressively during and following construction to maintain and enhance habitat, particularly in identified regional corridors and key habitat areas. Re-vegetation and rehabilitation works will be completed as soon as possible following the completion of earthworks, with a preference for progressive stabilisation of works. Vegetation species selected for rehabilitation will be representative of the vegetation communities adjacent to the specific area of works. Rehabilitation works shall be completed in accordance with the approved Landscape design and evidence of the application of native vegetation species shall be recorded and maintained throughout construction. Following completion of construction of the OH2Ku project, re-vegetation/rehabilitation areas should achieve a species diversity and quality similar to the vegetation community adjacent to the works.	**Performance indicator:** Direct seeding (hydromulch) of disturbed areas following completion of all construction activities. AND Completion of rehabilitation works in accordance with the approved Landscape design. AND Use in landscaping works seed mix representative of the vegetation community adjacent to the works. **Performance target:** Direct seeding (hydromulch) of disturbed areas within 14 days of completion of all activities required to finalise and rehabilitate disturbed areas, including the placement of topsoil. AND Completion of all rehabilitation works in accordance with the approved Landscape	Direct seeding will be completed 14 days from completion of works (completion of all activities required to finalise and rehabilitate disturbed areas, including placement of topsoil). Rehabilitation works will be completed prior to construction completion. Seed mixes will be selected prior to commencement of revegetation works in each area. Revegetation/rehabilitation areas will be assessed Six-monthly; during	Project / Site Engineers Foreman / Leading Hands Environmental Manager	Rehabilitation and revegetation is occurring progressively in some areas that will not be further impacted by construction works. These areas are being hydromulched in accordance with the approved landscape design. Tubestock planting has also commenced in some areas, in accordance with the approved landscape design. See image 7. Seed mixes in the approved landscape design are broadly representative of the adjacent vegetation communities. All landscaping works use the seed mix outlined in the approved landscape design.

ID	Management Action	Performance Indicator/Target	Monitoring/Timing	Responsibility	Compliance Status
	The success of re-vegetation of the disturbed areas will be assessed by the Landscape Representative and collated into a Landscaping Review to be completed following construction completion and provided to RMS. Where the works do not meet the standards specified above additional landscape planting or native seeding may be required to achieve the desired outcome.	design prior to Construction Completion. AND 100% of landscaping works use seed mix representative of the vegetation community adjacent to the works.	construction period and 36 month landscape maintenance period. As required by Landscape Review.		
CoA 2b.					
EPBC 12 FF8	Native vegetation cleared from the construction footprint will be mulched and used along with retained topsoil for reuse in rehabilitation works and erosion control. Mulch and topsoil will not be stockpiled in 'no-go' areas and cleared vegetation will not be pushed into 'no-go' areas.	**Performance indicator:** Use of mulch in accordance with landscaping plans and erosion and sediment control plans. AND Storage of mulch and topsoil within approved stockpile areas outside no-go areas. **Performance targets:** Mulch is utilised in all areas nominated in landscaping plans and erosion and sediment control.	Use of mulch for landscaping and erosion and sediment control will be monitored progressively. Locations of stockpiles will be checked as part of weekly inspections.	Project / Site Engineers Foreman / Leading Hands Environmental Coordinators	Mulch has been used extensively across the site for erosion and sediment controls including perimeter bunds and blended with topsoil for rehabilitation. No mulch or topsoil has been stored in no-go areas nor has cleared vegetation been pushed into no-go areas.
EPBC 13 FF 31	Permanent water quality control measures will be installed as early as possible in the construction program and at least prior to construction completion. The timeframe for 'construction completion' is variable and will depend on a range of construction delays such as weather and other unforeseen delays. As per SW25 temporary controls will be installed within 24 hours and prior to forecast rain events following clearing. Installation of permanent water quality control measures includes stormwater pits, kerbs and pipes, and permanent erosion protection measures such as scour protection and must be completed prior to construction completion. With the exception of temporary water quality basins installed in accordance with SW25, permanent water quality controls are linked to the completion of permanent built works. While a construction program can be submitted that outlines indicative timeframes for installation of some of these measures, Lend Lease cannot accurately predict a specific milestone for their installation in the construction program as it may be subject to construction delays due to a range of issues including weather, plant and machinery availability, and other unforeseen construction difficulties.	**Performance indicator:** Permanent controls installed and operating prior to completion of construction. AND Temporary controls in place and maintained during construction as per ESCP. **Performance targets:** 100% of permanent controls installed and operational prior to the completion of construction. AND All temporary controls installed within 24 hours of clearing completion in that area and maintained as per ESCP.	Permanent controls prior to completion of works (completion of all activities required to finalise and rehabilitate disturbed areas, including placement of topsoil). Temporary controls installed within 24 hours and prior to forecast rain events following clearing.	Project / Site Engineers Foreman / Leading Hands	The installation of permanent water quality control measures has commenced across the site. This work will be ongoing until construction completion. All temporary controls are installed and maintained as per the ESCP. Controls are implemented within 24 hours of clearing, or sooner if rain is forecast. This is documented on the ESCP and checked during follow up environmental inspections.
EPBC 14 FF32	Waterways will be protected from sediment impacts during construction, in accordance with the CEMP. Measures designed specifically to protect aquatic flora and fauna may include: • Installation of in stream sediment curtains. • Construction of temporary diversions.	**Performance indicator:** Erosion and Sediment controls installed as per ESCP. AND Controls in waterways inspected and poorly operating/damaged controls repaired. **Performance targets:** All erosions and sediment controls installed as per ESCP. AND All controls in waterways inspected weekly and all poorly operating controls replaced.	Progressively. Weekly	Project / Site Engineers Foreman / Leading Hands Environmental Coordinators	Erosion and sediment controls on-site are installed as per the Progressive Erosion and Sediment Control Plans. On 20 March 2016, temporary controls near Barrys Creek were found not to have been re-installed as per the PESCP during surveillance by the Roads and Maritime Site Environment Officer. Once identified this was rectified immediately and training undertaken with the soil conservationist to remind site teams of the proper implementation of controls and the effects of poor workmanship. Due to the fact that the downstream sampling point existed as an isolated pond, the water was able to be contained on site and pumped to a basin for treatment. As such, it was not raised as a reportable incident. Inspections are conducted by the environment team weekly, and during and post-rainfall. Roads and Maritime and the Project Environmental Representative conduct fortnightly inspections, and agency representatives from the EPA and the Department of Primary Industries (Fishing and Aquaculture) conduct monthly inspections. During these inspections poorly operating controls are identified and their replacement actioned as part of the inspection close-out process.
EPBC 15	Water quality monitoring of matters of NES Habitat in Cooperabung Creek and Barrys Creek for the following parameters: • pH,	**Performance indicator:** Water quality monitoring outlined in the Water Quality Management Plan. **Performance target:**	Two wet events (where trigger rainfall events occur) and one dry event	Roads and Maritime	Water quality monitoring was conducted in accordance with the Water Quality Monitoring Program during this reporting period. There were no instances where an exceedence of a trigger value at Cooperabung Creek was considered to be attributable to

ID	Management Action	Performance Indicator/Target	Monitoring/Timing	Responsibility	Compliance Status
	• Dissolved oxygen, • Electrical conductivity, • Temperature, • Turbidity, • Total Suspended Solids, • Hydrocarbons, • Trace metals, • Nitrogen, and • Phosphorous	100% of water quality monitoring results are within trigger values in section 5 of Water Quality Management Plan (identified below). *High values:* if median values at the downstream site is *above* 80% of the recorded background water quality records (80th percentile). *Low values:* if median values at the downstream site are *below* the 20% of the recorded background water quality records (20th percentile). *Both values:* both the 80th and 20th percentile values of the upstream site can be compared with the median values of the downstream site.	per month.		construction, and not a result of a licenced discharge under the EPL. There was one instance where an exceedence of the trigger value for NTU at Barrys Creek was considered to be attributable to construction. On 20 March 2016, investigation of a high NTU reading at Barrys Creek found temporary controls had not been re-installed as per the PESCP. Once identified this was rectified immediately and training undertaken with the soil conservationist to remind site teams of the proper implementation of controls and the effects of poor workmanship. Due to the fact that the downstream sampling point existed as an isolated pond, the water was able to be contained on site and pumped to a basin for treatment. As such, it was not raised as a reportable incident. On 14 January 2016, water was being transferred between two basins at Barrys Creek, when a pipe failed. This resulted in increased turbidity levels in isolated pond where sampling was being undertaken, however due to the fact that this is a licensed basin discharge point, and the water met the discharge criteria, a reportable incident was not raised.
EPBC 16 FF34	Existing trees, grasses and ground cover will be retained within 15 metres of watercourses of known habitat of matters of NES (Cooperabung Creek and Barrys Creek) until immediately before construction commences in that area Works will be programmed to minimise the extent and duration of disturbance to vegetation where possible. This will include leaving clearing (unless undertaken manually or by other means that cause minimal disturbance (i.e. felling trees and leaving the stump in situ) and initial earthworks in intermittent and permanent watercourses until subsequent works are about to commence.	**Performance indicators:** Retention of vegetation in Cooperabung Creek and Barrys Creek. AND Avoidance of clearing in all watercourses until subsequent works are about to commence, or felling of vegetation manually or with minimal disturbance. **Performance targets:** No less than 15m of vegetation retained within Cooperabung Ck and Barrys Ck until construction commences in those areas. AND 100% of clearing in all watercourses left until works are about to commence unless all vegetation is felled manually / with minimal disturbance.	Prior to construction commencing in that area. Prior to construction commencing in watercourses.	Construction Manager Environmental Coordinators	Existing trees, grasses and ground cover were retained within 15 metres of Cooperabung Creek and Barrys Creek until immediately before construction commenced in that area and clearing was conducted manually. The need to retain stumps and groundcovers in these waterways is shown in ESCP for these areas, and confirmed through subsequent environmental inspections. Stage 2 clearing (the western side of the highway following the traffic switch) at Barrys Creek has recently been conducted. Image 8 shows the implementation of this requirement at this location. The area of disturbance at Cooperabung Creek was greatly reduced during clearing, resulting in the retention of riparian vegetation under the footprint of the new Cooperabung Creek Bridge.
EPBC 17 SW1	The potential for erosion during the construction of the Proposal would be appropriately managed in accordance with the measures contained within Managing Urban Stormwater: Soils and Construction Volume 1 (Landcom 2004) and Managing Urban Stormwater: Soils and Construction Volume 2D, Main Road Construction (DECC 2008b).	**Performance indicators:** Erosion control measures within the ESCPs are in accordance with the Blue Book. AND Controls inspected and poorly operating/damaged controls repaired. **Performance targets:** All erosion control measures nominated in the ESCPs are in accordance with the Blue Book. AND All controls inspected weekly and all poorly operating/ damaged controls repaired.	Prior to the commencement of construction in that area, or prior to changed work activities in that area. Weekly.	Construction Manager Environmental Coordinators	Erosion and sediment controls within the ESCPs are in accordance with Managing Urban Stormwater: Soils and Construction Volume 1 (Landcom 2004) and Managing Urban Stormwater: Soils and Construction Volume 2D, Main Road Construction (DECC 2008b) (the Blue Book). Inspections are conducted by the environment team weekly, and during and post-rainfall. Roads and Maritime and the Project Environmental Representative conduct fortnightly inspections, and agency representatives from the EPA and the Department of Primary Industries (Fishing and Aquaculture) conduct monthly inspections. During these inspections poorly operating controls are identified and their replacement actioned as part of the inspection close-out process.
EPBC 18 SW10	The following EWMS will be prepared where required and implemented to manage soil and water impacts which have a risk of impact on matters of NES : • Temporary waterway crossings; • Culvert and transverse drainage construction; • Managing runoff from curing processes; • Clearing and grubbing; • Sediment basin design, construction and management; • Dewatering; • Construction of temporary creek diversions.	**Performance indicators:** Preparation of EWMS for nominated activities. AND Construction activities undertaken in accordance with EWMS and staff tool boxed on requirements. **Performance targets:** No works commencing in these areas until an EWMS has been prepared for the activity. AND All construction activities conducted in	Prior to the commencement of the activity. Ongoing.	Superintendent/Environment Manager/Foreman	Environmental Work Method Statements have been prepared and implemented for temporary waterway crossings, culvert construction, clearing & grubbing, sediment basin design, construction & management, dewatering, and concrete paving (which covers curing runoff). Construction of temporary creek diversions and in stream works is covered in the Minor Temporary Waterway Crossings and Minor Working Platforms EWMS. Construction Work Method Statements are also prepared for specific areas, for example Barrys Creek. These work methods are in accordance with the EWMS for the type of construction activity being undertaken, and also contain detailed information

ID	Management Action	Performance Indicator/Target	Monitoring/Timing	Responsibility	Compliance Status
	• In stream works.	accordance with the EWMS. AND 100% of staff toolboxed on EWMS requirements before starting work in those areas.			specific to the site under construction. Relevant staff are toolboxed on the requirements of the EWMS prior to work commencing.
EPBC 19 SW25	Catch drains, contour banks and diversion drains across exposed areas will be installed immediately following clearing as per the ESCP, and re-established and maintained during topsoil removal and earthworks operations. Temporary Erosion and Sediment (ERSED) controls will be installed within 24 hours and prior to forecast rain events following clearing.	**Performance indicators:** Installation of controls in accordance with the ESCP. AND Inspection of controls and identification of poorly operating/damaged controls. **Performance target:** 100% of controls in ESCP installed within 24 hours of completion of clearing in that area. AND All controls inspected weekly and all poorly operating/ damaged controls repaired.	Within 24 hours of the completion of clearing in that area. Weekly.	Superintendent Foreman	See EPBC 14.
EPBC 20 SW28	Erosion and sediment control structures will remain installed and maintained until a minimum of 70% vegetative cover is achieved. This will be determined through consultation with a suitably qualified professional (Certified Professional in Erosion and Sediment Control).	**Performance indicators:** Installation of temporary erosion and sediment controls in accordance with ESCP. AND Inspection of controls at least weekly to identify operating/damaged controls. AND Removal of controls following consultation with suitably qualified professional. **Performance targets:** 100% of controls are installed as per the ESCP. AND All controls inspected weekly and all poorly operating/ damaged controls repaired. AND No controls are removed until suitably qualified professional has been consulted.	Ongoing during construction Weekly Ongoing	Superintendent Foreman	See EPBC 19 for compliance with the installation of controls as per the ESCP and inspection compliance. Controls are only removed once these catchments have been reviewed, and an updated PESCP prepared in consultation with the Soil Conservationist.
EPBC 21 SW17	Works will be programmed to minimise the extent and duration of disturbance to vegetation. This will include leaving clearing (unless undertaken manually or by other means that cause minimal disturbance(i.e. felling trees and leaving the root ball ,soil structure and existing groundcovers in situ) and initial earthworks in intermittent and permanent watercourses until subsequent works are about to commence.	**Performance indicator:** Clearing in all watercourses. **Performance target:** 100% of clearing in all watercourses left until works are about to commence unless all vegetation is felled manually / with minimal disturbance.	Prior to construction commencing in watercourses.	Superintendent Foreman	Existing trees, grasses and ground cover were retained within 15 metres of watercourses until immediately before construction commenced in that area and clearing was conducted manually. The need to retain stumps and groundcovers in these waterways is shown in ESCP for these areas, and confirmed through subsequent environmental inspections.
EPBC 22 SW35	Where temporary crossings are required, these shall be designed, constructed and maintained in accordance with Managing Urban Storm water Soils and Construction Volumes 2A and 2D Main Road Construction (DECC 2008) and section 5.3.4 of the guideline Managing Urban Storm water 4th edition March 2004, Volume 1 Soils and Construction (the 'Blue Book') and subject to the preparation of an EWMS identified in SW10 and SW33. Temporary crossings will: • Be 'fish friendly' with a lower section of the temporary crossing provided to act as an emergency spillway. Including the use of the adequate size and number of pipes set at bed level to facilitate fish passage in Class 1 -3 waterways. • Be used for the shortest time required to complete their designed operational function and affected riparian vegetation will be rehabilitated as soon as possible where the permanent design footprint does not overlay the temporary crossing location. • Use material that will not result in fine sediment material entering the waterway.	**Performance indicators:** Design of temporary crossings. AND Construction and maintenance of temporary crossings. AND Rehabilitation of temporary crossings **Performance targets:** 100% of temporary crossings designed in accordance with the Blue Book. AND 100% of temporary crossings constructed and maintained as per design. AND 100% of temporary crossings rehabilitated within	Prior to construction of temporary crossing Ongoing Within 24 hours of the removal of the temporary crossing.	Environment Manager Superintendent Engineers	All temporary waterway crossings have been designed in accordance with the Blue Book. All crossings have been constructed and maintained as per the design, including the use of suitably sized rock to prevent the material being washed away in a flood or storm event. Where temporary crossings were removed during this reporting period, rehabilitation commenced within 24 hours of complete removal. Staged crossing removal, or removal of a crossing that spanned several days, resulted in temporary ERSED controls being installed.

ID	Management Action	Performance Indicator/Target	Monitoring/Timing	Responsibility	Compliance Status
	Where rock crossings are used, the rock will be of suitable size to reduce the likelihood of the material being washed away in a storm or flood event, with large sized rock on the lower side of crossings where water velocity increases.	24 hours of removal.			
EPBC 23 SW 36	Scour protection shall be installed at the base of permanent and temporary drainage outlets, and will be integrated where feasible into existing banks to minimise impacts.	**Performance indicator:** Installation of scour protection installed at the base of all drainage outlets. **Performance target:** Scour protection installed at 100% of drainage outlets prior to commissioning.	Prior to commissioning these structures.	Engineers	Scour protection has been installed at the base of all drainage outlets prior to commissioning, as per the approved design drawings. Outlets of temporary controls are installed as per an approved design, or in accordance with Blue Book requirements, which includes scour protection. For example, basins are designed in accordance with the blue book, and include scour protection on the outlets.
EPBC 24 SW 37	Drainage works shall be stabilised against erosion by appropriate selection of channel dimensions, slope and lining, and the inclusion, if necessary, of drop structures and energy dissipaters.	**Performance indicators:** Preparation of ESCPs inclusive of erosion control measures. AND Erosion controls installed and maintained as per ESCPs. **Performance targets:** All erosion and sediment control measures installed are in ESCPs. AND 100% of erosion and sediment control plans prepared prior to works commencing in that area. AND 100% of erosion and sediment controls installed and maintained as per ESCPs.	Prior to commencing works in that area. Ongoing.	Engineers	The PESCPs outline all ERSED controls to be implemented within that section of the site. All PESCPs are prepared prior to work commencing in that area, as they are subject to a hold point process with Roads and Maritime. See EPBC 14. Onsite, controls can be found to be the appropriate width, depth and slope to prevent erosion.
EPBC 25 SW 38	Culverts and permanent stream protection measures shall be installed as early as possible where the construction program permits, to facilitate transverse drainage during the early stages of construction.	**Performance indicator:** Timing of culvert construction. **Performance target:** Where traffic staging permits, 100% of culverts are constructed within the first 12 months of the construction programme.	Within 12 months of clearing in that location.	Superintendent Foreman Engineers	All of the drainage culverts identified in Schedule 3 of EPBC 2012/6518 approval have commenced construction, and 41% are now complete. There are a large number of minor drainage culverts that are also under construction or have been completed. Where these are not completed this is due to traffic staging (ie the traffic needs to be switched off the existing highway onto the new road for these to be completed). Construction of all bridge structures has commenced, with several now complete. See image 9 & 10.
EPBC 26 SW 45	Operational water quality basins shall be constructed for use during construction of the project. Prior to the completion of construction, these, shall be converted to provide operational phase water quality management.	**Performance indicators:** Construction of operational water quality basins. AND Conversion of permanent basins to operational basins. **Performance targets:** 100% of operational basins constructed for use during construction. AND 100% of permanent basins are converted to operational basins prior to the completion of construction in that area.	During construction. Prior to the completion of construction.	Engineer Superintendent	All operational basins will be used at some stage during construction to manage water quality (the timing of which is subject to access and construction staging). To date 16 out of 18 operational basins have been constructed and are being used to manage construction water quality. Eight of the 16 have been fitted out with permanent basin furniture and are ready for operation. Construction is still ongoing across the project.

ID	Management Action	Performance Indicator/Target	Monitoring/Timing	Responsibility	Compliance Status
EPBC 27 SW 50	Sediment basins shall be retained for a minimum of six months or until a 70% vegetative cover is achieved in its catchment; other satisfactory controls are in place and approved by the EM in consultation with a suitably qualified soil conservationist or the basin is otherwise redundant.	**Performance indicator:** Retention of sediment basin. **Performance target:** No sediment basins are removed until management action criteria are achieved.	Minimum of six months or until management action criteria achieved.	Environmental Manager	All basin decommissioning requests have been approved by the project Soil Conservationist. These were generally removed as 70% cover had been achieved in the catchment, they were redundant controls (ie no water could reach the sediment basin due to, for example, it being perched above construction works after the completion of a cutting) or no longer required under the Blue Book. Other satisfactory controls were installed after approval by the EM and review by the Soil Conservationist through the PESCP sign-off process. See image 11. The EPA is also notified of basin decommissioning prior to this occurring. This notification includes the revised PESCP.
EPBC 28 SW 65	Erosion and sediment controls shall be inspected informally at least daily (with maintenance and/or modifications made as necessary). Formal inspections will be conducted weekly with maintenance and/or modifications made as identified. Inspections and/or maintenance will also be undertaken daily during periods of rainfall and within 24 hours of the cessation of a rainfall event causing runoff to occur on or from the premises.	**Performance indicators:** Completion of informal and formal inspections. AND Completion of maintenance of erosion and sediment controls. **Performance targets:** Informal inspection conducted on 100% of work days. AND Formal inspections undertaken every week during construction. AND 100% of maintenance actions in inspection reports are undertaken.	Informal inspections daily and formal inspections weekly for the duration of construction. Ongoing.	Environmental Coordinators	Informal inspections are undertaken daily during construction, by the environmental team. Inspections are conducted by the environment team weekly, and during and post-rainfall. These inspections are captured on a weekly environmental checklist and provide to site teams for actioning. Roads and Maritime and the Project Environmental Representative conduct fortnightly inspections, and agency representatives from the EPA and the Department of Primary Industries (Fishing and Aquaculture) conduct monthly inspections. During these inspections poorly operating controls are identified and their replacement actioned as part of the inspection close-out process. Actions must be completed for the inspection report to be closed out.
EPBC 29 SW 66	A Project soil conservation specialist shall inspect the work areas, assess drainage and riparian conditions, prepare and /or review erosion and sediment control plans and provide advice to the Project team to maintain a high standard of erosion and sediment practices on site. Inspections will be undertaken typically on a fortnightly basis, or as required where high-risk activities are proposed, or where sensitive areas have the potential to be affected (SEPP 14 wetland, heritage sites). Inspections and timing will be reviewed regularly by the Environmental Manager in response to site conditions, risk profile and stage of the project.	**Performance indicators:** Engagement of project soil conservation specialist. AND Preparation and review of ESCPs by soil conservationist. AND Completion of inspections by soil conservationist. **Performance targets:** No construction works commence until soil conservation specialist engaged. AND 100% of ESCPs are prepared or reviewed by the soil conservationist prior to the commencement of work in that area. AND Soil conservationist inspections conducted every fortnight during construction. AND No high risk activities commence until soil conservation inspection has been conducted.	Prior to the commencement of construction. Prior to the commencement of work in that area. At least fortnightly.	Soil Conservation Specialist Environment Manager	Soil conservation specialist was engaged on 21 May 2014, construction commenced on this stage in early November 2014. All PESCPs are reviewed by the soil conservationist prior to be implemented. Fortnightly inspections (or as required) are conducted by a soil conservation specialist. Inspections are also conducted prior to commencing high risk activities, eg clearing, culvert construction works, etc.
CoA 2c.					
EPBC 30 SW 67	Watercourse bed and banks shall be monitored weekly and post rainfall during construction for indications of instability. Attention to monitoring for channel erosion will be completed during and following higher than normal flow conditions. Protection measures may be required should increased intensity or erosion be identified as a result of construction activities.	**Performance indicators:** Inspections for instability of watercourse bed and banks completed weekly and post rainfall. AND Protection measures implemented as recommended by these inspections. **Performance targets:**	Weekly and post rainfall Where increased erosion is observed and is likely to impact matters of NES in Cooperabung and Barry's Creek, the erosion will be rectified within 5 working days.	Soil Conservation Specialist Environmental Coordinators	Watercourse bed and bank monitoring is included in both informal inspections, and weekly environmental inspections by the environment team. The weekly environmental inspection checklist includes a requirement to check "are beds of watercourses or banks showing signs of erosion caused by construction?" See EPBC 28 for frequency of environmental inspections, which includes inspections both during and post rainfall events. No increased intensity or erosion has been identified in any of

ID	Management Action	Performance Indicator/Target	Monitoring/Timing	Responsibility	Compliance Status
		All watercourses inspected every week and after all rainfall events. AND 100% of the recommendations from these inspections implemented within 5 days (likely impact) or 48 hours (immediate risk).	This timeframe may be extended if the cause of erosion is highly complex and requires detailed analysis, in this case a temporary preventative solution will be installed and maintained in lieu of final rectification. If an immediate risk of impact to matters of NES species in Cooperabung and Barry's Creek, i.e temporary rectification will be undertaken within 48 hours of the risk being identified.		these inspections, so there have been no recommendations from this part of the inspection to date.
EPBC 31 FF7	Prior to vegetation clearing in areas of known or potential Habitat for matters of NES, suitably qualified ecologist/expert will survey all areas to be cleared and will mark out any areas of significant vegetation (EECs, threatened species, riparian vegetation and mangroves) to be fenced and protected. Areas of weed infestation will also be identified and documented.	**Performance indicators:** Suitably qualified expert surveys area to be cleared and marks significant vegetation no later than 20 working days prior to clearing commencing. AND Weed infestations identified and documented as part of these surveys. **Performance targets:** No clearing commences until surveyed by a suitably qualified expert no later than 20 working days prior to clearing. AND 100% of weed infestations identified during these surveys are documented.	These surveys will be completed no later than 20 working days prior to the commencement of clearing and will be limited to the time required to complete these surveys.	Environmental Manager Project Ecologist	At least 20 days prior to clearing, the Project Ecologist (who is suitably qualified), completed this survey and surveyed all areas to be cleared. The survey included: • Confirmation of the accuracy of the sensitive area mapping, which includes areas of significant vegetation No additional areas were identified for protection. • Noxious weed survey including, location of weed infestations, species of weed, weed class, patch size and weed mapping. The results of these surveys will be included in the Pre-Clearing & Clearing Report for Stage 3, which will be finalised following the completion of Stage 2 clearing (the western side of the highway following the traffic switch), and included in the 2016/17 annual report.
EPBC 32	Pre clearing surveys for Giant Barred Frog at Cooperabung Creek and Barrys Creek shall be undertaken in accordance with the following (as identified in section 3.2.2 of Appendix B): a) Within 48 hours of scheduled clearing/ground disturbance operations, the Project Ecologist will perform pre-clearing surveys over a minimum of two non consecutive nights (i.e. before clearing). b) Surveys are to last 1 person hour per hectare of habitat to be disturbed/removed and involve the use of call broadcast, spotlighting and active searches of litter, debris and logs. c) All Giant Barred Frogs captured will be relocated to the nearest side of the clearing limit with information collected on sex, breeding condition and snout-vent length. Alternative relocation sites may be considered provided they occur within the same drainage line. As a general rule, frogs should not be relocated further than 300 m from the capture site which should theoretically remain within an individual's home range. d) Frogs with a snout-vent length >40 mm will be PIT3 tagged to document the performance measure of this as a suitable relocation strategy. Juvenile/sub adult frogs may be marked in accordance with the animal care and ethics licence of the Project Ecologist. e) A frog hygiene protocol will be adopted at sites with known Giant Barred Frog habitat. This protocol will be in accordance with Department of Environment and Climate Change DECC (now EPA) Hygiene protocol for the control of disease in frogs Information Circular Number 6 (DECC 2008). As part of this hygiene protocol the status of Chytrid fungus will be assessed by taking swab samples of captured frogs.	**Performance indicators:** Completion of pre-clearing surveys for the Giant Barred Frog. AND Relocation of captured Giant Barred Frogs outside the clearing limit. AND Implementation of Chytrid Fungus washdown procedure in Appendix J. **Performance targets:** No clearing / ground disturbance in Giant Barred Frog habitat unless pre-clearing survey conducted within 48 hours. AND 100% of Giant Barred Frogs captured are relocated outside clearing limit. AND Chytrid Fungus washdown procedure is completed in all areas identified in Appendix J prior to work in those areas.	48 hours prior to clearing in Cooperabung Creek and Barrys Creek. During pre-clearing surveys. As outlined in Appendix J.	Environmental Manager Project Ecologist Environmental Coordinators	All pre-clearing surveys were undertaken in accordance with the requirements of the Giant Barred Frog Management Plan (in Appendix B of the FFMP). The chytrid fungus washdown procedure has been implemented at Barrys Creek, and re-established for the recent commencement of Stage 2 clearing (the western side of the highway following the traffic switch). Chytrid fungus washdown is not required at Cooperabung Creek, as this creek was identified as being infected prior to the commencement of construction. No Giant Barred Frog relocations were conducted during this reporting period as there was no clearing in these areas (and hence no pre-clearing surveys).
EPBC 33	Relocation of Giant Barred Frogs shall be undertaken by a suitably qualified expert.	**Performance indicator:** Captured Giant Barred Frog relocated suitably qualified expert.	During pre-clearing surveys.	Project Ecologist Environmental Manager Environmental Coordinators	All Giant Barred Frog relocations have been undertaken by the Project Ecologist who qualifies as a suitably qualified expert under EPBC 2012/6518. These were all at Cooperabung Creek.

ID	Management Action	Performance Indicator/Target	Monitoring/Timing	Responsibility	Compliance Status
		Performance target: 100% of Giant Barred Frog relocations undertaken by a suitably qualified expert.			
EPBC 34 FF22	Clearing in Barrys Creek and Cooperabung Creek will be conducted outside of periods of wet weather to minimise impacts to habitat values consistent with the Giant Barred Frog Strategy.	**Performance indicator:** Clearing in Barrys Creek and Cooperabung Creek. **Performance target:** No clearing in Barrys Creek and Cooperabung Creek conducted in wet weather.	Prior to clearing commencing in these areas.	Project Ecologist Superintendent Environmental Coordinators	No clearing was conducted in Barrys Creek or Cooperabung Creek during this reporting period. Stage 2 clearing (the western side of the highway following the traffic switch) at Barrys Creek commenced in August 2016 (to be reported on in the next annual report).
EPBC 35 FF 33	Riparian and aquatic habitat in the vicinity of Cooperabung Creek and Barrys Creek shall be protected from construction works through the installation of protective temporary frog fencing and signage prior to works commencing. Protective fencing will be maintained until construction activities in that area are complete Riparian vegetation impacted by construction would be rehabilitated.	**Performance indicators:** Installation of temporary frog fencing and signage adjacent to Cooperabung and Barrys Creek. AND Commencement of rehabilitation of impacted riparian vegetation. **Performance targets:** No works commence in Cooperabung Creek and Barrys Creek until temporary frog fence and signage is installed. AND 100% of riparian vegetation rehabilitation commences within 24 hours of construction completion in that area.	Prior to works commencing in these areas. Within 24 hours of construction completion in that area.	Project / Site Engineers Foreman / Leading Hands Environmental Manager Environmental Coordinators	Temporary frog fencing and signage was installed at Cooperabung Creek prior to work commencing in this area. Works in this area were ongoing during this reporting period and fencing remains in place. Temporary fencing at Barrys Creek for stage 2 clearing was installed prior to works commencing in that area. Temporary fencing remains in place around the eastern side (stage 1 clearing) of Barrys Creek. Revegetation has commenced at Barrys Creek through the translocation of salvaged Lomandras, hydromulching and landscape planting.
EPBC 36	Dewatering procedures in Cooperabung Creek and Barrys Creek shall be in accordance with section 3.2.2(iv) of the Giant Barred Frog Management Strategy: a) In accordance with an Environmental Work Method Statement (EWMS) and the DECC (2008) Hygiene protocol for the control of disease in frogs Information Circular Number 6 (DECC 2008). b) Where the water body is to be pumped dry, the intake pipe must be positioned in the deepest section. This will avoid further disturbance of the aquatic habitat prior to capture and relocation of aquatic fauna. c) Screening of the pump intake (5mm mesh size) will be installed to prevent tadpole entrainment. d) Dip netting will be undertaken to remove as many aquatic fauna as practical once the water body is shallow enough to be effectively waded through by field personnel. e) All tadpoles will be identified and sorted by species and/or genus and placed into separate holding containers. The size of these containers will be left to the discretion of the qualified expert. f) All tadpoles will be released into permanent/semi-permanent pools in adjacent habitats by the qualified expert. Tadpoles will be first acclimatised to the recipient sites water temperature by immersing bags or aquaria in the release pools to allow a gradual equilibrium of water temperature prior to release. g) In instances where there are numerous tadpoles from a wide range of species, preferential treatment will be given to Giant Barred Frog tadpoles due to their legislative status as an endangered species. The release of predatory species (i.e. eels) will not occur in areas where Giant Barred Frog tadpoles are being released. This will reduce the risk of additional predation and/or competition.	**Performance indicators:** Development of dewatering EWMS for Cooperabung and Barrys Creek. AND Implementation of Chytrid Fungus wash-down procedure in Appendix J. AND Dewatering works in these areas. **Performance targets:** No dewatering works conducted in Cooperabung Creek and Barrys Creek until dewatering EWMS developed. AND Chytrid Fungus washdown procedure is completed in all areas identified in Appendix J prior to work in those areas. AND 100% of dewatering activities in Cooperabung Creek and Barrys Creek conducted in accordance with the EWMS.	Prior to dewatering commencing in these areas. As per Appendix J. Ongoing.	Project / Site Engineers Foreman / Leading Hands Environmental Coordinators Qualified expert (for tadpole relocation)	Dewatering EWMS was subject to agency consultation in October 2014. No dewatering in Cooperabung Creek or Barrys Creek was conducted prior to this time and all dewatering in these areas was conducted in accordance with this EWMS. In addition the EWMS for Minor Temporary Waterway Crossings and Minor Working Platforms includes these specific requirements for Cooperabung Creek and Barrys Creek. All dewatering activities within Barrys Creek and Cooperabung Creek have complied with these requirements.
EPBC 37	The sensitive area plans and clearing plans for the project in the vicinity of Cooperabung and Barrys Creek shall identify clearing extents and known and potential Giant Barred Frog Habitat.	**Performance indicator:** Inclusion of Giant Barred Frog habitat and clearing extents for Cooperabung and Barrys Creek in Sensitive Area Plans and clearing plans. **Performance target:** 100% of sensitive area plans identify Giant	Prior to construction commencing in these areas.	Environmental Manager	The CT01 design package (clearing plans) identifies the clearing extents in Cooperabung Creek and Barrys Creek. Giant Barred Frog habitat at Cooperabung Creek and Barrys Creek is identified on the Sensitive Area Plans.

ID	Management Action	Performance Indicator/Target	Monitoring/Timing	Responsibility	Compliance Status
		Barred Frog habitat, and 100% of clearing plans identify clearing extent in Cooperabung Creek and Barrys Creek.			
CoA 2d.					
EPBC 38 FF 23	A suitably qualified expert will undertake pre-clearance surveys for matters of NES immediately prior to clearing activities. Searches will be undertaken for nests, hollow bearing trees, logs & bat roosts within existing culverts and bridges. Searches will take place no earlier than 48 hours prior to the removal of vegetation occurring in that area to ensure that the area is free of the Koala, Giant-Barred Frog, Grey-headed Flying-fox, and Spotted-tail Quoll.	**Performance indicator:** Completion of pre-clearance surveys for matter of NES. **Performance target:** 100% of pre-clearance surveys are conducted no earlier than 48 hours prior to clearing commencing in that area.	No earlier than 48 hours prior to clearing	Project / Site Engineers Construction Manager Project Ecologist Environmental Coordinators	Pre-clearing surveys for matters of NES were conducted no earlier than 48 hours prior to clearing commencing in that area. These surveys will be documented in the Pre-Clearing/ Clearing Report for this stage, to be included in the 2016/17 Annual Report.
EPBC 39 FF24	During the proposed clearing works, the suitably qualified expert or an experienced wildlife handler under the supervision of the suitably qualified expert will be present to retrieve and provide appropriate care of any displaced matters of NES and release the fauna into adjacent habitats safe from construction work.	**Performance indicators:** Clearing works undertaken with suitably qualified expert or experienced wildlife handler present. AND Relocation of fauna relocation conducted by suitably qualified expert or an experienced wildlife handler. **Performance targets:** Suitably qualified expert or experienced wildlife handler present for 100% of clearing works. AND 100% of fauna relocation conducted by suitably qualified expert or wildlife handler.	During all clearing. During all clearing.	Environmental Manager Superintendent Project Ecologist Environmental Coordinators	A suitably qualified expert or experienced wildlife handler was present during all clearing works. All Giant Barred Frog relocations have been conducted by a suitably qualified expert. None were conducted during this reporting period as there was no clearing in these areas (and hence no pre-clearing surveys).
EPBC 40 FF25	Clearing activities for the project will be undertaken in accordance with the following two stage process in all areas supporting identified matters of NES and fauna habitat such as hollow bearing trees, habitat trees and bushrock. This process will include but not be limited to: • Non-habitat trees will be removed before habitat trees, allowing fauna an opportunity to move from the habitat trees; • Habitat trees will be retained for a minimum of two night's after initial clearing, unless the Project Ecologist determines the tree can be removed one night after initial clearing safely; and • Felled habitat trees will be assessed by the Project Ecologist to determine if there is fauna remaining in the tree(s). Resident species or injured wildlife will be treated or relocated. In the event that a hazardous habitat tree is identified (a risk to the safety of workers and/or flora and fauna), an assessment will be under taken to identify any need for removal of the habitat tree prior to the minimum requirements stipulated above. This assessment will be undertaken with the Project Ecologist, the Clearing contractor, Lend Lease Environmental Manager, Lend Lease Safety Manager and a designated RMS Representative. If the tree is deemed a hazard to safety the following actions may be taken: ▪ Removal of the tree immediately (if there is low risk to injury of wildlife during felling). ▪ Removal of the tree within 24hrs of initial clearing if there is a high potential for significant fauna occupation. ▪ Establishment of an exclusion zone around the tree, and felling 48hrs after initial clearing (if there is a high potential for significant fauna occupation and a high risk of injury to fauna during felling). Dead or hazardous trees identified on the clearing boundary or with the potential to cause construction and/or operational safety concerns will be subject to an assessment for removal. If the tree is deemed to unsafe to remain it will be felled following the initial clearing front in accordance with approved clearing methodologies. If the tree is identified as a habitat tree and compensatory habitat assessments (i.e additional nest boxes) will be investigated and implemented where required.	**Performance indicator:** All clearing done in accordance with two stage clearing procedure and hazardous tree protocol. **Performance target:** 100% of clearing done in accordance with two stage clearing procedure and hazardous tree protocol.	During all clearing.	Environmental Manager Construction Manager Project Ecologist Environmental Coordinators	All clearing was conducted in accordance with the two stage clearing procedure and hazardous tree protocol. This clearing, and the clearing of any hazardous trees, is captured in the pre-clearing / clearing permits, and this information will be collated in the Pre-Clearing/ Clearing Report for this stage, to be included in the 2016/17 Annual Report.

ID	Management Action	Performance Indicator/Target	Monitoring/Timing	Responsibility	Compliance Status
CoA 2e.					
EPBC 41 App H	Fauna handling and rescue activities involving matters of NES shall be undertaken in accordance with Appendix H of this FFMP.	**Performance indicator:** Fauna handling and rescue conducted as per Appendix H. **Performance target:** All fauna handling and rescue done in accordance with Appendix H.	As per Appendix H.	Environmental Manager Construction Manager Project Ecologist Environmental Coordinators	See EPBC 39.
EPBC 44 FF 27	Contact details for the suitably qualified expert, local NPWS officers, FAWNA, RSPCA, the Port Macquarie Koala Hospital and local veterinary hospitals will be made available at the main site compound and should be attached to clearing permits for Clearing and Grubbing, These documents will be held by supervisory personnel at all locations where clearing is being undertaken, to enable quick contact in the event of a fauna rescue.	**Performance indicator:** Inclusion of contact details at main site compound and attached to clearing permits. **Performance target:** Contact details always available at main site compound and attached to 100% of clearing permits.	Prior to commencement of clearing each day.	Environmental Coordinators Foreman	Relevant contact details are provided on all Clearing and Grubbing permits. Contact details are also available on the Environmental Manager's Office door and in induction room, both of which are located at the main site compound. Clearing and Grubbing permits are held by supervisory personnel during clearing, to ensure these contact details are on hand if needed.
EPBC 45 FF21	Where clearing activities coincide with the Koala breeding season and a Koala with joey are identified in the clearing footprint, the following will be employed in consultation with the suitably qualified expert: - Temporary no go area; - Use of appropriate fencing to direct the Koala and Joey in a single direction outside the footprint; - Follow procedure identified in Section 5 of Appendix H	**Performance indicator:** Establishment of no go areas and provision of safe passage where a Koala with joey is identified during the breeding season. **Performance target:** No-go area established and safe passage provided immediately once Koala and Joey detected.	Immediately once Koala and Joey are detected in work area.	Project Ecologist Foreman / Leading Hands Environmental Coordinators	No koalas with joeys were identified within the clearing footprint during clearing.

Images

#	Description	Image
	Stage 1	
1	Revegetation along a cut batter of the project	
	Stage 2	
2	Progressive revegetation through hydromulching and tubestock planting at Smiths Creek (frog fence in background)	

#	Description	Image
3	Hydrocarbon boom installed at Smiths Creek	
4	Progressive installation of fauna furniture in completed box culvert C36.40 (also shown is low flow fish passage)	

#	Description	Image
5	Completed box culvert including fish passage within scour rock and replanting of salvaged lomandras	
6	Clearing incident on 21 July 2016, showing the area cleared, which was dominated by Pacific Highway regrowth vegetation.	
	Stage 3	

#	Description	Image
7	Tubestock planting, mulch-topsoil stabilisation and fauna (phascogale) fence at Barrys Creek	
8	Retention of groundcover in Barrys Creek until immediately prior to works commencing. This ultimately led to this area being able to be retained (between the flagging and the frog fence), rather than removed and replaced with scour rock.	

#	Description	Image
9	Fauna furniture out of a half completed box culvert at the southern end of the project (other half to be completed after the traffic switch) and progressive revegetation	

#	Description	Image
10	Culvert construction in progress just south of Fernbank Creek	
11	Example of progressive revegetation, where 70% cover would be considered to have been achieved (area to the right has been paved)	

Appendix B Ecological Monitoring Program

Species monitored	Report title
Giant Barred Frog spring, summer and autumn monitoring	Giant Barred Frog 2015-16 Monitoring Report Oxley Highway to Kempsey Pacific Highway Upgrade
Road kill construction monitoring conducted in this reporting period	Road Kill Report 2015/16 Oxley Highway to Kempsey Pacific Highway Upgrade
Koala spring/summer 2015 (year 1) monitoring	Koala Monitoring – Year 1 surveys Oxley Highway to Kempsey Pacific Highway Upgrade

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Environment and Heritage

Giant Barred Frog 2015-16 Monitoring

Oxley Highway to Kempsey, Pacific Highway Upgrade

Prepared for Road and Maritime Services

28 September 2016

Document control

Project no.:	1702
Project client:	Road and Maritime Services
Project office:	Port Macquarie
Document description:	Monitoring Report
Project Director:	Rhidian Harrington
Project Manager:	Chris McEvoy
Authors:	Francesca Amorosi, David Cummings
Internal review:	Frank Lemckert, Chris McEvoy, Rhidian Harrington
Document status:	Rev 1 - Final
Local Government Area:	Port Macquarie

Author	Revision number	Internal review	Date issued	Signature
Francesca Amorosi	Rev D5	Rhidian Harrington Frank Lemckert	25/08/2016	R Harrington
Francesca Amorosi	Rev 0	Rhidian Harrington Frank Lemckert Chris McEvoy	27/09/2016	C McEvoy
Francesca Amorosi	Rev 1	Rhidian Harrington Frank Lemckert Chris McEvoy	28/09/2016	C McEvoy

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Cover photograph: Giant Barred Frogs from Cooperabung Creek reference site (Photo: Frank Lemckert)

Executive summary

Context

This report documents findings for the 2015/2016 monitoring period (including spring 2015, summer 2016 and autumn 2016 surveys) for the Giant Barred Frog (*Mixophyes iteratus*) as required for the Oxley Highway to Kempsey (OH2K) Pacific Highway upgrade project (the Project).

Aims

The Giant Barred Frog monitoring program has the purpose of determining if the Project is having an impact upon populations and habitat of this species.

Methods

The Giant Barred Frog and its habitat is widely distributed within and outside the Project boundary. Six monitoring sites are identified (two reference and four impact). Each monitoring location was surveyed in accordance with the monitoring method and design specified in SMEC-Hyder (2014) and Lewis Ecological Surveys (2013).

Key results

A total of 162 records were made of frogs across the entire 2015/2016 monitoring period and Giant Barred Frogs were recorded at all six sites, and during all three monitoring periods. Summer surveys provided greater numbers of frog captures than in spring or autumn. The greatest counts obtained in any one survey were at the Pipers Creek Reference Site where 25 frogs were observed in the summer survey. The lowest counts obtained were at the Smiths Creek Impact Site in autumn, where only a single adult female frog was recorded.

Thirteen of the records were for recaptured individuals, representing 8% of all of the captures. This low recapture rate is resulting in population estimates with wide estimates of variance. Maximum population estimates are from the Pipers Creek Reference Site with 85 frogs (Variance = 860) and Maria River Impact site with 84 frogs (Variance = 2,720) and the lowest from the Pipers Creek Impact site with an estimate of 21.5 frogs (Variance = 24.7). High variance estimates preclude any meaningful statistical comparisons of the monitoring sites and periods.

Frogs were detected along all of the six transects and were recorded using a range of habitat types including *Lomandra*, leaf litter and bare earth. Female frogs were readily captured in all periods, whereas male frogs were captured predominantly in summer, reducing their chances of being recaptured.

Evidence of recruitment was noted at all six sites through the presence of juvenile and sub-adult frogs. Attempts to capture tadpoles resulted in two tadpoles being captured at one site over the entire survey period. The monitoring data currently indicates that lifecycle processes for Giant Barred Frog are persisting although it is not possible to make any conclusions about patterns of recruitment.

The sampling carried out for Chytrid fungus has indicated that this pathogen is present in the study area, but that its prevalence varies between sites and times of sampling. The presence of Chytrid is expected as it was detected during the baseline surveys in the Smiths Creek Impact site and in the Cooperabung Creek Reference site. Chytrid fungus infection was detected for the first time in both Pipers Creek Impact and Reference sites and in Maria River Impact site in spring 2016 and again in Pipers Creek Impact site during the summer 2016 survey.

Conclusions

There is evidence of compliance with performance indicators (i.e. persistence of Giant Barred Frog individuals and lifecycles). Chytrid testing has now confirmed Chytrid presence at Pipers Creek Impact site. No Chytrid fungus infection was detected at this site during the baseline surveys (it was only detected at Smiths Creek impact site and Cooperabung reference site).

Management implications

To contain the spread of the Chytrid fungus infection it is important that the hygiene protocol for the control of disease in frogs Information Circular Number 6 (DECC 2008) is methodically and rigorously followed for footwear but also for all vehicles that enter Giant Barred frog site/habitat where Chytrid fungus has already been detected. It is recommended to keep and review periodically a register of the wash down stations/procedures. Washdown procedures are currently present at Smiths Creek impact site and based on the 2015-2016 results should be implemented also at Pipers Creek impact site and also at Maria River Impact site. It also recommended to follow washdown procedures at Cooperabung Creek impact sites. Chytrid fungus has been previously recorded at Cooperabung Creek reference site, upstream of the impact site and even if not detected so far at the impact site, it is likely to be already present in this area.

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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 Statement of Commitments (SoC). A subsequent approval with additional conditions of consent (CoA) was granted in 2014 by the then Department of Environment (DoE) (now Department of the Environment and Energy; DEE) for matters of national environmental significance listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act* 1995 (EPBC Act). Combined, these approvals outline the mitigation and offsetting requirements for threatened species and ecological communities impacted by the Project. The Giant Barred Frog was identified as requiring mitigation and monitoring outcomes through the course of the Projects' construction and post construction period.

Legal Status

The Giant Barred Frog is listed as endangered on the New South Wales *Threatened Species Conservation Act* (TSC Act 1995) and Commonwealth EPBC Act. Monitoring of the species is required under the Project's approval.

Monitoring Framework

The Project MCoA, SoC and EPBC Act CoA require the Roads and Maritime Services to manage and monitor the Giant Barred Frog. Management is to be performed in accordance with the Construction Environmental Management Plan (CEMP) and Construction Flora and Fauna Management Sub-Plans (CFFMSP) for the Oxley Highway to Kundabung section (Lend Lease 2014) and Kundabung to Kempsey section (McConnell Dowell OHL JV 2014). Appended to these sub-plans is the Giant Barred Frog Management Strategy (Lewis Ecological Surveys 2013); an important component of the species management and monitoring framework.

The design, methods and performance indicators that define the Giant Barred Frog monitoring program are specified in the approved Ecological Monitoring Plan (EMP) (SMEC-Hyder 2014) and Giant Barred Frog Management Strategy (Lewis Ecological Surveys 2013).

Baseline Data

Four distinct Giant Barred Frog sub-populations have been recorded in the Project area (SMEC-Hyder 2014. Known 'impact' sites within the Project area are listed below:

- Cooperabung Creek
- Smiths Creek
- Pipers Creek
- Maria River.

Baseline data is provided in Niche (2015) for these 'impact' sites. In addition, baseline data for two reference sites (Cooperabung Creek and Pipers Creek) is also provided in Niche (2015). The purpose of this data is to enable before and after comparisons / analysis, and thus determine whether there has been any change in Giant Barred Frog populations within the impact sites.

Purpose of this Report

This report details the findings obtained from the third monitoring period following the baseline surveys. It represents the second monitoring report for the construction phase of the Project.

The first aim of this report is to summarise the findings of spring 2015, summer 2016 and autumn 2016 Giant Barred Frog monitoring surveys (2015/2016), including the number of individuals recorded at each site, presence of Chytrid and the prevailing weather conditions.

A second aim is to compare the results with the baseline surveys to determine whether performance measures are being met and comment on whether additional measures need to be implemented.

1.2 Project objectives

The Project objectives for the Giant Barred Frog are specified in the MCoA, SoC and EPBC Act CoA and are listed in Table 1.

Table 1: Project MCoAs, SoCs and EPBC Act CoAs for the Giant Barred Frog

Objective	Reference Number	Commitment	Timing
Management of Giant Barred Frog and its habitat	MCoA B31(b)(v)	Management Strategy for the Giant Barred Frog.	Pre-construction and operation
Determine effectiveness of flora and fauna mitigation measures	SoC F21 MCoA 10	An adaptive monitoring program will be developed and implemented to allow the effectiveness of mitigation and offset measures to be assessed and allow for their modification if necessary. The program will be for a minimum of six years after construction completion.	Pre-construction, construction and operation
Prevention of wildlife mortality	SoC F19	Fauna exclusion fencing (e.g. floppy-top fencing) will be erected along the Proposal at appropriate locations to direct fauna movement towards wildlife crossing structures.	Construction

1.3 Performance measures

The approved EMP (SMEC-Hyder 2014) specifies the following performance indicators 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.
- Continued presence of Giant Barred Frogs during each survey event in Years 1 – 8 at sites where it was identified during baseline surveys.
- 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).
- 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.

1.4 Monitoring timing

The finalised Ecological Monitoring Program (EMP) required three baseline surveys for the Giant Barred Frog to be undertaken in spring, summer and autumn prior to the commencement of construction. The surveys are to cover four impact sites and two control sites.

Monitoring of all sites will continue tri-annually in years 1, 2 and 3 once substantial construction has commenced. Following the completion of the project, monitoring will continue for a further five years, or until the mitigation measures can be demonstrated to be effective. The location of field sites and the techniques employed are summarised in section 2.

1.5 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 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 Monitoring sites

As per baseline survey, 2015/2016 monitoring was undertaken in four separate 'treatment' habitats, where the Pacific Highway crosses creek lines known to contain the Giant Barred Frog. These include Cooperabung Creek, Smiths Creek, Pipers Creek and Maria River. Two analogue "control" stream sites, termed reference sites for this study, were also surveyed, being upstream sections of Cooperabung Creek and Pipers Creek.

Each site comprises a one kilometre transect. The treatment 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.

During 2015/2016, five of the six transects were surveyed for their entire length. The Cooperabung Creek impact site was not surveyed for the full kilometre because access agreements with landowners could not be obtained for the final zone downstream, and for the first three zones upstream.

The locations of all monitoring sites are shown onFigure 1**Error! Reference source not found.**, with detailed locations for each site transect provided from Figure 2 to Figure 7.

2.2 Survey method

The methods used to survey the six transects follow those described in the approved Giant Barred Frog Management Strategy (Lewis 2013). Each one kilometre transect was searched for a minimum of 120 person minutes, but the time required to effectively survey a site depended on access and structure of the vegetation and so total person minutes spent on surveys varied between transects and sites. The time of arrival at the start of the survey transect was noted and the survey initiated by listening for vocalisations for 10 minutes. This was followed by calls played intermittently for 15 minutes and then listening for a further 10 minutes. Two or more surveyors then walked slowly down the sides of the stream using headlamps or spotlights to search for Giant Barred Frogs, using reflective eye shine to locate animals in the water or on the banks within 20 metres of the water. Additional call playback followed by periods of listening was undertaken at least every 50 metres along the transect. Time of finishing was recorded at the end of each transect.

When an animal was located, its position on the transect was recorded and the animal was captured, if possible. Once captured, the frog was checked to see if it had been previously marked with a Passive Integrated Transponder (PIT) tag and, if so, the number was recorded. If not, the animal was injected with a PIT tag for permanent identification. At the same time, the animal's sex, weight, snout vent length, age status (metamorph/juvenile/adult) and breeding condition (being the condition of the nuptial pads in males or in females whether they were gravid) were all recorded and each individual was swabbed for the presence of Chytrid fungus.

Tadpole trapping was also undertaken as per the EMP. This consisted of two types of sampling. Dip-netting was undertaken through a series of 10 sweeps with a 20 centimetre diameter dip net completed every 50 metres of stream length. Tadpole trapping was undertaken by placing two standard baitfish traps (~300 millimetres by 200 millimetres) in pools in each of the ten 100 metre zones (i.e. a total of 20 traps per transect) and all left for a minimum of three hours before being inspected. Numbers and types of tadpoles captured by either method were recorded and then all tadpoles released.

The weather conditions recorded for each survey included temperature and humidity (either by windwatch or hygrometer), % cloud cover and broad wind level (scale of 0-3). Rainfall within the previous 24 hours, 7 days and 30 days was recorded from the Roads and Maritime Services Weather Stations Oxley Highway to Kempsey upgrade – Telegraph Point (station code RMSN1AWS). This data was collected to indicate the suitability of the weather conditions at the time of the surveys.

All three monitoring events (spring 2015, summer 2016 and autumn 2016) were conducted by Niche Environment and Heritage.

2.3 Water quality

Water quality measurements were conducted by the Roads and Maritime Services and data was available between 22 July 2015 and 21 July 2016 for this work (RMS 2016a, 2016b). Water quality data from both upstream and downstream sites was summarised for the following GBF habitats:

- Cooperabung Creek
- Smiths Creek
- Pipers Creek
- Maria Creek.

Water quality parameters interpreted for this monitoring included:

- electrical conductivity (EC)
- dissolved oxygen (DO)
- pH
- turbidity (NTU)
- total suspended solids (TSS)
- metals (AL, As, Cd, Cr, Cue, Fe, Pb, Mn, Hg, Ni, Ag and Zn)
- total nitrogen
- total phosphorus.

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 Australia for slightly disturbed ecosystems for freshwater systems. Trigger values were derived from 24 sampling events up to and including the month indicated, where data was available.

2.4 Analysis

Population estimates of the number of individuals present at each site were undertaken from the available mark-recapture data using the Chapman correction of the Lincoln-Petersen Model (hereafter called Chapman) to reduce variability in the estimates.

The equation for the Chapman Correction used was:

$$N = \frac{(M+1)\,(C+1)}{R+1} - 1$$

Where:

N = Population Size Estimate

M = The total number of animals captured and marked on the first visit

C = The total number of animals located on the second visit

R = The number of animals on the first visit recaptured on the second visit.

A basic estimate of the variance of the population size was also provided using the following formula:

$$\text{Variance (N)} = \frac{(M+1)\,(C+1)\,(M-R)\,(C-R)}{(R+1)\,(R+1)\,(R+2)}$$

The Minimum Known to be Alive (MKTBA) was also calculated (see Sutherland 2006) to provide a simple comparative measure of population size. This index is based on the number of new individuals encountered over multiple visits, where any new animals are summed, providing an aggregate total. Limitations of this method are that it does not account for any migration out of the population or any death, so may over-estimate the total population size if counts are completed over a long period of time. However, the same assumptions apply equally for the Chapman method.

3. Results

3.1 Streamside search results

A total of 162 records were made of Giant Barred Frogs during the 2015/2016 monitoring surveys, with frogs being recorded at all six sites, and during all three monitoring events (Table 2). Frogs were captured on 146 occasions, including 13 recaptures. One frog was recaptured twice. The results clearly demonstrate that the summer surveys provide greater numbers of frog captures than spring or autumn. The highest counts obtained in any one survey were at the Pipers Creek Reference site (summer = 26) and lowest at the Smiths Creek Impact site (autumn = 1). The mean number of frogs per visit was relatively uniform across sites (n = 6.0 - 8.67) except for the Pipers Creek Reference site that had larger number of frogs present (n = 18.33).

Table 2: Number of Giant Barred Frogs recorded at each site during 2015/2016 surveys

	Cooperabung Creek Impact	Smiths Creek Impact	Pipers Creek Impact	Maria River Impact	Cooperabung Creek Reference	Pipers Creek Reference
Spring	6	7	5	9	6	21
Summer	13	14	9	15	7	25
Autumn	2	1	7	4	5	9
Mean number of frogs per visit	7.00	7.33	6.00	9.33	6.00	18.33
Standard Error (SE)	3.21	3.76	1.53	3.18	0.58	4.81
MKTBA	16	21	14	24	15	46

The MKTBA count was highest at the Pipers Creek Reference Site (n = 46), but the estimate for the Cooperabung Creek reference site (n = 15) was in the same range as for the Impact Sites (n = 14 - 24). The raw data for the field surveys are presented in Annex 2.

The population estimates based on the Lincoln-Peterson equation with the Chapman Correction are provided in Table 3. Even with the Chapman correction the estimates of the variance associated with the counts were generally very large indicating little certainty in those estimates. For example, the Pipers Creek Reference site had a very similar overall population estimate to that for the Maria River Impact site (85 and 84 respectively), even though a much larger number of frogs were recorded at the Pipers Creek Reference Site. However, the variance estimates were 860 and 2,720 (i.e. more than 10 times the counts), demonstrating that neither estimate can be treated with any confidence. The Pipers Creek Impact site had the lowest overall population estimate being 21.5 frogs.

Table 3: Population estimates based on the Lincoln-Peterson Estimate with Chapman correction (variance is in brackets)

	Cooperabung Creek Impact	Smiths Creek Impact	Pipers Creek Impact	Maria River Impact	Cooperabung Creek Reference	Pipers Creek Reference
Spring 2015 vs Summer 2016	69 (1890)	39 (320)	19 (35)	80 (2592)	17.7 (31.1)	160.3 (4853.4)
Summer vs Autumn 2016	19 (90)	19 (90)	14 (9)	44 (720)	39 (560)	43 (209)
All visits	31 (240)	33 (272)	21.5 (24.7)	84 (2720)	69 (1820)	85 (860)

* The all visits data was analysed by comparing the autumn data against the combined spring and summer captures.

3.2 Tadpole trapping

Two 'Barred Frog' tadpoles *Mixophyes* sp. were caught using tadpole traps during the spring survey period at Cooperabung Creek Impact site. The tadpoles were highly likely to be Giant Barred Frogs, but positive identification is very difficult without removing animals from the field and access restrictions to the site did not allow this.

Tadpoles were infrequently observed at the other sampling sites, but were not able to be captured and their identity was uncertain.

3.3 Weather conditions

The prevailing weather conditions encountered during the field surveys are summarised in Table 4. More details of the prevailing micrometeorological conditions at the six sites during the field surveys are presented in Annex 1. Conditions were similar to those recorded during the baseline surveys.

Table 4: Prevailing weather conditions recorded during spring 2015, summer 2016 and autumn 2016 field surveys

Date	Maximum temperature (C)	Minimum temperature (C)	Humidity (%)	Rainfall in the last 24 hours (mm)	Rainfall in the last 7 days (mm)	Rainfall in the last 30 days (mm)
19/10/2015	26.0	14.6	80.7	0	17.6	77.8
20/10/2015	30.0	13.0	74.5	0	17.4	75.2
21/10/2015	30.3	15.6	72.7	0	17.4	68.2
01/02/2016	33.0	14.7	72.9	0	27.6	158.0
02/02/2016	28.1	18.9	73.9	0	22.2	158.0
03/02/2016	31.7	16.9	81	0	21.8	146.2
12/04/2016	25.4	14.7	77.2	14.2	23.0	68.6
13/04/2016	27.0	15.1	78.7	31.8	25.8	71.4
14/04/2016	24.1	11.1	85.5	39.4	26.4	72

3.4 Chytrid Fungus

Chytrid fungus sampling was carried out in all three monitoring events: spring 2015, summer 2016 and autumn 2016 surveys. During spring 2015, Chytrid fungus was detected at three of the six sites. Chytrid fungus was detected in Piper creek impact and reference sites and in Maria River impact site. In summer 2016, infected frogs were recorded only in Pipers creek impact site. Chytrid fungus was not detected from any frogs during the autumn monitoring surveys. Chytrid fungus was detected during baseline survey in Cooperabung creek reference site and in Smiths creek impact site. It was not detected in these two sites during the 2015/2016 monitoring but once detected, it is presumed this pathogen will still be present at a location on a permanent basis. So far Cooperabung creek impact is the only site where Chytrid fungus has not been detected yet (Table 5).

Table 5: Chytrid fungus detection/present within the Project sites.

	Cooperabung Creek Impact	Smiths Creek Impact	Pipers Creek Impact	Maria River Impact	Cooperabung Creek Reference	Pipers Creek Reference
Baseline	Chytrid fungus non detected	Chytrid fungus detected	Chytrid fungus non detected	Chytrid fungus non detected	Chytrid fungus detected	Chytrid fungus non detected
2015-2016	Chytrid fungus non detected	Chytrid fungus present	Chytrid fungus detected	Chytrid fungus detected	Chytrid fungus present	Chytrid fungus detected

3.5 Habitat survey information

Habitat information collected for each site is presented in Annex 1.

3.6 Water quality

A review of water quality monitoring data (RMS 2016a, 2016b) and comparison against the site specific trigger values (80th and 20th percentile) for the corresponding upstream sites allowed for the performance measure of water quality in GBF habitat to be assessed. These findings are presented as a summary of the relevant data in the sections below.

3.6.1 Cooperabung Creek

The majority of water quality parameters monitored during each sampling event for the downstream site in Cooperabung Creek conformed to the site specific trigger values. Parameters that were outside the site specific trigger value range included electrical conductivity on six occasions, total nitrogen, total suspended solids and turbidity on three occasions, and dissolved oxygen and total phosphorus on one occasion. Of these, total nitrogen also exceeded the ANZECC default trigger value, while a very low turbidity reading was also below the lower limit for the ANZECC default trigger value. For metals there were six occasions where zinc, four occasions for manganese, two occasions for aluminium, and one occasion for iron where they were detected at concentrations above the site specific trigger value. Of these zinc and aluminium were also found to be above ANZECC default trigger values (Table 6).

Table 6: Water quality parameters that exceeded site specific trigger values at Cooperabung Creek

Sampling event	Parameter	Value Downstream site (median)	Upstream Trigger (PM)	ANZECC default trigger value
August 2015	Zinc (mg/L)	0.015	0.006	0.008
September 2015	Electrical conductivity (uS/cm)	227	135-212$^{\#}$	125-2200$^{\#\#}$
	Turbidity (NTU)	38	10-33$^{\#}$	6-50

Sampling event	Parameter	Value Downstream site (median)	Upstream Trigger (PM)	ANZECC default trigger value
	Zinc (mg/L)	0.01	0.006	0.008
	Total nitrogen (mg/L)	0.8	0.5	0.5
October 2016	Electrical conductivity (uS/cm)	225	135-207[#]	125-2200[##]
November 2015	Total suspended solids (mg/L)	6	5	NA
	Aluminium (mg/L)	0.49	0.37	0.055
	Total nitrogen (mg/L)	0.8	0.5	0.5
December 2015	Electrical conductivity (uS/cm)	225	140-203[#]	125-2200[##]
	Manganese (mg/L)	0.215	0.124	1.9
	Temperature (°C)	21	14.7-20.5[#]	NA
January 2016	Total suspended solids (mg/L)	8	5	NA
February 2016	Zinc (mg/L)	0.011	0.005	0.008
March 2016	Electrical conductivity (uS/cm)	214	159-208[#]	125-2200[##]
	Total suspended solids (mg/L)	6	5	NA
	Manganese (mg/L)	0.1	0.081	1.9
	Zinc (mg/L)	0.008	0.005	0.008
April 2016	Electrical conductivity (uS/cm)	217	159-209[#]	125-2200[##]
	pH	7.8	6.8-7.5[#]	6.5-8[##]
	Manganese (mg/L)	0.161	0.099	1.9
	Zinc (mg/L)	0.011	0.006	0.008
May 2016	Dissolved oxygen (%)	57	42-79[#]	85-110[##]
	Turbidity (NTU)	3	11-28[#]	6-50[##]
	Total suspended solids (mg/L)	9	5	NA
	Iron (mg/L)	0.9	0.83	ID
	Manganese (mg/L)	0.191	0.099	1.9
	Zinc (mg/L)	0.008	0.006	0.008
June 2016	Electrical conductivity (uS/cm)	144	150-204[#]	125-2200[##]
	Dissolved oxygen (%)	87	43-85[#]	85-110[##]
	Turbidity (NTU)	47	11-40[#]	6-50[##]
	Total suspended solids (mg/L)	6	5	NA
	Aluminium (mg/L)	0.56	0.22	0.055
	Total nitrogen (mg/L)	0.6	0.5	0.5
	Total phosphorus (mg/L)	0.04	0.03	0.05

[#]Upper trigger value for the corresponding upstream site for the 80th percentile and where relevant includes the lower value derived from the 20th percentile

[##]ANZECC upper default trigger value for physical and chemical stressors for south-east Australia for slightly disturbed ecosystems for freshwater systems

NA – No ANZECC default trigger value available

ID – Insufficient representative data (ANZECC)

3.6.2 Smiths Creek

The majority of water quality parameters monitored during each sampling event for the downstream site in Smiths Creek conformed to the site specific trigger values. Dissolved oxygen was found to be outside the range of the site specific trigger values on four occasions (two above and two below). The two low readings in December and April were well below the ANZECC default trigger values. Electrical conductivity was also found to be ousite the site specific trigger value range onthree occasions (two above and one below), with the low value also below the lower ANZECC default trigger value. Also turbidity on three occasions, total suspended solids and pH and on two occasions, and total nitrogen and total phosphorus on one occasion for each were also outside the range for the site specific trigger values. Of these only total phosphorus, which was slightly above, did not meet the ANZECC default guidelines. For metals, zinc on eight occasions, manganese on three occasions, and aluminium and iron on two occasions exceeded the site specific trigger values. Of these zinc and aluminium were also regularly well above the ANZECC default trigger value (Table 7).

Table 7: Water quality parameters that exceeded site specific trigger values at Smith Creek

Sampling event	Parameter	Value Downstream site (median)	Upstream Trigger (PM)	ANZECC default trigger value
August 2015	pH	7.1	6.4-6.9[#]	6.5-8[##]
	Total suspended solids (mg/L)	15	10	NA
	Zinc (mg/L)	0.019	0.006	0.008
September 2015	Electrical conductivity (uS/cm)	307	127-295[#]	125-2200[##]
	Zinc (mg/L)	0.028	0.005	0.008
October 2015	Zinc (mg/L)	0.041	0.006	0.008
November 2015	Turbidity (NTU)	47	10-35[#]	6-50[##]
	Total suspended solids (mg/L)	7	6	NA
December 2015	Dissolved oxygen (%)	38	52-92[#]	85-110[##]
January 2016	pH	7.1	6.7-7[#]	6.5-8[##]
	Zinc (mg/L)	0.019	0.005	0.008
February 2016	Zinc (mg/L)	0.007	0.005	0.008
	Total phosphorus (mg/L)	0.05	0.03	0.05
March 2016	Manganese (mg/L)	0.121	0.064	1.9
	Zinc (mg/L)	0.008	0.005	0.008
April 2016	Dissolved oxygen (%)	29	32-75[#]	85-110[##]
	Iron (mg/L)	0.85	0.75	ID
	Manganese (mg/L)	0.209	0.09	1.9
	Zinc (mg/L)	0.012	0.006	0.008
May 2016	Electrical conductivity (uS/cm)	362	166-242[#]	125-2200[##]
	Dissolved oxygen (%)	77	28-67[#]	85-110[##]

Sampling event	Parameter	Value Downstream site (median)	Upstream Trigger (PM)	ANZECC default trigger value
	Turbidity (NTU)	6	12-25[#]	6-50[##]
	Iron (mg/L)	1.58	0.8	ID
	Manganese (mg/L)	0.348	0.147	1.9
	Zinc (mg/L)	0.015	0.007	0.008
June 2016	Electrical conductivity (uS/cm)	111	136-235[#]	125-2200[##]
	Dissolved oxygen (%)	91	28-88[#]	85-110[##]
	Turbidity (NTU)	41	13-38[#]	6-50[##]
	Aluminium (mg/L)	0.36	0.17	0.055
	Total nitrogen (mg/L)	0.6	0.4	0.5
July 2016	Aluminium (mg/L)	0.33	0.30	0.055

[#]Upper trigger value for the corresponding upstream site for the 80th percentile and where relevant includes the lower value derived from the 20th percentile

[##]ANZECC upper default trigger value for physical and chemical stressors for south-east Australia for slightly disturbed ecosystems for freshwater systems

NA – No ANZECC default trigger value available

ID – Insufficient representative data (ANZECC)

3.6.3 Pipers Creek

The majority of water quality parameters monitored during each sampling event for the downstream site in Pipers Creek conformed to the site specific trigger values. Electrical conductivity was found to be greater than the site specific trigger value on five occasions but within the ANZECC default trigger value. Dissolved oxygen was also found on two occasions to be above the site specific trigger value but within ANZECC default trigger value. A very high result for turbidity was recorded in September, which was well above both the 80th percentile and ANZECC guideline trigger value however this reflected similarly elevated upstream turbidity. The only other occurrence where turbidity did not meet the site specific trigger value was due to a low turbidity value. On one occasion pH was slightly above the site specific trigger value but remained within the ANZECC default trigger values. Total phosphorus was found to be above both trigger values in January. For metals, zinc, aluminium, nickel and iron were elevated at times throughout the 12 months. Of these aluminium and zinc did occur at times at relatively high concentrations that were well above both trigger values (Table 8).

Table 8: Water quality parameters that exceeded site specific trigger values at Pipers Creek

Sampling event	Parameter	Value Downstream site (median)	Upstream Trigger (PM)	ANZECC default trigger value
August 2015	Electrical conductivity (uS/cm)	369	178-276[#]	125-2200[##]
September 2015	Electrical conductivity (uS/cm)	384	178-314[#]	125-2200[##]
	Turbidity (NTU)	134	16-54[#]	6-50[##]
October 2015	Electrical conductivity (uS/cm)	375	178-351[#]	125-2200[##]
	Zinc (mg/L)	0.013	0.007	0.008

Sampling event	Parameter	Value Downstream site (median)	Upstream Trigger (PM)	ANZECC default trigger value
November 2015	Aluminium (mg/L)	0.58	0.23	0.055
December 2015	Dissolved oxygen (%)	30	39-81[#]	85-110[##]
January 2016	pH	7.2	6.6-7.1[#]	6.5-8[##]
	Iron (mg/L)	1.02	0.90	ID
	Total Phosphorus (mg/L)	0.07	0.03	0.05
February 2016	Iron (mg/L)	1.23	0.96	ID
April 2016	Electrical conductivity (uS/cm)	468	283-394[#]	125-2200[##]
	Manganese (mg/L)	0.299	0.207	1.9
	Zinc (mg/L)	0.011	0.007	0.008
May 2016	Electrical conductivity (uS/cm)	523	238-422[#]	125-2200[##]
	Dissolved oxygen (%)	64	26-59[#]	85-110[##]
	Nickel (mg/L)	0.002	0.001	0.011
July 2016	Dissolved oxygen (%)	78	26-76[#]	85-110[##]
	Turbidity (NTU)	15	16-49[#]	6-50[##]
	Aluminium (mg/L)	1.02	0.22	0.055

[#]Upper trigger value for the corresponding upstream site for the 80th percentile and where relevant includes the lower value derived from the 20th percentile

[##]ANZECC upper default trigger value for physical and chemical stressors for south-east Australia for slightly disturbed ecosystems for freshwater systems

NA – No ANZECC default trigger value available

ID – Insufficient representative data (ANZECC)

3.6.4 Maria River

The majority of water quality parameters monitored during each sampling event for the downstream site in Maria Creek conformed to the site specific trigger values. Parameters that exceeded the trigger values included electrical conductivity and total suspended solids on two occasions, and dissolved oxygen, and total phosphorus on one occasion for each. Of these only total phosphorus exceeded the ANZECC default trigger value. Turbidity was found to be low on two occasions and outside the range of the site specific trigger values, but within the ANZECC default trigger value (Table 9). For metals, manganese was found to be above the site specific trigger value on seven occasions, but remained below the ANZECC default trigger value. Additionally aluminium, arsenic, copper, iron and nickel were also found to exceed the site specific trigger value on occasions. Of these, only alumminum and copper occurred at concentrations above the ANZECC default trigger value as well (Table 9).

Table 9: Water quality parameters that exceeded site specific trigger values at Maria Creek

Sampling event	Parameter	Value Downstream site (median)	Upstream Trigger (PM)	ANZECC default trigger value
August 2016	Electrical conductivity (uS/cm)	329	107-240[#]	125-2200[##]
	Turbidity (NTU)	14	18-44[#]	6-50[##]
September 2015	Electrical conductivity (uS/cm)	317	127-277[#]	125-2200[##]

Sampling event	Parameter	Value Downstream site (median)	Upstream Trigger (PM)	ANZECC default trigger value
	Manganese (mg/L)	0.372	0.186	1.9
October 2015	Manganese (mg/L)	0.372	0.186	1.9
November 2015	Aluminium (mg/L)	0.95	0.83	0.055
December 2015	Dissolved oxygen (%)	21	25-72[#]	85-110[##]
	Arsenic (mg/L)	0.002	0.001	0.024
	Copper (mg/L)	0.002	0.001	0.0014
	Iron (mg/L)	1.26	1.06	ID
	Manganese (mg/L)	0.205	0.175	1.9
	Nickel (mg/L)	0.002	0.001	0.011
January 2016	Total suspended solids (mg/L)	16	5-14[#]	NA
	Total Phosphorus (mg/L)	0.06	0.04	0.05
February 2016	Total suspended solids (mg/L)	19	5-14[#]	NA
	Iron (mg/L)	1.22	1.15	ID
	Manganese (mg/L)	0.002	0.001	1.9
March 2016	Arsenic (mg/L)	0.002	0.001	0.024
	Manganese (mg/L)	0.182	0.174	1.9
April 2016	Manganese (mg/L)	0.223	0.198	1.9
May 2016	Arsenic (mg/L)	0.002	0.001	0.024
	Iron (mg/L)	1.15	1.01	ID
	Manganese (mg/L)	0.220	0.208	1.9
June 2016	Aluminium (mg/L)	0.77	0.42	0.055
July 2016	Turbidity (NTU)	11	24-65[#]	6-50[##]
	Nickel (mg/L)	0.002	0.001	0.011

[#]Upper trigger value for the corresponding upstream site for the 80th percentile and where relevant includes the lower value derived from the 20th percentile

[##]ANZECC upper default trigger value for physical and chemical stressors for south-east Australia for slightly disturbed ecosystems for freshwater systems

NA – No ANZECC default trigger value available

ID – Insufficient representative data (ANZECC)

3.7 Other observations

Exotic predators or competitors were not noted during any of the monitoring survey periods. Exotic fish have been notable by their absence. There has been no indication of disturbance of habitat by pigs nor significant evidence of fox or cat activity that may impact on this species. Cattle activity at Smiths Creek was evident during the autumn survey and did cause some obvious disturbance to the banks of the creek.

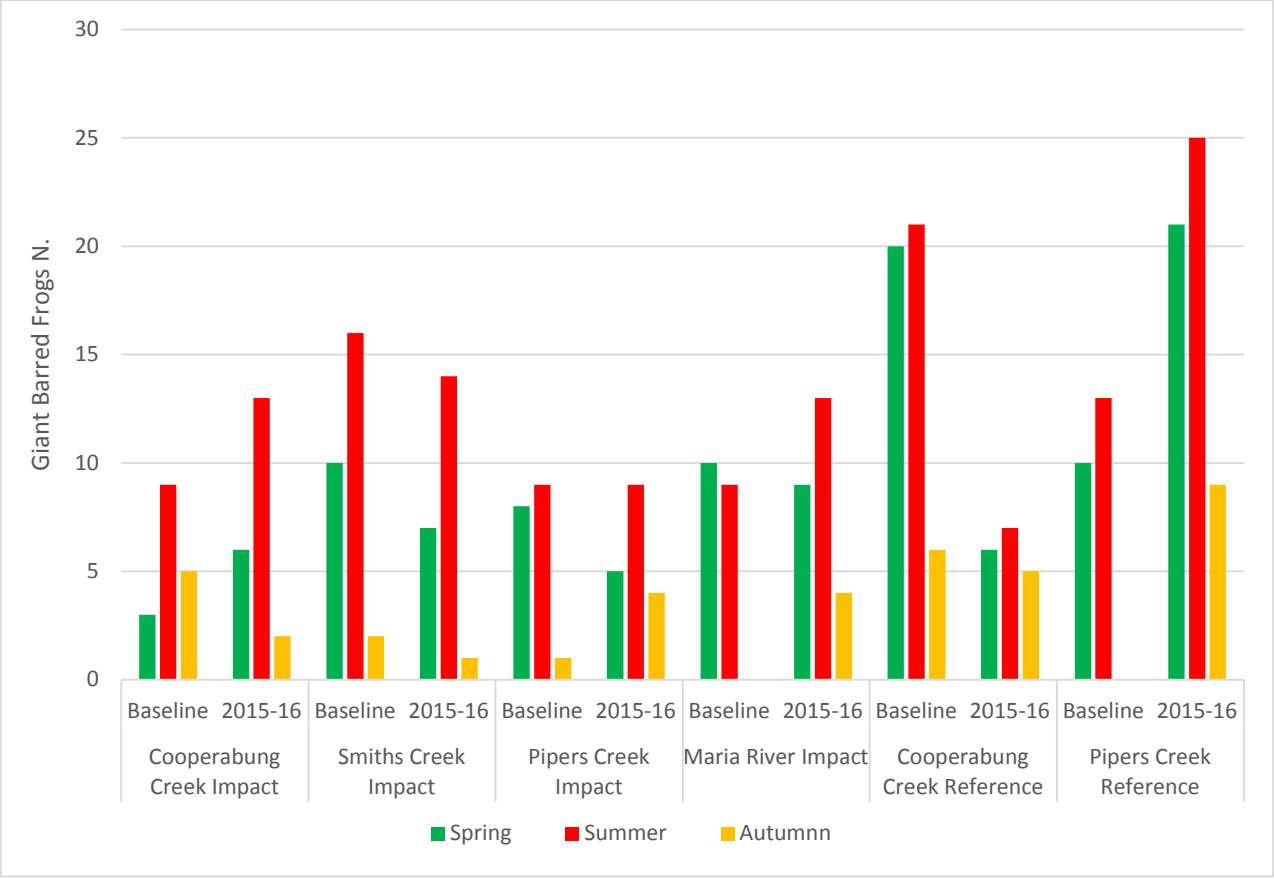
4. Discussion

During baseline surveys, the Giant Barred Frog was recorded across all six monitoring sites in spring and summer and in four sites in autumn (**Graph 1**; Table 10). No frogs were detected during the autumn 2014 survey in the Maria River Impact site or Pipers Creek Reference site. In contrast, during the 2015/2016 surveys, Giant Barred Frogs were recorded across all six sites in all three monitoring events (**Graph 1**).

In both the baseline and 2015/2016 surveys the counts clearly varied across the three monitoring periods, with the highest numbers of frogs recorded/captured in all but one instance occurring in summer and the lowest always occurring in autumn. Autumn results were always substantially lower than the other two periods, reflecting low frog activity in autumn. Also, calling and reproduction has ceased by autumn making frogs less easy to detect.

Notably, within these results was the distribution of records for the three categories of frogs. Females were readily detected in all three seasons, whereas male frogs were predominantly recorded in summer and juveniles mainly in autumn. This suggests differences in catchability of the sexes and age groups, depending on the season of the surveys. This does have a significant influence on recapture rates if males are only easily captured in the summer sampling period. Given the very limited number of recaptures for females, it also suggests that individuals are not active every night, and perhaps many nights, or different individuals are active at different times of the year.

Graph 1 Giant Barred Frogs recorded/captured, baseline vs. 2015/2016



MKTBA for the baseline survey and 2015/2016 surveys are relatively similar for the impact sites, with two sites having an increase in numbers, one a decrease and the other no change. The reference sites

presented opposite results to each other with the Cooperabung Creek reference MKTBA decreasing between baseline and 2015/2016, whereas at the Pipers Creek reference site the MKTBA increased.

In 2015/2016 Giant Barred Frogs were distributed broadly across all six transects, including downstream of the Cooperabung Creek Impact site, which had relatively few frogs recorded there previously. Previously the creek in this section had been essentially dry with only the occasional shallow pool. In summer 2016 the creek was flowing across its length and large pool areas were available for the frog to call adjacent to and breed in.

Habitat use was broad with frogs being located in all of the available microhabitats.

Table 10: Comparison of baseline and 2015/2016 survey results

	Coop Creek Impact		Smiths Creek Impact		Pipers Creek Impact		Maria River Impact		Coop Creek Reference		Pipers Creek Reference	
	Base-line	2015 2016	Base-line	2015 2016	Base-line	2015 2016	Base-line	2015 2016	Base-line	2015 2016	Base-line	2015 2016
Mean number of frogs per visit	5.67	7.00	9.33	7.33	6.00	6.00	6.33	9.33	15.67	6.00	7.67	18.33
Standard Error (SE)	1.76	3.21	4.06	3.76	2.52	1.53	3.18	3.18	4.84	0.58	3.93	4.81
MKTBA	15	16	26	21	14	14	15	24	45	15	23	46

4.1 Population estimates and comparisons

The use of the Chapman correction again provided population estimates with significant variance and so it is difficult to draw meaningful conclusions from the results. The high variance in the estimates of the populations precludes any rigorous statistical comparisons of the results as the high variances make it impossible to detect differences in estimates between sites or between years. The general capture and population results to date do not show any clear indications of declines at any site.

These variances will decrease if recapture rates increase, but recapture rates during both the baseline and 2015/2016 surveys were very low. Modification of the prescribed survey methodology may improve recapture rates and in turn provide more robust population estimates.

There are no losses of populations and all sites continue to support frogs of both sexes and juvenile frogs.

4.2 Chytrid sampling

The sampling carried out for Chytrid fungus has indicated that this pathogen is present in the study area, but that its prevalence varies between sites and times of sampling. The presence of Chytrid is expected as it was detected during the baseline surveys in the Smiths Creek Impact site and in the Cooperabung Creek Reference site. Chytrid fungus infection was detected for the first time in both Pipers Creek Impact and Reference sites and in Maria River Impact site in spring 2016 and again in Pipers Creek Impact site during the summer 2016 survey.

To contain the spread of the Chytrid fungus infection, it is important that the hygiene protocol for the control of disease in frogs Information Circular Number 6 (DECC 2008) be methodically and rigorously followed for footwear but also for all vehicles that enter Giant Barred frog site/habitat where Chytrid fungus has already been detected. It is recommended to keep and review periodically a register of the wash down stations/procedures. Washdown procedures are currently present at Smiths Creek impact site and based on the 2015-2016 results, should be implemented also at Pipers Creek impact site and also at Maria River Impact site. It also recommended to follow washdown procedures at Cooperabung Creek impact sites. Chytrid fungus has been previously recorded at Cooperabung Creek reference site, upstream of the impact site and even if not detected so far at the impact site it is likely to be already present on this area.

4.3 Tadpole monitoring

No "Barred Frog" tadpoles have been recorded in any of the six sites during the baseline surveys. Tadpoles were collected only on one occasion and in only one of the six monitoring sites (spring 2015 in the Cooperabung Creek Impact site) during the 2015/2016 surveys. However, reproduction can and has been concluded to have been successful due to the presence of juvenile and sub-adult frogs at all sites. Both bait trapping and dip-netting have demonstrated a very low catching rate. There is no clear guidance in the EMP document (SMEC-Hyder 2014) as to the reason to collect tadpoles nor a performance measure placed against the result and so the lack of success in capturing tadpoles does not influence the success of meeting the performance measures.

4.4 Water quality

Review of water quality monitoring data indicated that electrical conductivity was found to be higher than the upstream trigger value regularly throughout the 12 months. However, these values, while slightly elevated, were well within ANZECC guideline trigger values and have been reported to be typically consistent between upstream and downstream values when elevated (RMS 2016), indicating that these exceedances are unlikely related to construction activities. Although other water quality parameters were exceeded (i.e. dissolved oxygen, pH, turbidity and total suspended solids) they were typically minimal, infrequent and likely to be short-term occurrences with minimal potential for ecological impact on Giant Barred Frog habitat. Further discussion of these results is provided in Appendix A of the 2015/16 Annual Report.

Metal and nutrients were also found to exceed the 80th percentile based trigger value from the upstream site at times. Of these metals, aluminium, manganese and zinc were the most common metals found at elevated levels. Aluminium was regularly recorded above the trigger value and at levels 10 times or more the ANZECC guideline trigger value. Zinc was also commonly above the trigger value and ANZECC default value. While managanese showed slight elevated concentrations at times above the trigger value, but typically remained well within ANZECC default values. Given that it has been reported that, "elevated levels of metals were generally experienced concurrently both upstream and downstream" and that where "differences between upstream and downstream locations were recorded, this typically coincided with monitoring locations persisting as isolated ponds" (RMS 2016), it is likely that these typically short-term and infrequent elevations in metals are reflective of environmental variability at the subject sites and influences independent of the construction activities. There is no information available to indicate if such high levels of metals are likely to have negative impacts on the Giant Barred Frog, but if they are natural fluctuations for these creeks, then it would appear to be unlikely that they would have an impact.

5. Performance Measures

- **Monitoring is undertaken during baseline surveys and Years 1 – 8 or until monitoring can demonstrate that mitigation measures are effective.**

  This performance measure for 2015/2016 has been met. Giant Barred Frog monitoring has been undertaken in all six baseline sites.

- **Monitoring during Year 1 – 8 is undertaken at the Impact and Control sites where baseline monitoring was undertaken.**

  This performance measure for 2015/2016 has been met. Giant Barred Frog monitoring has been undertaken in all six baseline sites, except for Cooperabung Creek impact site that was not surveyed for the full kilometre because access agreements with landowners could not be obtained for the final zone downstream, and for the first three zones upstream. However, this section of stream was still monitored in the main, and population estimates were able to be completed.

- **Continued presence of Giant Barred Frogs during each survey event in Year 1 – 8 at sites where it was identified during baseline surveys.**

  This performance measure has been met for 2015/2016. During the baseline surveys, the Giant Barred Frog was recorded at all six monitoring sites in spring and summer and in 4 sites in autumn. During 2015/2016 surveys the Giant Barred Frog was recorded at all six sites in all three monitoring events.

- **Mitigation measures are effective as defined in the EPBC approval when all monitoring events are considered at Year 8.**

  Not applicable for 2015/2016 monitoring period as this is not the Year 8 period.

- **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).**

  Several water quality parameters exceeded the 80th percentile values, but only on occasions and they appear to be more likely be related to local stream variations rather than construction activity. Given the early stages of monitoring it is not reasonable to conclude that this is a result of impacts from road construction and so it is considered at this time that the performance measure has largely been met.

- **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.**

  The data obtained on the population estimates and actual counts vary greatly between events and years, but the number of frogs recorded do not clearly indicate significant changes in any of the monitored populations between the baseline and 2015/2016 surveys. The distribution of frogs remains widespread across the sites and transects and habitat use similarly remains widespread across the sites and transects. However, the results do not allow for meaningful comment on movement patterns of frogs.

Based on the data obtained, all of the performance measures for 2015/2016 are considered to have been met.

5.5 Contingencies

The EMP describes contingencies for potential problems identified in the construction and post construction period. For the Giant Barred Frog, the contingencies measures state that:

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.

No actions are required to be taken at this time as there is no indication of any decline in the Giant Barred Frog population.

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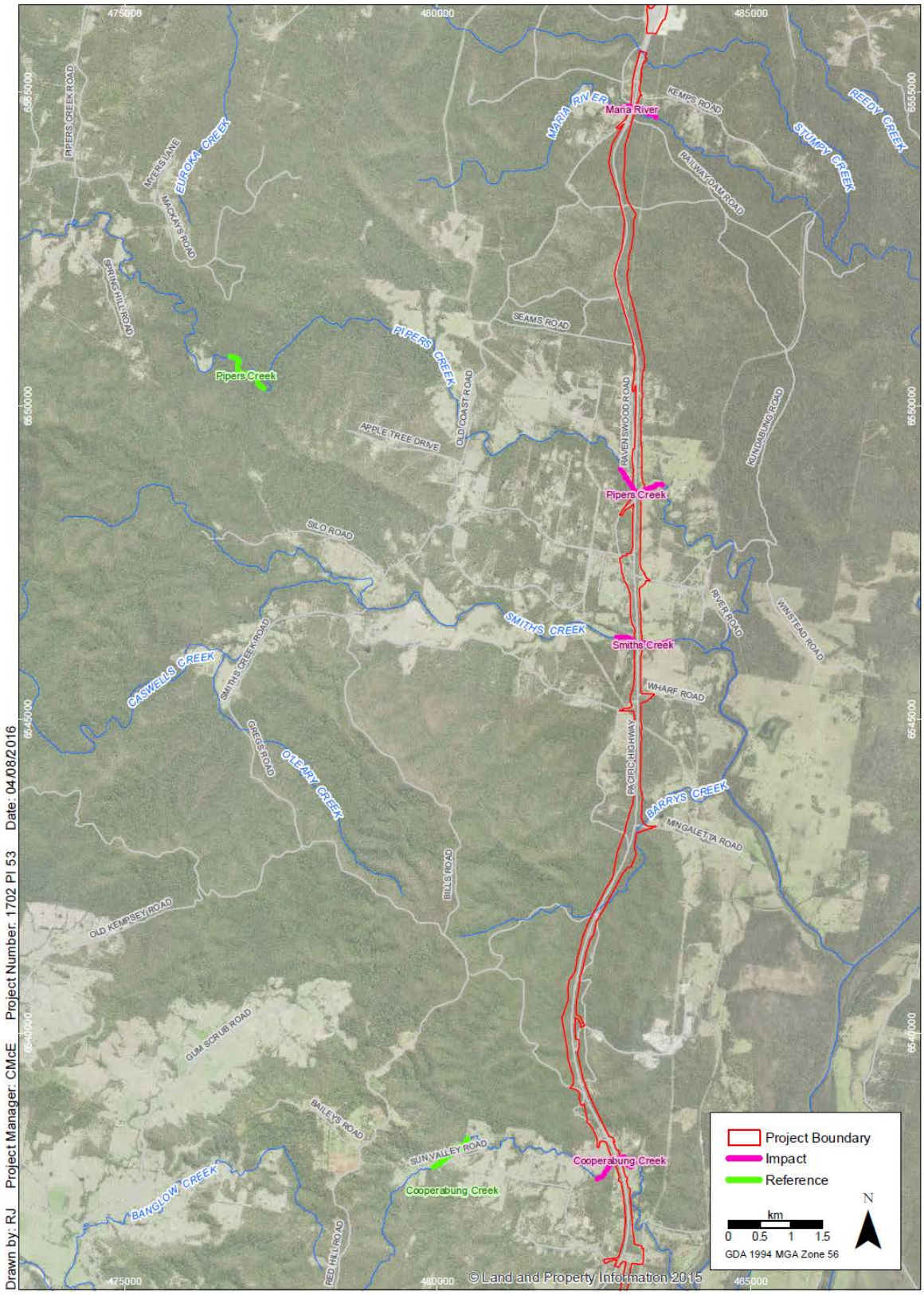
Figures

Figure 1. Giant Barred Frog 2015 - 2016 monitoring: sites overview



Giant Barred Frog 2015 - 2016 monitoring: sites overview

Pacific Highway Upgrade - Oxley Highway to Kempsey

Imagery: (c) LPI 2014-10-06

FIGURE 1

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Figure 2. Giant Barred Frog 2015 - 2016 monitoring: Cooperabung Creek Impact site

Giant Barred Frog 2015 - 2016 monitoring: Cooperabung Creek Impact site

Pacific Highway Upgrade - Oxley Highway to Kempsey

FIGURE 2

Imagery: (c) LPI 2014-10-06

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Figure 3. Giant Barred Frog 2015 - 2016 monitoring: Smiths Creek Impact site

Giant Barred Frog 2015 - 2016 monitoring: Smiths Creek Impact site

Pacific Highway Upgrade - Oxley Highway to Kempsey

FIGURE 3

Imagery: (c) LPI 2014-10-06

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Figure 4. Giant Barred Frog 2015 - 2016 monitoring: Pipers Creek Impact site

Giant Barred Frog 2015 - 2016 monitoring: Pipers Creek Impact site

Pacific Highway Upgrade - Oxley Highway to Kempsey

FIGURE 4

Imagery: (c) LPI 2014-10-06

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Figure 5. Giant Barred Frog 2015 - 2016 monitoring: Maria River Impact site

Giant Barred Frog 2015 - 2016 monitoring: Maria River Impact Site

Pacific Highway Upgrade - Oxley Highway to Kempsey

FIGURE 5

Imagery: (c) LPI 2014-10-06

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Figure 6. Giant Barred Frog 2015 - 2016 monitoring: Cooperabung Creek Reference site

Giant Barred Frog 2015 - 2016 monitoring: Cooperabung Creek Reference Site

Pacific Highway Upgrade - Oxley Highway to Kempsey

FIGURE 6

Imagery: (c) LPI 2014-10-06

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Figure 7. Giant Barred Frog 2015 - 2016 monitoring: Pipers Creek Reference site

Giant Barred Frog 2015 - 2016 monitoring: Pipers Creek Reference Site

Pacific Highway Upgrade - Oxley Highway to Kempsey

FIGURE 7

Imagery: (c) LPI 2014-10-06

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Annex 1 – 2015/2016 data summary for each monitoring site

Cooperabung Creek Impact

A summary of the date and time of the transect surveys and the abiotic conditions recorded during the fieldwork at the Cooperabung Creek Impact site is presented in Table 11.

Table 11: Summary of field works and prevailing abiotic variables recorded on Cooperabung Creek impact site

Date	Time		Air Temp. °C	Water Temp. °C	Humidity %	Steam Depth (cm)	Wind	Cloud Cover %	Rain
20/10/2015	Start	7:30:00 PM	24.1	24	72.4	100	0	30	0
21/10/2015	Finish	8:45:00 PM	21.8	22.5	85.6	70	0	30	0
3/02/2016	Start	1:16:00 AM	28.2	25.1	70	100	0	10	0
3/02/2016	Finish	3:06:00 AM	24.2	23.4	83.3	70	0	10	0
14/04/2016	Start	9:45:00 PM	17.3	20	94	150	0	25	0
14/04/2016	Finish	12:15:00 AM	16.7	19.8	99	70	0	0	0

Habitat details recorded at Cooperabung Creek Impact site are presented in Table 12.

Table 12: Habitat details recorded at Cooperabung Creek impact site

Zone	OS %	Shrub %	Ground cover %	leaf litter %	Bare Earth %	Cattle	Pools	Riffles	Depth of deepest Pool (cm)	Fence breaches (if applicable)
Clz6	60	40	95	5	1	No	1	0	150	1
Clz7	80	15	75	25	5	No	1	1	60	n/a
Clz8	80	35	55	5	40	No	3	2	70	n/a
Clz9	85	30	60	30	20	No	2	1	40	n/a
Clz5	75	40	30	10	30	No	2	0	50	1
Clz4	80	40	35	40	5	No	1	0	40	n/a
Clz3	70	20	55	15	10	No	3	1	40	n/a
Clz2	20	15	95	5	0	No	4	1	70	n/a

Number of Giant Barred Frogs Recorded:

Spring - Six Giant Barred Frogs were recorded/captured during the survey. They comprised three sub adult, two female and one males. At the time of the survey, male frog displayed 'no colour' of nuptial pads. One of the female was clearly gravid. This gravid female was a recapture from spring 2013. During the first time capture (FTC) this individual wasn't gravid and was located less than 50 metres downstream.

Summer – Thirteen Giant Barred Frogs were recorded/captured during the survey. They comprised two juveniles, one sub-adult, one female and nine males. At the time of the survey, all male frogs displayed dark nuptial pad colours indicating that all males were in a reproductive state to commence breeding.

Autumn – Two Giant Barred Frogs were recorded/captured during the autumn survey including one female and one sub adult. On two occasion during year 1 surveys the Giant Barred Frogs were distributed on both the eastern and western side of the study transect.

Evidence of Breeding Recorded: Via the presence of three sub-adult frogs in spring, two juveniles and one sub-adult frog in summer survey and two sub-adults in autumn.

Table 13: Summary of captures at the Cooperabung Creek impact site

	Spring 2015	Summer 2016	Autumn 2016
Number of frogs recorded	6	13	2
Number of adult males	1	9	0
Number of adult females	2	1	1
Number of subadults	3	1	1
Number of juveniles	0	2	0
Number of recaptures	1	0	0
Number of frogs with Chytrid/ swabbed	/6	/10	/1
Number of tadpoles caught in bait traps/nets	2	0	0

Zones Inhabited By Giant Barred Frogs: Restricted to zones CIz3, CIz4, CIz6, CIz7, CIz8, CIz9, CIz10 lie within and both upstream and downstream of the existing carriageway. In contrast to the baseline surveys, in 2015-2016 no frogs were recorded in zone CIz5 that forms part of the construction footprint.

Spring Sampling of Chytrid: All frogs swabbed tested negative for Chytrid.

Summer Sampling of Chytrid: All frogs swabbed tested negative for Chytrid.

Autumn Sampling Chytrid: All frogs swabbed tested negative for Chytrid.

Giant Barred Frog Tadpoles: Two *Mixophyes* tadpoles were captured in two big and low flowing pools in zones CIz2 and CLz3 but the species of *Mixophyes* could not be determined.

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

Water Levels: Mean depth 500 mm west and 800 mm east. During the baseline surveys the mean depth was 700 mm west and 50 mm east. The level of water on the eastern side dramatically increased during the 2015/2016 surveys and that could be one of the main reasons why Giant Barred Frogs have been recorded for the first time on the eastern side of the existing carriageway.

Smiths Creek Impact

A summary of the date and time of the transect surveys and the abiotic conditions recorded during the fieldwork at the Smiths Creek Impact site is presented in Table 14.

Table 14: Summary of field works and prevailing abiotic variables recorded at Smiths Creek impact site

Date	Time		Air Temp. °C	Water Temp. °C	Humidity %	Steam Depth (cm)	Wind	Cloud Cover %	Rain
21/10/2015	Start	11:00:00 PM	19.9	19.5	84.5	10	0	30	0
21/10/2015	Finish	1:30:00 AM	17.3	18.7	94.8	10	0	30	0
2/02/2016	Start	11:25:00 PM	21.6	21.6	85.1	10	0	0	0
2/02/2016	Finish	2:45:00 AM	18.8	21.1	98	10	0	0	0
13/04/2016	Start	9:45:00 PM	18.7	19	99	10	0	100	1/3
13/04/2016	Finish	12:10:00 AM	18.1	19	99	10	0	100	1/3

Habitat details recorded at Smiths Creek impact site are presented in Table 15.

Table 15: Habitat details recorded at Smiths Creek impact site

Zone	OS %	Shrub %	Ground cover %	leaf litter %	Bare Earth %	Cattle	Pools	Riffles	Depth of deepest Pool (cm)	Fence breaches (if applicable)
SIz6	50	20	20	20	80	Yes	1	0	120	2
SIz7	50	10	80	10	20	Yes	1	0	120	n/a
SIz8	60	15	10	25	20	Yes	1	0	120	n/a
SIz9	<5	15	90	10	10	Yes	2	1	70	n/a
SIz10	<5	20	80	30	10	Yes	2	0	50	n/a
SIz5	60	50	20	40	80	No	4	1	40	0
SIz4	80	50	40	25	60	No	5	2	40	n/a
SIz3	70	80	80	10	20	No	3	0	50	n/a
SIz2	40	40	20	45	80	No	3	3	20	n/a
SIz1	80	40	80	25	20	No	1	1	50	n/a

Number of Giant Barred Frogs Recorded:

Spring – Seven Giant Barred Frogs were recorded/captured during the survey. They comprised one sub-adult, four female and two males. At the time of the survey, male frogs all displayed 'no colour' on nuptial pads. No females were gravid.

Summer – Fourteen Giant Barred Frogs were recorded/captured during the survey. One frog was a recapture. They comprised two juveniles, one sub-adult, one female and ten males. At the time of the

survey, male frogs all displayed dark nuptial pad colours indicating that all males were in a reproductive state.

Autumn – One Giant Barred Frog was recorded/captured during the survey, and was an adult female.

Evidence of Breeding Recorded: Via the presence of one sub-adult frog in spring, two juveniles and one sub-adult frog in summer survey.

Table 16: Summary of findings from baseline surveys at the Smiths Creek impact site

	Spring 2015	Summer 2016	Autumn 2016
Number of frogs recorded	7	14	1
Number of adult males	2	10	0
Number of adult females	4	1	1
Number of subadults	1	1	0
Number of juveniles	0	2	0
Number of recaptures	0	1	0
Number of frogs with Chytrid/ swabbed	/7	/13	/1
Number of tadpoles caught in bait traps/nets	0	0	0

Zones Inhabited By Giant Barred Frogs: In spring and summer distributed across the transect, except within the construction footprint . In autumn the only frog recorded was upstream of the existing carriageway.

Spring Sampling of Chytrid: All frogs swabbed tested negative for Chytrid.

Summer Sampling of Chytrid: All frogs swabbed tested negative for Chytrid.

Autumn Sampling Chytrid: All frogs swabbed tested negative for Chytrid.

Giant Barred Frog Tadpoles: No *Mixophyes* tadpoles were recorded or observed across the transect.

Habitat: Microhabitat within these zones included flood debris as overhang shelter, grass and leaf litter. High level of ground disturbance due to high level of cattle activity was recorded downstream of the existing carriageway during the autumn survey.

Water Levels: Mean depth 500 mm west, 400 mm east.

Pipers Creek Impact

A summary of the date and time of the transect surveys and the abiotic conditions recorded during the fieldwork for the Pipers Creek Impact site is presented in Table 17.

Table 17: Summary of field works and prevailing abiotic variables recorded at Pipers Creek impacts site

Date	Time		Air Temp. °C	Water Temp. °C	Humidity %	Steam Depth (cm)	Wind	Cloud Cover %	Rain
20/10/2015	Start	11:20:00 PM	19.8	19.6	84.5	100	2	25	0
20/10/2015	Finish	1:30:00 AM	17.2	18.9	94.8	100	2	25	0
2/02/2016	Start	8:58:00 PM	24.5	24.3	80.2	100	1	10	0
2/02/2016	Finish	11:20:00 PM	21.3	23.4	90.4	100	0	10	0
13/04/2016	Start	6:10:00 PM	22.8	22	74	100	2	30	0
13/04/2016	Finish	9:00:00 PM	18.9	20	97	100	2	90	1/3

Habitat details recorded at Pipers Creek impact site are presented in Table 18

Table 18: Habitat details recorded at Pipers Creek impacts site

Zone	OS %	Shrub %	Ground cover %	leaf litter %	Bare Earth %	Cattle	Pools	Riffles	Depth of deepest Pool (cm)	Fence breaches (if applicable)
PIz5	80	20	80	40	2	No	1	0	40	0
PIz4	60	40	30	40	10	No	1	0	200	n/a
PIz3	70	50	80	35	2	No	1	0	105	n/a
PIz2	60	35	70	35	10	No	1	0	110	n/a
PIz1	65	45	50	45	10	No	1	0	100	n/a
PIz6	35	40	80	20	2	No	1	0	200	0
PIz7	85	20	40	15	20	No	3	1	100	n/a
PIz8	60	35	70	50	1	No	2	5	40	n/a
PIz9	50	40	90	5	2	No	2	1	100	n/a
PIz10	60	45	60	5	35	No	2	1	70	n/a

Number of Giant Barred Frogs Recorded:

Spring – A total of five Giant Barred Frogs were recorded/captured, including two adult males and two females.

Summer – Nine Giant Barred Frogs were recorded/captured during the survey. They comprised one sub-adult, six males and two females. At the time of the survey, male frogs all displayed dark nuptial pad colours indicating that all males were in a reproductive state.

Autumn – Seven Giant Barred Frogs were recorded/captured during the autumn survey including three males, two females, one unknown adult (it was unable to be captured) and one sub-adult. Two recaptures were recorded in summer and three in autumn. One adult male was recaptured in all three monitoring events and on all three occasions it was located in approximately the same area.

Evidence of Breeding Recorded: one sub-adult frog was recorded in summer, and one sub adult was recorded in the autumn survey.

Table 19: Summary of findings from baseline field surveys at the Pipers Creek impacts site

	Spring 2015	Summer 2016	Autumn 2016
Number of frogs recorded	5	9	7
Number of adult males	2	6	3
Number of adult females	3	2	2
Number of subadults	0	1	1
Number of juveniles	0	0	0
Number of recaptures	0	2	3
Number of frogs with Chytrid/ swabbed	/5	/9	/5
Number of tadpoles caught in bait traps/nets	0	0	0

Zones Inhabited By Giant Barred Frogs: Recorded from zones PIz7-PIz10 downstream and zone PIz4-PIz5 upstream. No frogs were identified within the construction footprint, as expected because the frog proof fence kept animals outside the construction area.

Spring Sampling of Chytrid: two of the five frogs swabbed tested positive for Chytrid.

Summer Sampling of Chytrid: seven of the nine frogs swabbed tested positive for Chytrid.

Autumn Sampling Chytrid: All frogs swabbed tested negative for Chytrid.

Giant Barred Frog Tadpoles: No tadpoles were recorded or observed.

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

Water Levels: Mean depth 1,000 mm west, 1,500 mm east. Over 2,000 mm in the deepest pool.

Maria River Impact

A summary of the date and time of the transect surveys and the abiotic conditions recorded during the fieldwork for the Maria River Impact site is presented in Table 20.

Table 20: Summary of field works and prevailing abiotic variables recorded at Maria River impact site

Date	Time		Air Temp. °C	Water Temp. °C	Humidity %	Steam Depth (cm)	Wind	Cloud Cover %	Rain
20/10/2015	Start	7:30:00 PM	23.4	22.3	72.4	40	2	10	0
20/10/2015	Finish	11:00:00 PM	21.1	21.9	75.3	40	2	20	0
1/02/2016	Start	9:19:00 PM	25.6	26.3	80.6	30	0	100	0
1/02/2016	Finish	11:20:00 AM	23.3	25.9	86	30	0	90	0
14/04/2016	Start	6:20:00 PM	19.5	19	92	50	0	20	0
14/04/2016	Finish	9:10:00 PM	17.4	18.5	99	50	0	20	0

Habitat details recorded at Maria River impact site are presented in Table 21

Table 21: Habitat details recorded at Maria River impact site

Zone	OS %	Shrub %	Ground cover %	leaf litter %	Bare Earth %	Cattle	Pools	Riffles	Depth of deepest Pool (cm)	Fence breaches (if applicable)	Zone
MIz6	20	15	75	5	5	No	1	0	50	3	MI5
MIz7	40	20	60	15	20	No	1	0	50	n/a	MI4
MIz8	70	10	10	20	80	No	4	0	40	n/a	MI3
MIz9	60	20	20	20	60	No	2	0	50	n/a	MI2
MIz10	10	40	40	5	20	No	2	0	100	n/a	MI1
MIz5	50	30	20	10	50	No	1	0	120	0	MI6
MIz4	15	30	30	20	40	No	1	0	120	n/a	MI7
MIz3	10	85	5	15	10	Yes	1	0	100	n/a	MI8
MIz2	3	90	10	5	0	No	1	0	100	n/a	MI9
MIz1	0	95	5	5	0	No	1	0	100	n/a	MI10

Number of Giant Barred Frogs Recorded:

Spring – A total of nine Giant Barred Frogs were recorded/captured during the spring survey, including three males, five female and one sub-adult. At the time of the survey, male frogs all displayed light nuptial pad colours, apart from one individual that exhibited light and dark nuptial pad colours.

Summer – Thirteen Giant Barred Frogs were recorded, comprising one male, nine female, one sub-adult and two juveniles. At the time of the survey, male frogs all displayed dark nuptial pad colours indicating

that all males were in a reproductive state. Six females were gravid or semi-gravid, two were not gravid and two adult females were unable to be captured.

Autumn – Four Giant Barred Frogs were recorded/captured during the survey, including two female and two sub-adults.

Evidence of Breeding Recorded: Yes, via the presence of one sub-adult frogs in spring and one sub-adult and two juvenile frogs in summer and two sub-adults in autumn.

Table 22: Summary of findings from baseline field surveys at the Maria River impact site

	Spring 2015	Summer 2016	Autumn 2016
Number of frogs recorded	9	15	4
Number of adult males	3	5	0
Number of adult females	5	8	2
Number of sub-adults	1	1	2
Number of juveniles	0	1	0
Number of recaptures	0	0	0
Number of frogs with Chytrid/ swabbed	/5	/11	/4
Number of tadpoles caught in bait traps/nets	0	0	0

Zones Inhabited By Giant Barred Frogs: Giant Barred Frogs recorded from zones MIz6 to MIz10 downstream and zone MIz4 to MIz5 upstream.

Spring Sampling of Chytrid: two of the eight frogs swabbed tested positive for Chytrid.

Summer Sampling of Chytrid: All frogs swabbed tested negative for Chytrid.

Autumn Sampling Chytrid: All frogs swabbed tested negative for Chytrid.

Giant Barred Frog Tadpoles: No tadpoles were recorded or observed.

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.

Water Levels: Mean depth 450 mm west, 400 mm east.

Cooperabung Creek Reference

A summary of the date and time of the transect surveys and the abiotic conditions recorded during the fieldwork for the Cooperabung Creek Reference site is presented in Table 23.

Table 23: Summary of field works and prevailing abiotic variables recorded at Cooperabung Creek reference site

Date	Time		Air Temp. °C	Water Temp. °C	Humidity %	Steam Depth (cm)	Wind	Cloud Cover %	Rain
21/10/2015	Start	8:50:00 PM	21.8	21.1	68.2	30	0	20	0
21/10/2015	Finish	10:40:00 PM	19.1	19.9	84.5	30	0	20	0
1/02/2016	Start	12:47:00 AM	21.3	26.5	88.9	40	1	10	0
1/02/2016	Finish	3:30:00 AM	19.1	25.6	97.6	40	0	10	0
12/04/2016	Start	11:00:00 PM	19.3	20.8	89	40	0	30	0
12/04/2016	Finish	1:30:00 AM	16.7	20.2	89	40	0	30	0

Habitat details recorded at Cooperabung Creek reference site are presented in Table 24

Table 24: Habitat details recorded at Cooperabung Creek reference site

Zone	OS %	Shrub %	Ground cover %	leaf litter %	Bare Earth %	Cattle	Pools	Riffles	Depth of deepest Pool (cm)	Fence breaches (if applicable)
CRz1	70	40	20	35	5	No	6	6	15	n/a
CRz2	60	5	70	15	20	No	5	4	15	n/a
CRz3	55	20	55	20	5	No	1	1	40	n/a
CRz4	30	15	65	15	5	No	3	4	35	n/a
CRz5	50	20	30	30	20	No	3	2	40	n/a
CRz6	50	20	40	5	35	No	3	3	20	n/a
CRz7	20	20	65	10	5	No	5	4	35	n/a
CRz8	70	15	65	15	5	No	1	1	45	n/a
CRz9	90	5	20	35	40	No	1	1	40	n/a
CRz10	80	10	55	20	15	No	2	2	20	n/a

Number of Giant Barred Frogs Recorded:

Spring – Six Giant Barred Frogs were recorded/captured, including one adult male, four females and one sub-adult. No juveniles were present.

Summer - Seven Giant Barred Frogs were recorded/captured, consisting of six adult males and one female. Male frogs all displayed dark nuptial pad colours. Two frogs were recaptures, both from spring 2015.

Autumn – Five Giant Barred Frogs were recorded/captured consisting of one male, two females, one sub-adult and one juvenile.

Evidence of Breeding Recorded: one sub-adult frog in spring, one sub-adult and one juvenile frog in autumn.

Table 25: Summary of findings from baseline field surveys at the Cooperabung Creek reference site

	Spring 2015	Summer 2016	Autumn 2016
Number of frogs recorded	6	7	5
Number of adult males	1	6	1
Number of adult females	4	1	2
Number of sub-adults	1	0	1
Number of juveniles	0	0	1
Number of recaptures	0	2	0
Number of frogs with Chytrid/ swabbed	/6	/7	/4
Number of tadpoles caught in bait traps/nets	0	0	0

Zones Inhabited By Giant Barred Frogs: Broadly distributed from zone CRz2-CRz9, and consistently presence in the middle and lower reaches of the transect.

Spring Sampling of Chytrid: All frogs swabbed tested negative for Chytrid.

Summer Sampling of Chytrid: All frogs swabbed tested negative for Chytrid.

Autumn Sampling Chytrid: All frogs swabbed tested negative for Chytrid.

Giant Barred Frog Tadpoles: No tadpoles were recorded or observed.

Habitat: Microhabitat found being used included above and partially buried within leaf litter (some of which included Lomandra shelters), pasture grass, within the undercut of the bank, and on dirt and rock.

Water Levels: Range from 150 to 450 mm.

Pipers Creek Reference

A summary of the date and time of the transect surveys and the abiotic conditions recorded during the fieldwork for the Pipers Creek Reference site is presented in Table 26.

Table 26: Summary of field works and prevailing abiotic variables recorded at Pipers Creek reference site

Date	Time		Air Temp. °C	Water Temp. °C	Humidity %	Steam Depth (cm)	Wind	Cloud Cover %	Rain
19/10/2015	Start	8:00:00 PM	21.9	22.1	72.2	50	0	0	0
19/10/2015	Finish	1:00:00 AM	20	19.9	84.4	50	0	0	0
3/02/2016	Start	8:15:00 PM	27.1	23.1	89.9	20	0	0	0
3/02/2016	Finish	12:05:00 AM	26	22.8	88.6	20	0	0	0
12/04/2016	Start	6:30:00 PM	21.6	19	83	18	0	30	0
12/04/2016	Finish	10:10:00 PM	17.2	18.8	99	18	0	30	0

Habitat details recorded at Pipers Creek reference site are presented in Table 27

Table 27: Habitat details recorded at recorded at Pipers Creek reference site

Zone	OS %	Shrub %	Ground cover %	leaf litter %	Bare Earth %	Presence of Cattle	Pools	Riffles	Depth of deepest Pool (cm)	Fence breaches (if applicable)
PRz5	55	15	80	15	5	No	1	2	90	n/a
PRz4	50	30	68	30	2	No	1	3	20	n/a
PRz3	70	20	70	20	10	No	3	1	70	n/a
PRz2	60	15	80	15	5	No	4	0	90	n/a
PRz1	45	10	85	10	5	No	4	2	120	n/a
PRz6	70	20	70	20	10	No	2	1	25	n/a
PRz7	85	20	20	20	60	No	2	1	35	n/a
PRz8	85	10	30	10	60	No	3	0	40	n/a
PRz9	15	35	35	35	30	No	1	0	40	n/a
PRz10	60	15	35	15	50	No	1	0	40	n/a

Number of Giant Barred Frogs Recorded:

Spring – A total of twenty one Giant Barred Frogs were recorded during the survey, comprising eight adult males, three females and ten sub-adults. At the time of the survey, male frogs displayed a range of nuptial pad colours with one frog each exhibiting 'no colour', light nuptials or medium nuptials, and three frogs exhibiting dark nuptials, indicating most males were in a reproductive state.

Summer – Twenty five Giant Barred Frogs were recorded/captured during the survey, including eighteen adult males, three females, two sub-adults and two juvenile. At the time of the survey, male frogs displayed

a range of nuptial pad colours with six frog exhibiting moderate nuptial pad colour and twelve frogs exhibiting dark nuptials, indicating most males were in a reproductive state. Two frogs were recaptures.

Autumn – Nine Giant Barred Frogs were recorded/captured during the survey, including two adult males, two females, one sub-adult and four juveniles. Two frogs were recaptures, both from spring 2015.

Evidence of Breeding Recorded: Via the presence of ten sub-adults in spring, two sub-adults and two juveniles in summer, and one sub-adult and four juveniles in autumn.

Table 28: Summary of finding from the baseline field surveys at the Pipers Creek reference site

	Spring 2015	Summer 2016	Autumn 2016
Number of frogs recorded	21	26	9
Number of adult males	8	21	2
Number of adult females	3	3	2
Number of subadults	10	1	1
Number of juveniles	0	1	4
Number of recaptures	0	2	2
Number of frogs with chytrid/ swabbed	/21	/24	/6
Number of tadpoles caught in bait traps/nets	0	0	0

Zones Inhabited By Giant Barred Frogs: Broadly distributed from zones PRz3-PRz9.

Spring Sampling of Chytrid: three of the 21 frogs swabbed tested positive for Chytrid.

Summer Sampling of Chytrid: All frogs swabbed tested negative for Chytrid.

Autumn Sampling Chytrid: All frogs swabbed tested negative for Chytrid.

Giant Barred Frog Tadpoles: No tadpoles were recorded or observed.

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

Water Levels: Range from 200 mm to 1,200 mm.

Annex 2 – Giant Barred Frog individual frog data

Location		Season	Sex	Age	Reproductive Status	Length	Weight	Distance to water	Pit Tag No.	First Time Capture/Recapture	Swabbed	Zone	Microhabitat	Activity	Notes
Impact	Cooperabung Creek	Spring	prob. Male	Adult	Uncoloured Nuptial Pads	80.0	100.0	0.1	00077E7BFB	First Time Capture	Y	CIz4	On ground		
Impact	Cooperabung Creek	Spring	Unknown	Sub Adult	Immature	55.7	38.0	4.0	00077E7E98	First Time Capture	Y	CIz4			
Impact	Cooperabung Creek	Spring	Unknown	Sub Adult	Immature	57.0	46.0	3.0	00077E7FFD	First Time Capture	Y	CIz4	On litter		
Impact	Cooperabung Creek	Spring	Unknown	Sub Adult	Immature	66.0	52.0	3.0	00077E8018	First Time Capture	Y	CIz4	bank on litter		
Impact	Cooperabung Creek	Spring	Female	Adult	Gravid	96.9	178.0	2.0	000735B40B	Recapture	Y	CIz3			Recap. Spring 2013
Impact	Cooperabung Creek	Spring	Female	Adult	Non Gravid	83.0	105.0	0.3	00077E7F53	First Time Capture	Y	CIz4	On ground		
Impact	Cooperabung Creek	Summer	Male	Adult	Dark Nuptial Pads	73.3	61.0	3.5	0007921ACC	First Time Capture	Y	Ciz9	On steep slope	Calling	
Impact	Cooperabung Creek	Summer	Male	Adult	n/a	n/a	n/a	0.0	n/a	Not Captured	n/a	CIz9			
Impact	Cooperabung Creek	Summer	Male	Adult	Dark Nuptial Pads	75.6	56.0	2.0	00079205FF	First Time Capture	Y	CIz10	On ground		
Impact	Cooperabung Creek	Summer	Male	Adult	n/a	n/a	n/a	n/a	n/a	Not Captured	n/a	CIz7		Calling	
Impact	Cooperabung Creek	Summer	Unknown	Juvenile	Immature	n/a	n/a	3.0	n/a	Not Captured	n/a	CIz7	On litter		
Impact	Cooperabung Creek	Summer	Male	Adult	Dark Nuptial	76.2	55.0	2.0	000791E9CA	First Time Capture	Y	CIz7	On bank under overhanging veg		
Impact	Cooperabung Creek	Summer	Male	Adult	Dark Nuptial Pads	76.9	57.0	6.0	000791EB9F	First Time Capture	Y	CIz6	On brick next to causeway		
Impact	Cooperabung Creek	Summer	Female	Adult	Gravid	96.6	128.0	0.5	000791E8C5	First Time Capture	Y	CIz7			
Impact	Cooperabung Creek	Summer	Unknown	Juvenile	Immature	52.4	12.0	4.0	000791EAA5	First Time Capture	Y	CIz4	On litter		
Impact	Cooperabung Creek	Summer	Male	Adult	n/a	n/a	n/a	1.0	n/a	Not Captured	n/a	CIz8		Calling in	

Location		Season	Sex	Age	Reproductive Status	Length	Weight	Distance to water	Pit Tag No.	First Time Capture/Recapture	Swabbed	Zone	Microhabitat	Activity	Notes
														stream	
Impact	Cooperabung Creek	Summer	Male	Adult	Dark Nuptial Pads	74.0	65.0	1.0	000791EBBD	First Time Capture	Y	CIz8		Calling in stream	
Impact	Cooperabung Creek	Summer	Unknown	Sub Adult	Immature	51.5	10.0	3.0	000791E973	First Time Capture	Y	CIz4	On dirt under trees		
Impact	Cooperabung Creek	Summer	Male	Adult	Dark Nuptial Pads	74.2	60.0	2.0	000791E8E2	First Time Capture	Y	CIz10	On ground		
Impact	Cooperabung Creek	Autumn	Female	Adult	Unknown	n/a	n/a	5.0	n/a	Not Captured	n/a	CIz9	On dirt		
Impact	Cooperabung Creek	Autumn	Unknown	Sub Adult	Non Gravid	64.0	44.0	3.0	0007921B50	First Time Capture	Y	CIz3	leaf matter under Lomandra		
Impact	Maria River	Spring	Female	Adult	Gravid	85.0	105.0	5.0	0077E6AC9	First Time Capture	Y	MIz10	On litter		
Impact	Maria River	Spring	Unknown	Sub Adult	Immature	47.0	42.0	4.0	00077E7F92	First Time Capture	Y	MIz10	On ground		
Impact	Maria River	Spring	Male	Adult	n/a	n/a	n/a	n/a	n/a	No Captured	n/a	MIz9		Calling	
Impact	Maria River	Spring	Female	Adult	Non Gravid	80.0	60.0	0.1	00077E6D1C	First Time Capture	Y	MIz9	On bank		
Impact	Maria River	Spring	Female	Adult	Non Gravid	91.4	90.0	4.0	00077E7DA0	First Time Capture	N	MIz8	On litter		
Impact	Maria River	Spring	Female	Adult	Gravid	91.1	120.0	2.0	00077E7F09	First Time Capture	N	MIz8	On litter		
Impact	Maria River	Spring	Male	Adult	One Dark/ One light Nuptial Pad	77.2	60.0	1.5	0007634268	First Time Capture	Y	MIz7	On litter		
Impact	Maria River	Spring	Male	Adult	Light Nuptial Pads	70.7	48.0	3.0	00077E8083	First Time Capture	N	MIz7	On litter near lantana		
Impact	Maria River	Spring	Female	Adult	Gravid	93.9	125.0	4.0	00077E8C90	First Time Capture	Y	MIz5	On litter		
Impact	Maria River	Summer	Female	Adult	Gravid	95.0	106.0	13.0	00077E7F84	First Time Capture	Y	MIz9	On litter on top of bank		
Impact	Maria River	Summer	Female	Adult	Semi-Gravid	92.8	102.0	7.0	00077E6D41	First Time Capture	Y	MIz10	On ground under shrub		

Location		Season	Sex	Age	Reproductive Status	Length	Weight	Distance to water	Pit Tag No.	First Time Capture/Recapture	Swabbed	Zone	Microhabitat	Activity	Notes
Impact	Maria River	Summer	Male	Adult	n/a	n/a	n/a	n/a	n/a	Not captured	n/a	MIz8	n/a	Calling male	
Impact	Maria River	Summer	Unknown	Juvenile	Immature	35.0	10.0	0.4		First Time Capture	Y	MIz4	On litter		
Impact	Maria River	Summer	Female	Adult	Gravid	103.8	200.0	1.5	00077E6CCA	First Time Capture	Y	MIz6			
Impact	Maria River	Summer	Female	Adult	Semi-Gravid	90.4	110.0	2.0	0007634C7C	First Time Capture	Y	MIz5	On litter		
Impact	Maria River	Summer	Female	Adult	Semi-Gravid	94.3	125.0	2.0	0007634C1C	First Time Capture	Y	MIz5	On litter		
Impact	Maria River	Summer	Male	Adult	Dark Nuptial Pads	72.0	48.0	0.5	007634710	First Time Capture	Y	MIz8	On litter		
Impact	Maria River	Summer	Unknown	Sub Adult	Immature	45.0	10.0	5.0	0007634735	First Time Capture	Y	MIz8	On litter		
Impact	Maria River	Summer	Female	Adult	Non Gravid	83.4	68.0	2.5	00077E7EBD	First Time Capture	Y	MIz8	On ground		
Impact	Maria River	Summer	Female	Adult	n/a	n/a	n/a	n/a	n/a	Not Captured	n/a	MIz5			
Impact	Maria River	Summer	Female	Adult	n/a	n/a	n/a	n/a	n/a	Not Captured	n/a	MIz5			
Impact	Maria River	Summer	Male	Adult	Dark Nuptial pads	83.2	60.0	0.6	00077E7F26	First Time Capture	Y	MIz5	In streamside veg	Calling male	
Impact	Maria River	Summer	Male	Adult	n/a	n/a	n/a	n/a	n/a	Not captured	n/a	MIz5	n/a	Calling male	
Impact	Maria River	Summer	Male	Adult	Mod Nuptial pads	71.7	40.0	9.5	00077E6A51	First Time Capture	Y	MIz5	On ground under tree branches		
Impact	Maria River	Autumn	Unknown	Sub Adult	Immature	54.0	24.0	4.0	000791EAE6	First Time Capture	Y	MIz10	On dirt		
Impact	Maria River	Autumn	Female	Adult	Non Gravid	96.2	155.0	5.0	000791E98D	First Time Capture	Y	MIz8	On litter		
Impact	Maria River	Autumn	Female	Adult	Non Gravid	92.3	130.0	6.0	000791E955	First Time Capture	Y	MIz7	On litter		
Impact	Maria River	Autumn	Unknown	Sub Adult	Immature	56.0	29.0	2.0	0007634AC3	First Time Capture	Y	MIz4	On moss on bottom of tree		

Location		Season	Sex	Age	Reproductive Status	Length	Weight	Distance to water	Pit Tag No.	First Time Capture/Recapture	Swabbed	Zone	Microhabitat	Activity	Notes
Impact	Pipers Creek	Spring	Female	Adult	Gravid	87.0	105.0	8.0	00077E7DA3	First Time Capture	Y	PIz3			
Impact	Pipers Creek	Spring	Female	Adult	Mod. Gravid	84.9	120.0	3.0	00077E7EE7	First Time Capture	Y	PIz9		Amongst Lamondra	
Impact	Pipers Creek	Spring	Male	Adult	Dark Nuptial Pads	70.7	45.0	2.0	00077E7F06	First Time Capture	Y	PIz9			
Impact	Pipers Creek	Spring	Female	Adult	Non Gravid	83.6	87.0	10.0	00077E7FB5	First Time Capture	Y	PIz8	On debris at base of tree		
Impact	Pipers Creek	Spring	Male	Adult	Dark Nuptial Pads	60.0	50.0	2.0	00077E6D19	First Time Capture	Y	PIz8	On ground		
Impact	Pipers Creek	Summer	Male	Adult	Dark Nuptial Pads	72.1	43.0	1.7	00077E7F06	Recapture	Y	PIz9	On bank	Calling male	Recap. Spring 2015
Impact	Pipers Creek	Summer	Female	Adult	Semi-Gravid	94.2	130.0	0.0	000791E995	First Time Capture	Y	PIz9	Under Lomandra		
Impact	Pipers Creek	Summer	Female	Adult	Gravid	91.3	140.0	2.0	000791EBEF	First Time Capture	Y	PIz8	On log		
Impact	Pipers Creek	Summer	Male	Adult	Dark Nuptial Pads	73.1	60.0	0.3	00077E6D19	Recapture	Y	PIz8	On dirt		Recap. Spring 2015
Impact	Pipers Creek	Summer	Male	Adult	Dark Nuptial Pads	81.0	50.0	0.4	000791EA2C	First Time Capture	Y	PIz9	On ground	Calling male	
Impact	Pipers Creek	Summer	Male	Adult	Dark Nuptial Pads	66.7	49.0	3.0	0007920747	First Time Capture	Y	PIz9	On ground	Calling male	
Impact	Pipers Creek	Summer	Male	Adult	Dark Nuptial Pads	72.2	52.0	4.0	000792057C	First Time Capture	Y	PIz8	On ground	Calling male	
Impact	Pipers Creek	Summer	Male	Adult	Dark Nuptial Pads	71.3	60.0	3.0	000791E9C9	First Time Capture	Y	PIz9		Calling male	
Impact	Pipers Creek	Summer	Unknown	Sub Adult	Immature	58.4	28.0	0.7	00079207EC	First Time Capture	Y	PIz5	On litter		
Impact	Pipers Creek	Autumn	Unknown	Sub Adult	Immature	0.0	0.0	4.0	n/a	Not Captured	n/a	PIz10	Southern bank of creek		No safe access
Impact	Pipers Creek	Autumn	Male	Adult	Medium Nuptial Pads	50.1	62.0	3.0	000775ED19	Recapture	Y	PIz8	On litter		Recap. Spring 2015 and Summer 2016

Location		Season	Sex	Age	Reproductive Status	Length	Weight	Distance to water	Pit Tag No.	First Time Capture/Recapture	Swabbed	Zone	Microhabitat	Activity	Notes
Impact	Pipers Creek	Autumn	Female	Adult	Non Gravid	98.7	115.0	4.0	00077E7FB5	Recapture	Y	PIz8	On leaf litter		Recap. Spring 2015
Impact	Pipers Creek	Autumn	Female	Adult	Non Gravid	92.0	140.0	0.5	0007634951	First Time Capture	Y	PIz3	Sitting on leaf		
Impact	Pipers Creek	Autumn	Male	Adult	Dark Nuptial Pads	65.7	50.0	8.0	00079207EC	Recapture	Y	PIz5	On litter		Recapt. Summer 2016
Impact	Pipers Creek	Autumn	Unknown	Adult	n/a	n/a	n/a	n/a	n/a	Not Captured	n/a	Piz4	On litter		
Impact	Pipers Creek	Autumn	Male	Adult	Unknown	70.4	62.0	2.0	0007920501	First Time Capture	Y	PIz5	Steep embankment on leaf litter		
Impact	Smiths Creek	Spring	Male	Adult	Uncoloured Nuptial Pads	71.1	67.0	3.0	00077E8044	First Time Capture	Y	SIz7	On ground at base of tree		
Impact	Smiths Creek	Spring	Female	Adult	Not Gravid	86.1	92.5	3.0	00077E6AD1	First Time Capture	Y	SIz7	On ground at base of tree		
Impact	Smiths Creek	Spring	Female	Adult	Not Gravid	84.6	90.0	12.0	00077E6D37	First Time Capture	Y	SIz6	On ground at base of tree		
Impact	Smiths Creek	Spring	Prob. Female	Adult	No Nuptial Pads	76.1	60.0	3.0	00077E6A5F	First Time Capture	Y	SIz6	On ground at base of tree		
Impact	Smiths Creek	Spring	Male	Adult	Uncoloured Nuptial Pads	69.0	60.0	3.0	00077E7EE0	First Time Capture	Y	SIz2	Up on steep bank on litter		
Impact	Smiths Creek	Spring	Unknown	Sub Adult	Immature	54.5	19.0	3.0	00077E6A31	First Time Capture	Y	SIz2	Up on steep bank on litter		
Impact	Smiths Creek	Spring	Female	Adult	Non Gravid	86.5	104.0	5.0	00077E6A8B	First Time Capture	Y	SIz1	Under log on litter		
Impact	Smiths Creek	Summer	Male	Adult	n/a	n/a	n/a	n/a	n/a	Not Captured	n/a	SIz7		Calling	
Impact	Smiths Creek	Summer	Female	Adult	Gravid	100.4	120.0	10.0	00077E6A5F	Recapture	Y	SIz6			Recapture from Spring 2015

Location		Season	Sex	Age	Reproductive Status	Length	Weight	Distance to water	Pit Tag No.	First Time Capture/Recapture	Swabbed	Zone	Microhabitat	Activity	Notes
Impact	Smiths Creek	Summer	Female	Adult	Gravid	89.5	120.0	6.0	000791EC77	First Time Capture	Y	SIz4	On litter		
Impact	Smiths Creek	Summer	Male	Adult	Dark Nuptial Pads	71.4	58.0	1.0	000791E992	First Time Capture	Y	SIz1	Under Lomandra		
Impact	Smiths Creek	Summer	Male	Adult	Dark Nuptial Pads	73.0	62.0	2.0	000791E9FB	First Time Capture	Y	SIz1	On litter		
Impact	Smiths Creek	Summer	Male	Adult	Dark Nuptial Pads	72.1	54.0	2.0	000763463C	First Time Capture	Y	SIz1	On litter		
Impact	Smiths Creek	Summer	Male	Adult	Dark Nuptial Pads	68.8	60.0	0.5	000791EB9B	First Time Capture	Y	SIz2	Under Lomandra		
Impact	Smiths Creek	Summer	Male	Adult	Dark Nuptial Pads	77.1	70.0	1.0	000791EBB3	First Time Capture	Y	SIz2	On litter		
Impact	Smiths Creek	Summer	Male	Adult	Dark Nuptial Pads	70.6	46.0	1.0	000791EC22	First Time Capture	Y	SIz2	On litter		
Impact	Smiths Creek	Summer	Male	Adult	Dark Nuptial Pads	74.2	54.0	1.5	000791E8FB	First Time Capture	Y	SIz2	On litter		Odd colour on belly
Impact	Smiths Creek	Summer	Male	Adult	Dark Nuptial Pads	67.5	44.0	1.5	000791EB5D	First Time Capture	Y	SIz1	On ground in depression		
Impact	Smiths Creek	Summer	Male	Adult	Dark Nuptial Pads	72.4	49.0	2.0	00077E6B54	First Time Capture	Y	SIz2	Under shrub on ground	Calling	
Impact	Smiths Creek	Summer	Unknown	Juvenile	Immature	35.0	15.0	2.0	n/a	Not marked	Y	SIz2	On ground on litter and dirt		
Impact	Smiths Creek	Summer	Female	Adult	n/a	n/a	n/a	10.0	n/a	Not Captured	n/a	SIz2	On litter		
Impact	Smiths Creek	Autumn	Female	Adult	Non Gravid	92.0	130.0	6.0	000791EA56	First Time Capture	Y	SIz4	On litter		
Reference	Cooperabung Creek	Spring	Female	Adult	Gravid	93.0	132.0	0.0	00077E7FEB	First Time Capture	Y	CRz9	On gravel		
Reference	Cooperabung Creek	Spring	Female	Adult	Non Gravid	80.0	107.0	3.0	00077E7E2D	First Time Capture	Y	CRz9	On ground		
Reference	Cooperabung Creek	Spring	Unknown	Sub Adult	Immature	68.0	52.0	1.0	00077E6D49	First Time Capture	Y	CRz8	On ground		
Reference	Cooperabung Creek	Spring	Female	Adult	Gravid	90.0	145.0	2.0	0007635887	First Time Capture	Y	CRz5	On ground		

Location		Season	Sex	Age	Reproductive Status	Length	Weight	Distance to water	Pit Tag No.	First Time Capture/Recapture	Swabbed	Zone	Microhabitat	Activity	Notes
Reference	Cooperabung Creek	Spring	Male	Adult	Dark Nuptial Pads	71.5	70.5	4.0	00077E6AB1	First Time Capture	Y	CRz5	On ground		
Reference	Cooperabung Creek	Spring	Female	Adult	Non Gravid	85.0	74.5	1.0	00077E7E31	First Time Capture	Y	CRz5	On ground		
Reference	Cooperabung Creek	Summer	Male	Adult	Dark Nuptial Pads	74.5	65.0	1.0	00077E6AB1	Recapture	Y	CRz4	Above litter	Fighting with below	Recapture from Spring 2015
Reference	Cooperabung Creek	Summer	Male	Adult	Dark Nuptial Pads	76.6	70.0	1.0	not recorded	First Time Capture	Y	CRz4	Above litter	Fighting with above	
Reference	Cooperabung Creek	Summer	Male	Adult	Dark Nuptial Pads	78.3	52.0	0.2	00077E6AA0	First Time Capture	Y	CRz4	On ground		
Reference	Cooperabung Creek	Summer	Female	Adult	Gravid	92.3	165.0	0.1	00677E7FEB	Recapture	Y	CRz4	On ground very edge of bank		Recapture from Spring 2015
Reference	Cooperabung Creek	Summer	Male	Adult	Dark Nuptial Pads	78.6	57.0	0.5	000791EB0D	First Time Capture	Y	CRz5	On litter build up, 40cm above ground in dead branch		
Reference	Cooperabung Creek	Summer	Male	Adult	n/a	n/a	n/a	n/a	n/a	Not captured	n/a	CRz5	n/a	Calling male	
Reference	Cooperabung Creek	Summer	Male	Adult	Dark Nuptial Pads	69.9	60.0	0.1	0007634FB8	First Time Capture	Y	CRz2	On gravel		
Reference	Cooperabung Creek	Summer	Male	Adult	Dark Nuptial Pads	80.4	85.0	0.4	0007634838	First Time Capture	Y	CRz2	Above litter		
Reference	Cooperabung Creek	Autumn	Unknown	Sub Adult	Immature	45.6	17.0	3.0	000791EAB4	First Time Capture	Y	CRz6	On rock		
Reference	Cooperabung Creek	Autumn	Unknown	Sub Adult	Immature	53.0	25.0	1.0	000791E8FF	First Time Capture	Y	CRz6	On litter		
Reference	Cooperabung Creek	Autumn	Female	Adult	Non Gravid	89.6	130.0	1.0	00079204EA	First Time Capture	Y	CRz6	On dirt		
Reference	Cooperabung Creek	Autumn	Female	Adult	Non Gravid	90.5	105.0	0.2	00079205AE	First Time Capture	Y	CRz4	On dirt		
Reference	Cooperabung Creek	Autumn	Male	Adult	n/a	n/a	n/a	0.5	n/a	Not Captured	n/a	CRz3	On bank/dirt		

Location		Season	Sex	Age	Reproductive Status	Length	Weight	Distance to water	Pit Tag No.	First Time Capture/Recapture	Swabbed	Zone	Microhabitat	Activity	Notes
Reference	Pipers Creek	Spring	Unknown	Sub Adult	Immature	46.4	18.8	2.0	00077E69A5	First Time Capture	Y	PRz43	On ground		
Reference	Pipers Creek	Spring	Unknown	Sub Adult	Immature	51.4	24.0	4.0	00077E6A43	First Time Capture	Y	PRz8	On ground		
Reference	Pipers Creek	Spring	Unknown	Sub Adult	Immature	50.7	24.5	4.0	00077E7FF9	First Time Capture	Y	PRz8	On ground		
Reference	Pipers Creek	Spring	Unknown	Sub Adult	Immature	50.0	19.0	2.5	00077E7F1A	First Time Capture	Y	PRz8	On litter		
Reference	Pipers Creek	Spring	Unknown	Sub Adult	Immature	46.5	16.5	4.0	00077E6C1D	First Time Capture	Y	PRz8	On ground		
Reference	Pipers Creek	Spring	Male	Adult	Light Nuptial Pads	64.3	40.0	2.0	007633E02	First Time Capture	Y	PRz8	on ground		
Reference	Pipers Creek	Spring	Male	Adult	Dark Nuptial Pads	71.8	58.0	1.0	00077E7E92	First Time Capture	Y	PRz7	On ground		
Reference	Pipers Creek	Spring	Female	Adult	Gravid	98.9	155.0	1.5	00077E69AF	First Time Capture	Y	PRz7	On ground		
Reference	Pipers Creek	Spring	Male	Adult	Dark Nuptial Pads	72.9	55.8	3.0	00077E8D1F	First Time Capture	Y	PRz7	On ground		
Reference	Pipers Creek	Spring	Male	Adult	Light Nuptial Pads	59.6	31.0	1.0	00077E8019	First Time Capture	Y	PRz7	On ground		
Reference	Pipers Creek	Spring	Male	Adult	Light Nuptial Pads	68.6	40.0	2.0	00077E6D03	First Time Capture	Y	PRz7	On ground		
Reference	Pipers Creek	Spring	Unknown	Sub Adult	Immature	50.7	21.3	6.0	00077E8057	First Time Capture	Y	PRz7	On litter		
Reference	Pipers Creek	Spring	Unknown	Sub Adult	Immature	57.6	26.5	3.0	00077E7E09	First Time Capture	Y	PRz7	On litter		
Reference	Pipers Creek	Spring	Unknown	Sub Adult	Immature	50.7	24.9	5.0	00077E7D78	First Time Capture	Y	PRz7	On moss under log		
Reference	Pipers Creek	Spring	Prob. Female	Adult	No Nuptial Pads	76.1	69.0	4.0	007633434	First Time Capture	Y	PRz7	On ground		
Reference	Pipers Creek	Spring	Male	Adult	Light Nuptial Pads	57.3	30.8	3.0	00077E7FE8	First Time Capture	Y	PRz7	On litter		
Reference	Pipers Creek	Spring	Unknown	Sub Adult	Immature	51.4	18.0	2.0	00077E80E2	First Time Capture	Y	PRz6	On litter		
Reference	Pipers Creek	Spring	Prob. Female	Sub Adult	No Nuptial Pads	64.9	41.0	2.0	000777EGBB1	First Time Capture	Y	PRz6	On moss		

Location		Season	Sex	Age	Reproductive Status	Length	Weight	Distance to water	Pit Tag No.	First Time Capture/Recapture	Swabbed	Zone	Microhabitat	Activity	Notes
Reference	Pipers Creek	Spring	Prob. Male	Sub Adult	Light Nuptial Pads	60.1	38.0	0.6	00077E80D9	First Time Capture	Y	PRz6	On litter		
Reference	Pipers Creek	Spring	Male	Adult	Light Nuptial Pads	77.7	68.0	1.0	00077I80A7	First Time Capture	Y	PRz6	On a log	Calling	
Reference	Pipers Creek	Spring	Unknown	Sub Adult	Immature	54.9	21.0	1.5	00077E6CB3	First Time Capture	Y	PRz6	On moss		
Reference	Pipers Creek	Summer	Male	Adult	Moderate Nuptial Pads	72.4	41.0	2.3	00079206D3	First Time Capture	Y	PRz8	On litter	Calling	
Reference	Pipers Creek	Summer	Female	Adult	Gravid	n/a	n/a	n/a	000791E91F	First Time Capture	Y	PRz8	On litter		
Reference	Pipers Creek	Summer	Male	Adult	Mod Nuptial pads	n/a	n/a	n/a	000791EB7A	First Time Capture	Y	PRz8	On litter		
Reference	Pipers Creek	Summer	Male	Adult	Dark Nuptial Pads	71.9	55.0	0.7	0007920736	First Time Capture	Y	PRz8	On litter		
Reference	Pipers Creek	Summer	Male	Adult	Dark Nuptial Pads	71.5	50.0	2.0	00079219F8	First Time Capture	Y	PRz8	On base of tree		
Reference	Pipers Creek	Summer	Unknown	Juvenile	Immature	n/a	n/a	1.0	n/a	Not Captured	n/a	PRz7	On litter		
Reference	Pipers Creek	Summer	Male	Adult	Moderate Nuptial Pads	67.6	43.0	1.5	00077E80E2	Recapture	Y	PRz8	On litter	Calling	Recap. Spring 2015
Reference	Pipers Creek	Summer	Male	Adult	Dark Nuptial Pads	69.4	38.0	6.0	000791EC31	First Time Capture	Y	PRz6	On litter		
Reference	Pipers Creek	Summer	Male	Adult	Moderate Nuptial Pads	66.1	40.0	2.5	00079206C4	First Time Capture	Y	PRz7	On litter		
Reference	Pipers Creek	Summer	Male	Adult	Dark Nuptial Pads	73.0	58.0	0.7	0007920640	First Time Capture	Y	PRz6	On moss		
Reference	Pipers Creek	Summer	Male	Adult	Moderate Nuptial Pads	75.0	50.0	2.0	000791EA9A	First Time Capture	Y	PRz6	On ground		
Reference	Pipers Creek	Summer	Male	Adult	Dark Nuptial Pads	80.4	60.0	3.0	0007926027	First Time Capture	Y	PRz6	On ground		
Reference	Pipers Creek	Summer	Male	Adult	Dark Nuptial Pads	69.9	42.0	1.5	000791EC03	First Time Capture	Y	PRz6	At base of tree on litter		
Reference	Pipers Creek	Summer	Male	Adult	Dark Nuptial Pads	81.2	67.0	2.0	000791EBB6	First Time Capture	Y	PRz4	In Lomandra	Calling	

Location		Season	Sex	Age	Reproductive Status	Length	Weight	Distance to water	Pit Tag No.	First Time Capture/Recapture	Swabbed	Zone	Microhabitat	Activity	Notes
Reference	Pipers Creek	Summer	Female	Adult	Gravid	94.2	150.0	2.5	00079217BF	First Time Capture	Y	PRz5	On ground		
Reference	Pipers Creek	Summer	Male	Adult	Moderate Nuptial Pads	75.2	54.0	0.0	000791EAAF	First Time Capture	Y	PRz4	Edge of water		
Reference	Pipers Creek	Summer	Unknown	Sub Adult	Immature	60.9	20.0	1.0	000791EA75	First Time Capture	Y	PRz5	On litter		
Reference	Pipers Creek	Summer	Male	Adult	Dark Nuptial Pads	68.6	52.0	0.7	00079206E5	First Time Capture	Y	PRz5	Under Lomandra		
Reference	Pipers Creek	Summer	Male	Adult	Dark Nuptial Pads	64.2	42.0	0.5	0007921942	First Time Capture	Y	PRz3	On dirt		
Reference	Pipers Creek	Summer	Male	Adult	Dark Nuptial Pads	73.0	63.0	1.0	00079206D6	First Time Capture	Y	PRz3	Under Lomandra		
Reference	Pipers Creek	Summer	Male	Adult	Dark Nuptial Pads	75.0	46.0	5.0	000792068F	First Time Capture	Y	PRz3	On ground on steep bank		
Reference	Pipers Creek	Summer	Male	Adult	Mod Nuptial pads	n/a	60.0	5.0	000791EBA3	First Time Capture	Y	PRz3	On ground on steep bank		
Reference	Pipers Creek	Summer	Female	Adult	Moderate Gravid	81.7	65.0	4.0	0007923BFA	First Time Capture	Y	PRz4	On ground		
Reference	Pipers Creek	Summer	Male	Adult	Dark Nuptial Pads	75.0	65.0	2.0	0007925F61	First Time Capture	Y	PRz3	On litter		
Reference	Pipers Creek	Summer	Male	Adult	Moderate Nuptial Pads	71.3	57.0	4.5	00077E7D76	Recapture	Y	PRz3	On ground	Calling	
Reference	Pipers Creek	Autumn	Male	Adult	Moderate Nuptial Pads	70.0	48.0	2.5	000791EC27	First Time Capture	Y	PRz8	Base of tree, leaf matter		
Reference	Pipers Creek	Autumn	Female	Adult	Non Gravid	85.3	103.0	7.0	00077E6A43	Recapture	Y	PRz8	Base of tree, on leaf		Recap. Spring 2015
Reference	Pipers Creek	Autumn	Unknown	Sub Adult	Immature	n/a	n/a	n/a	n/a	Not Captured	n/a	PRz7			
Reference	Pipers Creek	Autumn	Unknown	Sub Adult	Immature	44.1	16.0	3.0	000791E8EB	First Time Capture	Y	PRz8	On rock		
Reference	Pipers Creek	Autumn	Unknown	Sub Adult	Immature	0.0	0.0	0.0	n/a	Not Captured	n/a	PRz8	On litter		
Reference	Pipers Creek	Autumn	Female	Adult	Non gravid	92.0	115.0	3.5	00077E6D03	Recapture	Y	PRz7	Base of tree, top of leaf		Recap. Spring 2015

Location		Season	Sex	Age	Reproductive Status	Length	Weight	Distance to water	Pit Tag No.	First Time Capture/Recapture	Swabbed	Zone	Microhabitat	Activity	Notes
Reference	Pipers Creek	Autumn	Unknown	Sub Adult	Immature	48.0	16.0	3.0	00079205AB	First Time Capture	Y	PRz6	Above leaf matter	Jumping	
Reference	Pipers Creek	Autumn	Unknown	Sub Adult	Immature	46.4	18.0	5.0	000791EC0D	First Time Capture	Y	PRz6	Under Lomandra	Jumping	
Reference	Pipers Creek	Autumn	Male	Adult	Unknown	n/a	n/a	n/a	n/a	Not Captured	n/a	PRz5		Calling	

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Road Kill Report

2015/2016 – Oxley Highway to Kempsey, Pacific Highway Upgrade

Prepared for Road and Maritime Services

October 2016

Document control

Item	Description
Project no.:	1702
Project client:	Road and Maritime Services
Project office:	Port Macquarie
Document description:	OH2K Road Kill Report 2015/2016
Project Director:	Rhidian Harrington
Project Manager:	Chris McEvoy
Authors:	Francesca Amorosi
Internal review:	Amanda Griffith
Document status:	Final
Local Government Area:	Port Macquarie

Author	Revision	Internal review	Date issued	Signature
F Amorosi	D1	Amanda Griffith		
F Amorosi	D2	Bruce Blunden	4 October 2016	
F Amorosi	R0	Frank Lemckert	5 October 2016	

Executive summary

Context

This report details the findings of the road kill surveys undertaken from the 22 of July 2015 up to 21 July 2016 as required for the Oxley Highway to Kempsey (OH2K) Pacific Highway upgrade project (the Project).

Aims

The Road Kill Survey is designed to monitor the effectiveness of flora and fauna mitigation measures on the OH2K Pacific Highway Upgrade.

Methods

This survey was conducted weekly for the period 22 of July 2015 to 21 July 2016 in accordance with the monitoring methodology specified in the Oxley Highway to Kempsey Ecological Monitoring Program (Hyder,2014).

Key results

Road kill monitoring results were similar to those reported in the2014-2015 monitoring period, namely: a range of groups of fauna were recorded, with birds and large macropods being the most commonly recorded, and the majority of road kill occurred within sites adjacent to riparian vegetation.

Conclusions

The surveys for 2015/2016 show a reduced road kill rate compared to the baseline surveys in spring and summer (Lewis 2014) and therefore are in line with the performance measures for these seasons. Data from future monitoring events will provide further information on seasonal and yearly variability in road kill rates and thus inform progress against stated performance measures.

Only one threatened species (one individual Koala) was recorded during the construction phase 2015/2016 while three individual threatened species (one Koala and two Grey-headed Flying-foxes) were recorded as road kill during the baseline survey. In this respect, the performance criteria for the 2015/2016 period have been met.

Management implications

No specific management implications have resulted from the monitoring undertaken to date.

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1. Introduction

1.1 Purpose

This report summarises the findings of the 2015/2016 road kill monitoring surveys undertaken as part of the Oxley Highway to Kempsey (OH2K) section of the Pacific Highway Upgrade Project. These were undertaken in accordance with the Oxley Highway to Kempsey Ecological Monitoring Program (EMP) 2014 , Hyder Consulting Pty Ltd (Hyder 2014) over the period 22 of July 2015 to 21 July 2016. This report has been prepared as per the Minister's Condition of Approval (MCoA) for the Oxley Highway to Kempsey section of the Pacific Highway Upgrade Project, MCoA B10 (f) which requires the "Provision for annual reporting of monitoring results to the Director General and the EPA and DPI (Fishing and Aquaculture), or as otherwise agreed by the agencies".

Specifically, this document reports on the timing and results of monitoring activities undertaken, methodology employed and progress/results measured against previously identified performance measures.

1.2 Background

The Oxley Highway to Kempsey section of the Pacific Highway Upgrade Project (the "Project") was approved in 2012 subject to various MCoA and Statement of Commitments (SoC). A subsequent approval with additional conditions of consent (CoA) was granted in 2014 by the Department of Environment (DoE) for Matters of National Environmental Significance (MNES) listed under the *Commonwealth Environment Protection and Biodiversity Conservation Act 1995* (EPBC Act). Combined, these approvals outline the mitigation, offsetting and monitoring requirements for threatened species and ecological communities impacted by the Project.

Specifically, the Oxley Highway to Kempsey EMP (2014) was developed to address MCoA B10 and Department of the Environment CoA 4. These conditions are detailed below.

MCoA B10

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 EPA 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).

Condition of Approval (CoA) 4

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

a. The baseline data collected from surveys undertaken by a suitably qualified expert on the Koala, Spotted-tail Quoll and Giant-Barred Frog within all habitat areas outside areas to be cleared of vegetation for the proposed action, that are likely to contain these species and that are likely to be adversely impacted by the action (as determined by a suitably qualified expert).The data must address the densities, distribution, habitat use and movement patterns of these species;

b. The methodology to be implemented for the ongoing monitoring of road kill, the species densities, distribution, habitat use and movement patterns, and the use of fauna crossing during construction and operation of the action, including the timing, and duration of the methodology;

c. Goals and performance indicators to measure the success of proposed fauna crossings, which must be specific, measureable, achievable, realistic and timely (SMART), and be compared against baseline data described in condition 4a); and

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

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

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

2. Road Kill

2.1 Monitoring timing

The approved EMP (Hyder 2014) states the timing and location for road kill monitoring as detailed in Table 1 below.

Table 1: Road kill monitoring timing and location

Project Phase	Timing of survey	Location
Baseline	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	Daily	Portion of existing highway adjacent to clearing operations
One month following clearing operations	Daily	Portion of existing highway adjacent to clearing operations
For the duration of construction	Weekly	Entire length of existing highway in Project area
Within one month of opening of the Project	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 approved EMP (Hyder 2014) specifies the following performance indicators for the road kill survey:

- 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 Methods

Monitoring methodology followed that prescribed in the approved EMP (Hyder 2014) and detailed 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 safely 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.

If the animal was identified as a TSC Act or EPBC Act threatened species, the following information was also 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, local habitat attributes were 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.

2.4 Results

The results presented in this report summarise the 2015/2016 monitoring undertaken weekly between August 2015 and July 2016. This is the second year of the construction phase monitoring. The data has been collected by Road and Maritime Services and is summarised below. The raw data is provided in Annex 1.

2.4.1 Data limitations and assumptions

Due to safety concerns associated with slowing down on the highway to identify road kill, data collection was limited in some circumstances. In summary:

- Most of the road kills recorded were not identified at the genus or species level but at the "vertebrate group" level only.
- Some carcases could not be identified as a result of extensive collision damage. These road kill animals were classified as 'Unknown'.
- Small sized animals had the potential to be partially or wholly removed by scavenger animals and/or their remains not readily identifiable from the vehicle.

As a result, it is possible to have under-counted animals like frogs, small mammals and birds.

2.4.2 Construction phase 2015/2016

For consistency with previous monitoring periods, results for this year's surveys have been considered in relation to the following:

- Location (using a hand held GPS (GDA94)) to identify any focal points or hot spots.
- Season and fauna categories recorded to assess in relation to the types of mitigation measures being proposed.
- Legislative status of road kill under the *TSC* Act (1995) and *EPBC* Act (1999).

Survey effort for the construction phase 2015/2016 covered 49 weeks (12.7 weeks in spring, 12.4 in summer, 12.7 in autumn and 11.1 in winter (including 3.7 in winter 2015 and 7.4 in winter 2016) from the 6th of August 2015 to the 22nd of July 2016.

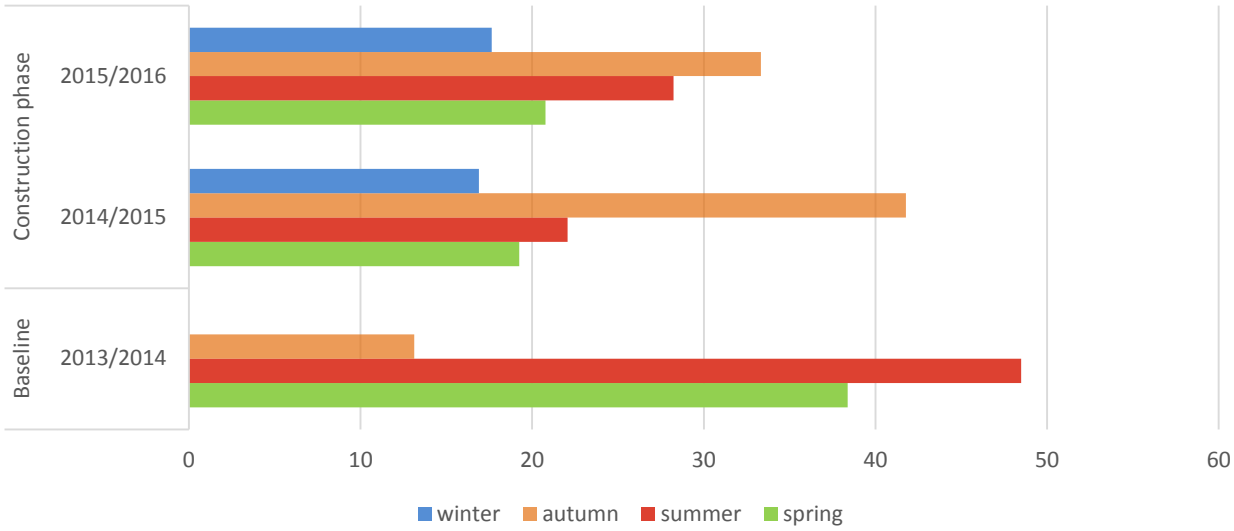
A total of 255 road kill animals were recorded over the 49 weeks of monitoring. This included 53 in spring 2015, 72 in summer 2015-2016, 85 in autumn 2016, and 45 in late winter 2015 and early winter 2016.

A wide range of fauna were recorded as road kill. The fauna categories with the highest number of road kill were birds (80 observations, 31.4% of the road kill) followed by large terrestrial mammals (kangaroos) (51 observations, 20.0% of the road kill). "Unknown" and unidentified mammals made up approximately 28% of the road kill. Small terrestrial mammals and reptiles made up approximately 6% of the road kill each. Arboreal and flying mammals were also recorded (10 and three records respectively), introduced mammals were recorded twice and only one road kill frog was recorded. (Graph 2).

These number of road kills recorded are not directly comparable with previous survey results because the survey effort for the construction phase 2015/2016 covered 49 weeks (12.7 weeks in spring, 12.4 in summer, 12.7 in autumn and 11.1 in winter including 3.7 in winter 2015 and 7.4 in winter 2016) as opposed to just 12 weeks for the baseline monitoring (4 weeks in spring, 4 in summer and 4 in autumn) and 38 weeks for construction phase 2014/2015 (4 weeks in spring, 12.9 in summer, 13.1 in autumn and 8.3 in winter). Baseline and construction phase monitoring were also generally undertaken daily, providing some added variation in results. However, the percentage of road kills recorded for each event can be used to reasonably compare different year's results and also identify any seasonal differences in fauna categories affected.

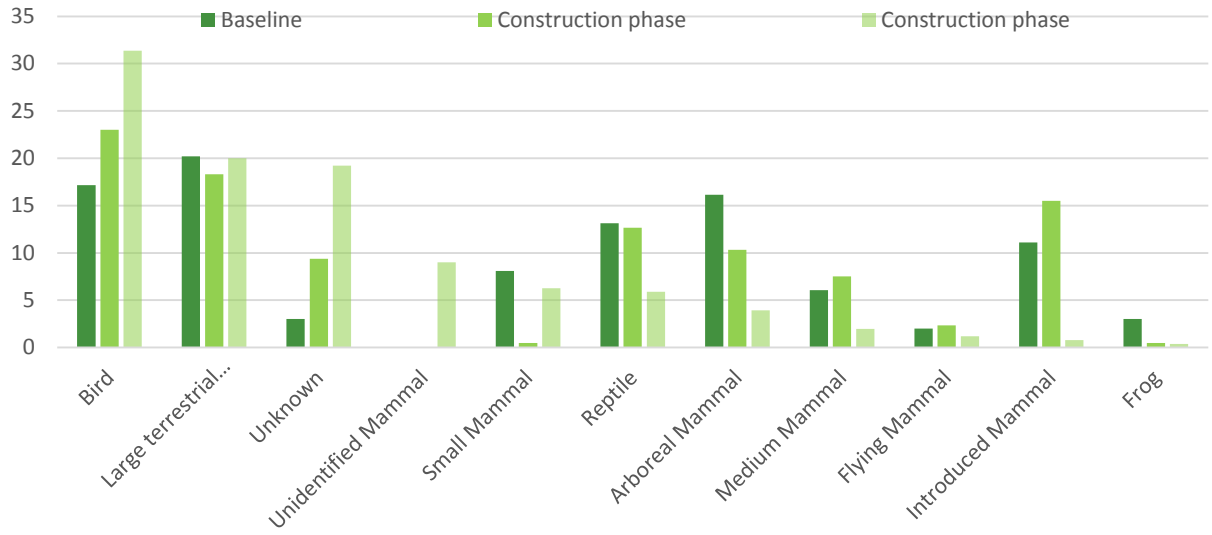
During the baseline monitoring, the lowest number of road kill was recorded in autumn (13% of observed road kills) while in both construction phases, autumn was the season with the highest number (41.9% in 2014/2015 and 33.3% in 2015/2016 of the road kill), indicating little pattern in road kill results in relation to season (Graph 1).

Graph 1: Percentages of road kill records, according to seasons, during baseline and two first years of construction phase (2014/2015 and 2015/2016)



In both years of the construction phase, birds were the fauna category with the highest number of road kill followed by large terrestrial mammals. The number of "unknown" and unidentified mammals was much greater in the most recent round of surveys compared to the previous two years, but reptile, arboreal mammals, medium mammals and introduced mammals has decreased compared to the previous two years (Graph 2). There has been a general overall decline in road kill over the three periods of survey to date.

Graph 2: Percentage of road kill records, according to fauna categories, during baseline and two first years of construction phase (2014/2015 and 2015/2016)



Road kills have been recorded across the entire length of the existing Pacific Highway carriageway during all four seasons with records extending from ch. 400 to ch. 37800.

Data from the construction phase 2015/2016 indicated five high impact areas - for road kills. These are shown in Figure 1 and listed below:

- 1800 – 3100 (Sancrox interchange). Mostly cleared area with remaining patches of wet sclerophyll forest and/or moist floodplain forest close by.

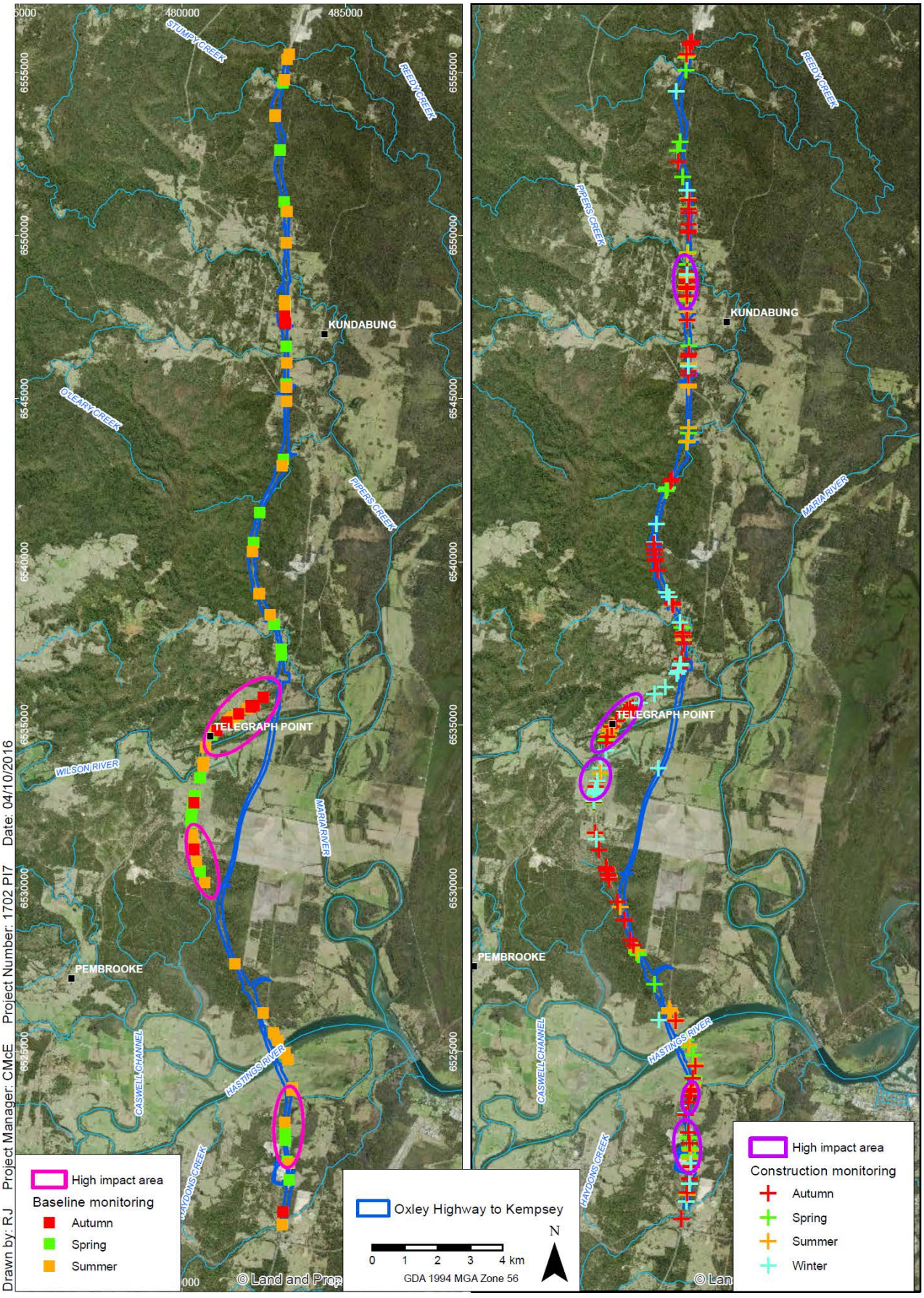
- 4000 – 4900 (Fernbank Creek). Part of a narrow, vegetated habitat linkage running in an east-west direction.
- 13200 – 14150 (Wilson River). Associated with an open floodplain area. This will become a service road once the Project has been constructed.
- 14400 – 17000 (Telegraph Point). This area will become a service road once the Project has been constructed.
- 29400 – 30900 (Pipers Creek). Associated with fragmented moist slopes forest.

All five high impact areas have been identified previously or during the baseline monitoring (Sancrox interchange, Fernbank Creek and Telegraph Point) or during the construction phase 2014/2015 (Wilson River and Pipers Creek).

During the 49 weeks of survey effort in the 2015/2016 period one individual threatened species, the Koala, was recorded as road kill (Table 2 and Figure 2).

Table 2: Threatened species road kill during construction phase 2015/2016.

Season	Date	Species detected	Location
Summer	22-December-2015	Koala	1km north of Ravenswood Rd



Seasonal distribution of road kill along the OH2K project (baseline monitoring vs. construction phase 2015-2016)

Pacific Highway Upgrade - Oxley Highway

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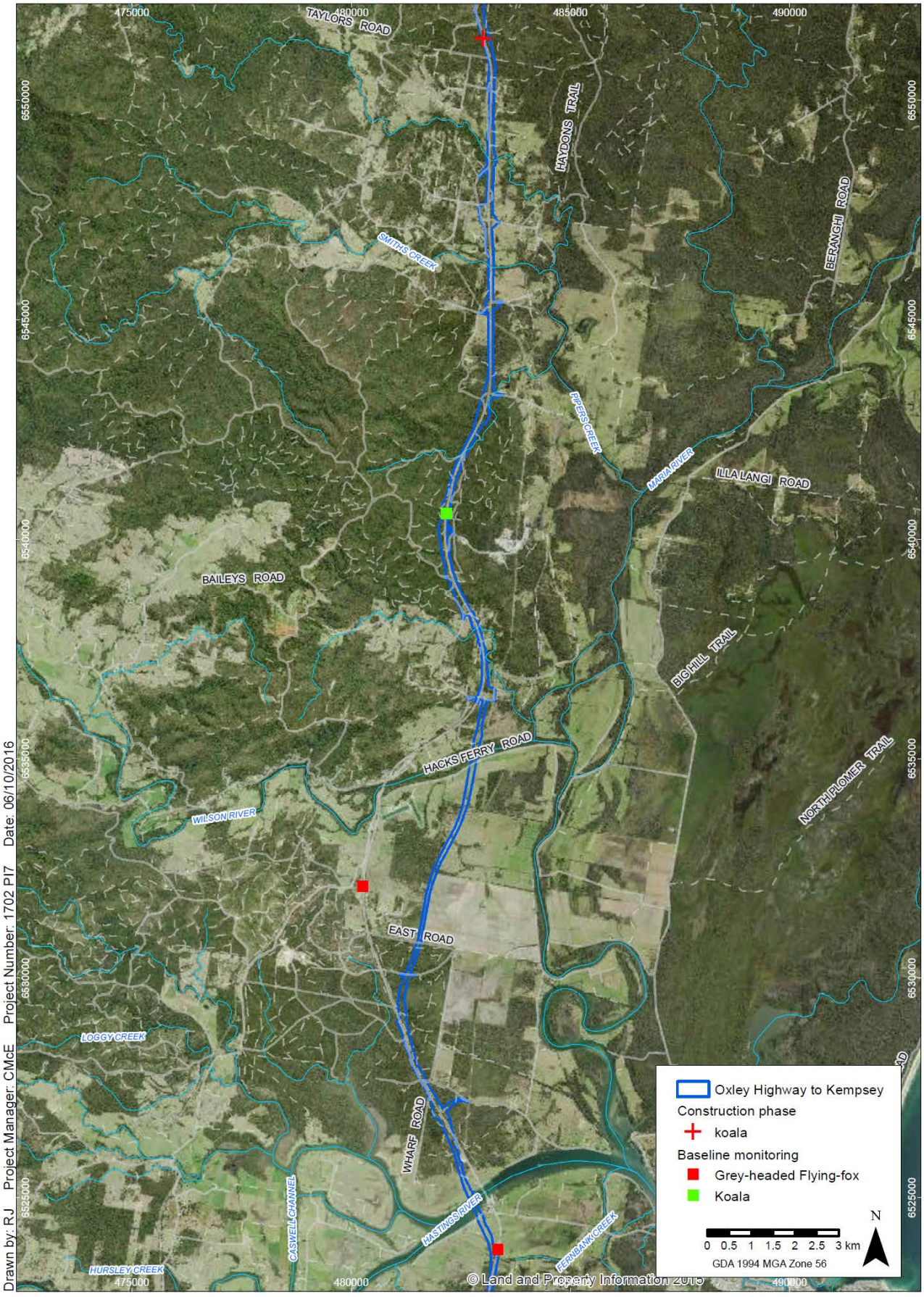
FIGURE 1

Imagery: (c) LPI 2014-10-06



Drawn by: RJ Project Manager: CMcE Project Number: 1702 PI7 Date: 06/10/2016

Threatened species road kill distribution along the OH2K project (baseline monitoring v. construction phase 2015-2016)

Pacific Highway Upgrade - Oxley Highway

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FIGURE 2

Imagery: (c) LPI 2014-10-06

2.5 Discussion

The following comments can be made about the results obtained compared to the listed performance measures:

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.

Majority of the traffic remains on the existing Pacific Highway, and as such, new fauna mitigation measures will have little benefit in these areas. The full benefit of these structures will not be realised until traffic is switched onto the new carriageways and these structures are completed. This is particularly evident in areas where the traffic will be switched onto a whole new alignment, and the existing highway will become a service road. The benefit of fauna mitigation in these areas will not be evident until the Project becomes operational.

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 in spring and summer but not in autumn for the 2015/2016 construction phase. There were more road kill recorded in autumn 2015/2016 than in the autumn surveys for the baseline monitoring periods. Overall there has been a decline in the recorded road kill between baseline and the subsequent two monitoring events and the overall performance measure has been met.

To be able to compare different year's data, a weekly road kill rate was calculated. The weekly rate was calculated as the number of road kill recorded per season divided the number of weeks surveyed in each season. The results are presented in Table 3.

In spring the weekly road kill rate was approximately the same for the Baseline and construction phase 2014/2015 (Niche 2016), but was much lower (approximately half) for the most recent monitoring period. Road kill rates for the summer months were greatest during the Baseline surveys and were consistently lower for the two subsequent rounds of construction monitoring (less than half that recorded in the first year). However, in autumn, the weekly road kill rate recorded during the construction phases was almost double that of the baseline survey, however the road kill rate recorded during the 2015/16 and 2014/15 surveys were similar. Winter surveys revealed approximately the same weekly road kill rate for each of the consecutive construction monitoring periods (as per requirements none were undertaken for the baseline surveys).

While there is some variability in the data at this stage (trends in road kill rates are not consistent across all seasons), the surveys for 2015/2016 show a reduced road kill rate compared to the baseline surveys in spring and summer (Lewis 2014) and therefore are in line with the performance measures in these seasons. Data from future monitoring events will provide further information on seasonal and yearly variability in road kill rates and thus inform progress against stated performance measures.

Overall the weekly road kill rates have declined from baseline and the performance measure therefore has been met.

Table 3: Comparison of baseline monitoring results against construction phases (road kill weekly rate)

		spring	summer	autumn	winter
Baseline monitoring	**2013/2014**	9.5	12.0	3.3	n/a
Construction phase	**2014/2015**	10.3	3.6	6.8	4.3
	2015/2016	4.2	5.8	6.7	4.1

Only one threatened species (one individual Koala) was recorded during the 2015/2016 construction phase while three individual threatened species (one Koalas and two Grey-headed Flying-fox) were recorded as road kill during the baseline survey. In this respect, the performance criteria for the 2015/2016 period has been met.

Fauna exclusion fencing is installed at a minimum in the locations identified in Schedule 3 of the EPBC approval at Year 4.

Not applicable until Year 4.

References

Hyder Consulting Pty Ltd (2014). Oxley Highway to Kempsey Pacific Highway Upgrade Ecological Monitoring Program 19 September 2014. Prepared for Roads and Maritime Service by Smec Hyder Joint Venture.

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 (2106). Annual Ecological Monitoring Report 2015 – Oxley Highway to Kempsey, Pacific Highway Upgrade. Prepared for Roads and Maritime Services.

Annex 1. Road Kill Data

Data provided by Roads and Maritime Services.

To be able to display all the information provided for each record the data are separated in two tables one with the location and the animal details (Table 4) and on with the habitat details (Table 5). An "ID record" column has been added to the original data to be able combine the data for each record in both tables.

Table 4. Road kill locations and animal details

ID record	Week Number	Date	Start Time	Finish Time	Location description	Latitude	Longitude	Species	Assigned Vertebrate Group	Sex	Age	Pouch Young
	Week 1	06/08/2015	11:40am	12:15pm	Hastings River to Barrys Creek			No new road kill identified				
1	Week 2	13/08/2015	12:00pm	12:50pm	northbound lane, south of Wilmaria Rd	31°18'50.4"	152°48'44.6"	crow	bird	unknown	adult	na
2					southbound lane, south of Bill Hill Rd	31°21'51.6"	152°47'51.7"	eastern grey kangaroo	mammal	unknown	adult	unknown
	Week 3	20/08/2015	10:20am	11:20am	Hastings River to Barrys Creek			No new road kill identified				
3	Week 4	27/08/2015	1:25pm	2:50pm	southbound lane, north of Dennis Bridge	31°24.252'	152°48.812'	wallaby	mammal	unknown	adult	unknown
4					northbound, turning lane into Mooney Street	31°20.073'	152°48.812'	brush tailed possum	mammal	unknown	adult	unknown
5					southbound lane, north of Haydons Wharf Rd	31°20.073'	152°47.709'	kookaburra	bird	unknown	adult	na
6	Week 5	03/09/2015	1:25pm	3:10pm	northbound lane, south of Kempsey Interchange	31°08.839'	152°49.187'	kookaburra	bird	unknown	adult	na
7					northbound lane, north of Yarabee Rd	31°16.330'	152°48.750'	kookaburra	bird	unknown	adult	na
8					southbound lane, south of Haydons Wharf Rd	31°17.157'	152°48.979'	tawny frog mouth	bird	unknown	adult	na
9					northbound lane, north of Fernbank Ck	31°25.221'	152°49.491'	eastern grey kangaroo	mammal	unknown	adult	unknown
10	Week 6	10/09/2015	8:45am	10:40am	southbound lane, north of Barrys Ck (K2K)	31°15'26.2"	152°48'59.3"	snake	reptile	unknown	adult	na
11					southbound lane, adjacent Cassegrain wines	31°25.802'	152°49.345'	brush tailed possum	mammal	unknown	adult	unknown
12	Week 7	17/09/2015	8:45am	10:25am	southbound, south of Kempsey Interchange	31°08.067'	152°49.431'	bird (probable owl)	bird	unknown	adult	na
13					Mooney St Intersection median turning lane	31°26.713'	152°49.435'	long nosed bandicoot	mammal	unknown	adult	unknown
14	Week 8	24/09/2015	2:45pm	4:00pm	southbound lane, south of the Wilson River Bridge	31°19.780'	152°47.799'	unidentifiable mammal	mammal	unknown	unknown	unknown

ID record	Week Number	Date	Start Time	Finish Time	Location description	Latitude	Longitude	Species	Assigned Vertebrate Group	Sex	Age	Pouch Young
15					southbound lane north of the Port Macquarie interchange	31°27.262'	152°49.344'	red necked wallaby	mammal	unknown	adult	unknown
16					Ravenswood Rd intersection median turning lane	31°11'31.4"	152°49'24.0"	magpie	bird	unknown	adult	na
17					northbound, south of Haydons Wharf Rd	31°18'30.4"	152°49'10.9"	fox	mammal	unknown	adult	na
18					southbound lane, driveway south of Wilmaria Rd	31°18.731'	152°48.951'	long nosed bandicoot	mammal	male	adult	na
19	Week 9	01/10/2015	8:10am	10:00am	southbound lane, Hastings River Bridge	31°24'34.8"	152°49'20.2"	kookaburra	bird	unknown	adult	na
20	Week 10	08/10/2015	10:00am	11:20am	soutbound lane, south of Fernbank Ck bridge	31°25'19.5"	152°49'27.8"	turtle/tortoise	reptile	unknown	adult	na
21					northbound lane, south of Glen Ewan Rd	31°24'34.8"	152°49'20.2"	kookaburra	bird	unknown	adult	na
22					Mobbs Rd, median turning lane	31°14'26.1"	152°49'24.4"	goanna	reptile	unknown	adult	na
23					southbound lane, north of Smiths Ck Rd	31°12'18.0"	152°49'23.0"	unidentified mammal	mammal	unknown	unknown	unknown
24	Week 11	14/10/2015	10:50am	11:55am	southbound, south of Fernbank Ck Bridge (gate 7)	31°25'26.8"	152°49'25.7"	wallaby	mammal	unknown	unknown	unknown
25					southbound, south of Cooperabung Close	31°17'44.4"	152°49'16.4"	echidna	mammal	unknown	sub-adult	unknown
26					southbound, north of Heavy Vehicle Checking Bay Kundabung	31°13'14.6"	152°49'24.9"	unidentifiable bird	bird	unknown	unknown	unknown
27	Week 12	21/10/2015			northbound, adjacent rest area south of Kempsey	31°09'50.0"	152°49'12.5"	Noisy Friarbird	bird	unknown	adult	unknown
28					northbound, Ravenswood Rd intersection north	31°11'51.2"	152°49'23.4"	unidentifiable	unknown	unknown	unknown	unknown
29					southbound, approx. 1km north of Mingaletta Rd	31°14'31.1"	152°49'24.4"	unidentifiable	unknown	unknown	unknown	unknown
30	Week 13	30/10/2015	7:10am	8:25am	southbound lane, south of Cooperabung Close	31°19'10.3"	152°48'08.8"	unidentified bird	bird	unknown	adult	na
31					southbound, south of Wilson River Bridge	31°20'18.6"	152°47'37.9	wallaby	mammal	unknown	sub adult	unknown
32					southbound lane, south of Pembrooke Rd	31°20'29.0"	152°47'35.6"	wallaby	mammal	unknown	adult	unknown
33					southbound lane, south of Pembrooke Rd	31°20'28.7"	152°47'35.8"	kookaburra	bird	unknown	adult	na
34	Week 14	05/11/2012	2:05pm	3:10pm	northbound, Barrys Ck	31°15'25.3"	152°48'59.5"	bird	bird	unknown	unknown	na
35					southbound, Barrys Ck	31°15'25.2"	152°49'00.1"	bird	bird	unknown	unknown	na

ID record	Week Number	Date	Start Time	Finish Time	Location description	Latitude	Longitude	Species	Assigned Vertebrate Group	Sex	Age	Pouch Young
36					northbound, 400m south of Hastings River Dr	31°24'41.8"	152°49'24.2"	bird	bird	unknown	unknown	na
37					southbound, 50m south of Blackmans Point Rd	31°23'10.2"	152°48'25.3"	bird	bird	unknown	unknown	na
38	Week 15	13/11/2015	7:00am	8:20am	northbound, start of BP Rd diversion	31°23'39.5"	152°48'44.3"	bird	bird	unknown	unknown	na
39					northbound Blackmans Point Rd	31°23'08.4"	152°48'23.6"	unidentifiable	unknown	unknown	unknown	na
40					northbound, north of Kempsey rest area	31°09'41.3"	152°49'15.8"	small bird	bird	unknown	adult	na
41					southbound, Smiths Ck Rd construction gate	31°12'19.6"	152°49'23.2"	unidentifiable	unknown	unknown	unknown	na
42					southbound, Wilson River Bridge	31°19'35.7"	152°47'49.2"	unidentifiable mammal	mammal	unknown	unknown	unknown
43					southbound, Blackmans Point Rd	31°23'09.3"	152°48'25"	unidentifiable mammal	mammal	unknown	unknown	unknown
44	Week 16	20/11/2015			northbound on bridge north of Telegraph Point turnoff	31°19'04.3"	152°48'18.8"	small bird	bird	unknown	adult	na
45					southbound Fernbank Ck bridge	31°25'17.8"	152°49'28.1"	kookaburra	bird	unknown	adult	na
46					northbound south of Hastings River Dr	31°24'50.3"	152°49'29.2"	small brown mammal	mammal	unknown	unknown	unknown
47	Week 17	26/11/2015	12:00pm	1:20pm	northbound, approximately 800m north of Mingaletta Rd	31°13'03.8"	152°49'25.1"	unidentifiable large mammal	mammal	unknown	unknown	na
48					southbound, south of Kempsey rest area	31°26'23.8"	152°49'30.6"	unidentifiable	unknown	unknown	unknown	na
49					Ravenswood Rd intersection median turning lane	31°11'31.4"	152°49'24.0"	bird	bird	unknown	unknown	na
50					south of Barrys Creek	31°15'28.3'	152°48'58.5'	kangaroo	mammal	unknown	unknown	unknown
51					southbound, north of Rollands Plains Rd	31°19'08.3"	152°48'12.1"	bird	bird	unknown	unknown	na
52					southbound, Mooney St	31°19'38.5"	152°47'48.7"	unidentifiable	unknown	unknown	unknown	unknown
53					southbound, south of Moonee St	31°20'10.4"	152°47'41.3"	turtle/tortoise	reptile	unknown	unknown	na
54					southbound, south of Pembrooke Rd	31°20'39.5"	152°47'34.1"	unidentifiable	unknown	unknown	unknown	unknown
55					southbound, south of Hastings River Bridge	31°24'40.0"	152°49'23.5"	unidentifiable	mammal	unknown	unknown	unknown
56					southbound, south of Fernbank Creek Bridge	31°25'20.1"	152°49'27.5"	unidentifiable	mammal	unknown	unknown	unknown

ID record	Week Number	Date	Start Time	Finish Time	Location description	Latitude	Longitude	Species	Assigned Vertebrate Group	Sex	Age	Pouch Young
57					southbound, Cassegrain Winery	31°26'22.5"	152°49'24.7"	unidentifiable	unknown	unknown	unknown	unknown
58					northbound, south of Sancrox Bridge	31°26'53"	152°49'25"	unidentifiable	unknown	unknown	unknown	unknown
59	Week 18	03/12/2015	10:00am	11:20am	southbound, south of Pembrooke Rd	31°20'32.5"	152°47'34.9"	small mammal	mammal	unknown	unknown	na
60	Week 19	11/12/2015	1:15pm	2:35pm	Mooney St intesection	31°19'38.8"	152°47'48.4"	small mammal	mammal	unknown	unknown	unknown
61					north of Mooney St	31°19'33.9"	152°47'49.4"	unidentifiable	unknown	unknown	unknown	unknown
62					Cooperabung Drive	31°18'24.6"	152°49'13.5"	brush tailed possum	mammal	unknown	unknown	unknown
63					southbound, north of Ravenswood Rd	31°10'15.7"	152°49'18.2"	snake	reptile	unknown	unknown	na
64					southbound, Bill Hill Rd	31°21'44.4"	152°47'48.4"	kangaroo	mammal	male	adult	na
65					southbound, Fernbank Ck bridge	31°25'18.1"	152°49'28.0"	kookaburra	bird	unknown	adult	na
66					adjacent Cassegrain Winery	31°26'11.7"	152°49'23.3"	kangaroo/wallaby	mammal	unknown	unknown	unknown
67					northbound, Sancrox	31°26'33.2"	152°49'25.2"	kookaburra	bird	unknown	adult	na
68					northbound, north of Fernbank Ck Bridge	31°25'11.2"	152°49'29.3"	kangaroo	mammal	unknown	adult	unknown
69	Week 20	15/12/2015	3:10pm	4:25pm	northbound, Kundabung	31°11'42.8"	152°49'23.5"	brush tailed possum	mammal	unknown	adult	no
70					southbound, south of Pembrooke Rd	31°20'27.8"	152°47'35.9"	galah	bird	unknown	adult	na
71	Week 21	21/12/2015	9:15am	10:45am	northbound, north of Ravenswood Rd	31°10'47.1"	152°49'25.0"	small unidentifiable	mammal	unknown	unknown	unknown
72					northbound, north of south Kempsey rest area	31°08'17.1"	152°49'22.6"	small unidentifiable	mammal	unknown	unknown	unknown
73					southbound, south of south Kempsey rest area	31°08'29.7"	152°49'22.2"	medium brown unidentifiable	mammal	unknown	unknown	unknown
74					north of Cairncross Waste Management	31°08'29.7"	152°49'22.2"	wallaby	mammal	unknown	unknown	unknown
75					northbound, south of Sancrox Rd	31°26'31.7"	152°49'24.8"	kookaburra	bird	unknown	adult	unknown
76		22/12/2015	am		1km north of Ravenswood Rd	31°10'15.9"	152°49'17.9"	koala	mammal	CALLED IN BY COMMUNITY MEMBER, DETAILS NOT KNOWN		

ID record	Week Number	Date	Start Time	Finish Time	Location description	Latitude	Longitude	Species	Assigned Vertebrate Group	Sex	Age	Pouch Young
77	Week 22	29/12/2015	10:10am	11:25am	northbound, south of Sancrox Rd	31°26'29.8"	152°49'24.7"	kookaburra	bird	unknown	adult	na
78					northbound adjacent Cassegrain	31°26'06.9"	152°49'22.4"	unidentifiable	unknown	unknown	unknown	unknown
79					northbound, Ravenswood Rd intersection north	31°10'46.4"	152°49'25.1"	bird	bird	unknown	adult	na
80					median turning lane, Mingaletta Rd	31°14'39.8"	152°49'22.0"	mammal	mammal	unknown	unknown	unknown
81					northbound, north of Mooney St	31°19'37.1"	152°47'48.4"	unidentifiable	unknown	unknown	unknown	unknown
82					southbound, Pembrooke Rd	31°20'27.4	152°47'36.2"	galah	bird	unknown	adult	na
83					southbound, approach to Wilson River Bridge	31°19'27.2"	152°47'52.8"	bird	bird	unknown	unknown	na
84					southbound, adjacent Cassegrain vineyard	31°26'13.2"	152°49'23.4"	unidentifiable	unknown	unknown	unknown	unknown
85					southbound, adjacent Cassegrain driveway	31°26'23.9"	152°49'24.9"	mammal	mammal	unknown	unknown	unknown
86	Week 23	08/01/2016	8:20am	9:30am	north of Smiths Creek Rd	31°12'04.4"	152°49'22.7"	unidentifiable	mammal	unknown	unknown	unknown
87					southbound, south of Hastings River Bridge	31°24'39.8"	152°49'23.5"	identifiable small	mammal	unknown	unknown	unknown
88					northbound, north of Fernbank Ck	31°24'59.3"	152°49'31.5"	identifiable	mammal	unknown	unknown	unknown
89	Week 23	15/01/2016	11:10am	12:20am	south of Sancrox	31°26'44.9"	152°49'26.0"	bird	bird	unknown	adult	na
90					northbound, south of Pembrooke Rd	31°20'33.4"	152°47'34.3"	unidentifiable	unknown	unknown	unknown	unknown
91					northbound, north of Mooney St	31°20'18.1"	152°47'37.8"	unidentifiable	mammal	unknown	unknown	unknown
92					northbound, south of Wilson River Bridge	31°19'32.8"	152°47'49.7"	brush tailed possum	mammal	unknown	adult	unknown
93					Mingaletta Rd turning lane	31°14'39.1"	152°49'22.9"	small mammal	mammal	unknown	unknown	unknown
94					south of Wilson River, median	31°19'33.0"	152°47'50.1"	small mammal	mammal	unknown	unknown	unknown
95					southbound, bridge south of Mooney St	31°20'08.6"	152°47'41.8"	python	reptile	unknown	adult	na
96	Week 24	21/01/2016	10:15am	11:20am	middle of road, south of Moorside Dr	31°21'09.3"	152°47'35.1"	owl/tawny frogmouth	bird	unknown	adult	na
97					little bridge over Cooperabung Dr, Telegraph Point	31°19'03.7"	152°48'19.4"	unidentifiable (probably small)	unknown	unknown	unknown	unknown
98					Mobbs Rd median turning lane	31°14'25.6"	152°49'24.3"	bird	bird	unknown	adult	na

ID record	Week Number	Date	Start Time	Finish Time	Location description	Latitude	Longitude	Species	Assigned Vertebrate Group	Sex	Age	Pouch Young
99					northbound, north of Wilson River Bridge	31°19'27.3"	152°47'52.2"	unidentifiable	small mammal	unknown	unknown	unknown
100					southbound, Wilson River Bridge	31°19'31.1"	152°47'50.7"	small unidentifiable	mammal	unknown	adult	unknown
101					southbound merging lane, main compound	31°24'05.9"	152°49'02"	bird	bird	unknown	unknown	na
102					northbound, north of McInerny's driveway	31°24'14.8"	152°49'07.5"	bird	bird	unknown	unknown	na
103					southbound, south of Fernbank Ck	31°25'21.9"	152°49'27.1"	unidentifiable	small mammal	unknown	unknown	unknown
104	Week 25	29/01/2016	7:30am	8:40am	southbound, north of Fernbank Ck	31°26'24.9"	152°49'25.1"	small unidentifiable	unknown	unknown	unknown	unknown
105					northbound, north of Wilson River Bridge	31°19'21.5"	152°47'55.9"	magpie lark	bird	unknown	adult	unknown
106					northbound, south of Ravenswood Rd (southern end)	31°11'32.6"	152°49'23.7"	small unidentifiable	reptile	unknown	unknown	na
107	Week 26	03/02/2016	7:15am	8:30am	southbound, north of main compound	31°24'07.9"	152°49'00.1"	wallaby	mammal	unknown	adult	unknown
108					northbound, south of Upper Smiths Ck Rd	31°13'45.5"	152°49'24.3"	rabbit	mammal	unknown	adult	na
109					northbound, Rodeo Drive (north)	31°11'55.9"	152°49'23.2"	black bird	bird	unknown	adult	na
110					southbound, pet motel Kempsey	31°08'15.6"	152°49'23.5"	wallaby	mammal	unknown	adult	unknown
111					southbound, Kundabung Dr	31°12'30.3"	152°49'23.4"	bird	bird	unknown	unknown	na
112					southbound, Mingaletta Rd	31°14'39.1"	152°49'23.1"	unidentifiable	unknown	unknown	unknown	unknown
113					Wilson River Bridge	31°19'32.9"	152°47'50.0"	unidentifiable	unknown	unknown	unknown	unknown
114					northbound, McInerney driveway	31°24'16.6"	152°49'08.7"	unidentifiable small	mammal	unknown	unknown	unknown
115	Week 27	12/02/2016			northbound south of Wilson River Bridge	31°19"32.7"	152°47'49.8"	frog	reptile	unknown	unknown	na
116					northbound north of Wilson River Bridge	31°19'24.7"	152°47'53.7"	bird	bird	unknown	unknown	na
117					northbound, north of Haydons Wharf Road	31°17'56.3"	152°49'18.1"	unidentifiable small mammal	mammal	unknown	unknown	unknown
118					northbound kundabung	31°13'21.5"	152°49'24.7"	unidentifiable	unknown	unknown	unknown	unknown
119					northbound, south of Kundabung Dr	31°12'39.4"	152°49'23.5"	duck	bird	unknown	unknown	na

ID record	Week Number	Date	Start Time	Finish Time	Location description	Latitude	Longitude	Species	Assigned Vertebrate Group	Sex	Age	Pouch Young
120					northbound, north of Smiths Creek Rd	31°12'17.6"	152°49'22.7"	magpie	bird	unknown	unknown	na
121					southbound, north of Riverview Close	31°19'22.1"	152°47'55.5"	possum	mammal	unknown	unknown	unknown
122	Week 28	19/02/2016	8:20am	9:25am	northbound, south of Fernbank Ck	31°25'20.2"	152°49'27.1"	turtle	reptile	unknown	adult	na
123					northbound, 200m north of Haydons Wharf Rd	31°17'52.2"	152°49'17.3"	kookaburra	bird	unknown	adult	na
124					northbound, 220m north of Haydons Wharf Rd	31°17'51.8"	152°49'17.5"	bird	bird	unknown	unknown	na
125					(old truck stop)	31°13'14.7"	152°49'25.0"	small unidentifiable mammal	mammal	unknown	unknown	unknown
126					southbound, north of Blackmans Point Rd	31°23'05.8"	152°48'23.0"	unidentifiable mammal	mammal	unknown	unknown	unknown
127	Week 29	25/02/2016	10:00am	11:05am	(gate 12)	31°12'07.3"	152°49'23.4"	bird	bird	unknown	unknown	na
128					turning lane south of Pembrooke Rd	31°20'29.6"	152°47'35.6"	bird	bird	unknown	unknown	na
129					southbound, south of Bill Hill Rd	31°21'50.7"	152°47'51.1"	wallaby	mammal	unknown	adult	unknown
130					southbound, south of Sancrox Rd	31°26'32.7"	152°49'25.8"	unidentifiable mammal	mammal	unknown	unknown	unknown
131	Week 30	04/03/2016	11:20am	12:55pm	northbound, south of the Wilson River Bridge	31°19'33.3"	152°47'49.5"	brush tail possum	mammal	unknown	adult	unknown
132					northbound, Cooperabung Drive turning lane	31°17'22.1"	152°49'06.3"	black flying fox	mammal	unknown	adult	na
133					northbound, north of Smiths Creek Rd	31°12'08.5"	152°49'22.2"	bird	bird	unknown	adult	na
134					southbound, Pembrooke Rd	31°20'27.8"	152°47'36.1"	kangaroo	mammal	unknown	adult	unknown
135					southbound, compound entrance	31°24'03.4"	152°49'01.3"	unidentified mammal	mammal	unknown	unknown	unknown
136	Week 31	11/03/2016	11:05am	12:15pm	northbound, adjacent start of widened median	31°22'22.3"	152°48'04.0"	snake	reptile	unknown	unknown	na
137					Cooperabung median acceleration lane	31°17'22.2"	152°49'06.3"	Tawny Frog Mouth	bird	unknown	adult	na
138					northbound, (adjacent Gate 12)	31°12'08.2"	152°49'22.7"	bird	bird	unknown	adult	na
139					soutbound, south of Wilson River Bridge	31°19'33.3	152°47'49.8"	unidentifiable mammal	mammal	unknown	unknown	unknown
140					northbound, start of project	31°27'08.7"	152°49'21.5"	possum	mammal	unknown	adult	unknown
141	Week 32	18/03/2016	9:05am	10:00am	northbound, south of Upper Smiths Ck Rd	31°13'43.1"	152°49'24.4"	small unidentifiable	mammal	unknown	unknown	unknown

ID record	Week Number	Date	Start Time	Finish Time	Location description	Latitude	Longitude	Species	Assigned Vertebrate Group	Sex	Age	Pouch Young
142					northbound, north of Ravenswood	31°10'37.8"	152°49'24.3"	macropod	mammal	unknown	unknown	unknown
143	Week 33	24/03/2016	1:00pm	2:05pm	southbound, north of the Wilson River	31°19'22.2"	152°47'55.9"	kangaroo	mammal	unknown	unknown	unknown
144					northbound, Cooperabung Drive	31°17'22.1"	152°49'06.4"	kangaroo/wallaby	mammal	unknown	unknown	unknown
145					Yarabee Rd	31°24'07.4"	152°49'02.4"	kangaroo	mammal	unknown	unknown	unknown
146	Week 34	01/04/2016	11:05am	12:00pm	approximately 500m south of Fernbank Creek	31°25'36.7"	152°49'23.5"	unidentifiable	unknown	unknown	unknown	unknown
147					northbound, south of Bill Hill Rd	31°21'50.0"	152°47'50.3"	wallaby	mammal	unknown	unknown	unknown
148					north of Yarabee Rd	31°16'31.2"	152°48'45.1"	wallaby	mammal	unknown	unknown	unknown
149					south of Barrys Creek	31°15'18.5"	152°49'03.7"	wallaby	mammal	unknown	unknown	unknown
150					northbound, north of Ravenswood Rd (south)	31°11'10.0"	152°49'24.5"	unidentified	mammal	unknown	unknown	unknown
151					south of Kempsey interchange	31°08'04.2"	152°49'27.5"	kookaburra	bird	unknown	adult	na
152					southbound, Ravenswood Rd	31°10'51.2"	152°49'25.6"	red bellied black snake	reptile	unknown	adult	na
153					southbound, north of Smiths Creek Rd	31°13'11.9"	152°49'25.2"	unidentifiable	unknown	unknown	unknown	unknown
154					southbound, Yarabee acceleration lane	31°16'37.3"	152°48'46.1"	bird	bird	unknown	unknown	na
155					south of Cooperabung Drive	31°17'21.8"	152°49'06.5"	unidentifiable	unknown	unknown	unknown	unknown
156					soutbound, north of Wilson River	31°19'23.0"	152°47'55.2"	unidentifiable	unknown	unknown	unknown	unknown
157					southbound, north of Bill Hill Rd	31°21'42.9"	152°47'47.8"	lace monitor	reptile	unknown	adult	na
158	Week 35	08/04/2016	11:30am	12:20	northbound, south of Bill Hill Rd	31°21'51.0"	152°47'50.7"	Tawny Frog Mouth	bird	unknown	adult	na
159					northbound, Bill Hill Rd	31°21'46.3"	152°47'48.7"	wallaby	mammal	unknown	unknown	unknown
160					southbound, north of Smiths Ck Rd	31°11'58.3"	152°49'23.6"	small mammal	mammal	unknown	unknown	unknown
161					southbound, Yarabee acceleration lane	31°16'36.5"	152°48'46.4"	bird	bird	unknown	unknown	na
162					southbound, south of Wilson River Bridge	31°19'33.2"	152°47'50.1"	brushtailed possum	mammal	unknown	adult	unknown
163					southbound, south of Fernbank Ck	31°25'26.3"	152°49'26.1"	black flying fox	mammal	unknown	adult	na

ID record	Week Number	Date	Start Time	Finish Time	Location description	Latitude	Longitude	Species	Assigned Vertebrate Group	Sex	Age	Pouch Young
164					southbound, adjacent to Cassegrain buildings	31°26'07.4"	152°49'22.9"	bird	bird	unknown	adult	na
165	Week 36	15/04/2016	7:30am	9:00am	northbound, north of Fernbank Ck	31°25'12.7"	152°49'28.8"	small mammal	mammal	unknown	unknown	unknown
166					northbound, approx. 200m south of Bill Hill Rd	31°21'55.0"	152°47'52.2"	wallaby	mammal	unknown	unknown	unknown
167					median, Pembrooke Rd	31°20'25.6"	152°47'36.2"	lorikeet	bird	unknown	adult	na
168					median, 500m south of Yarabee Rd	31°16'47.2"	152°48'48.3"	small unidentifiable	unknown	unknown	unknown	unknown
169					median, 500m north of Yarabee Rd	31°16'21.5"	152°48'44.6"	unidentifiable mammal	unknown	unknown	unknown	unknown
170					northbound, south of Smiths Ck Rd	31°12'38.8"	152°49'23.0"	small mammal	mammal	unknown	unknown	unknown
171					northbound, south of Ravenswood Rd (northern end)	31°11'09.7"	152°49'24.4"	small mammal	mammal	unknown	unknown	unknown
172					median, south Bloodwood Rest Area	31°10'01.2"	152°49'13.3"	magpie	bird	unknown	adult	na
173					northbound, south of Kempsey Interchange	31°08'02.9"	152°49'26.2"	unidentifiable	unknown	unknown	unknown	unknown
174					southbound, north Ravenswood	31°10'39.0"	152°49'25.4"	small unidentifiable	unknown	unknown	unknown	unknown
175					southbound, north of Smiths Ck Rd	31°12'14.1"	152°49'23.1"	small mammal	unknown	unknown	unknown	unknown
176					southbound, Yarabee Rd acceleration lane	31°16'36.9"	152°48'46.1"	bird	bird	unknown	unknown	unknown
177					southbound, Moonee St	31°17'19.7"	152°49'05.4"	black flying fox	mammal	unknown	adult	na
178	Week 37	22/04/2016	11:25pm	12:40pm	southbound, north of Sancrox Rd	31°26'17.6"	152°49'24.2"	bird	bird	unknown	unknown	na
179					northbound, north of Port Macquarie Interchange	31°27'32.5"	152°49'15.2"	unidentifiable mammal	mammal	unknown	unknown	unknown
180					northbound, south of Fernbank Ck	31°25'30.5"	152°49'24.4"	bird	bird	unknown	unknown	unknown
181					northbound, 400m north Blackmans Pt Rd	31°22'55.7"	152°48'16.2"	kangaroo	mammal	unknown	unknown	unknown
182					northbound, north of Mahogony Rd	31°22'17.2"	152°48'01.6"	kangaroo	mammal	unknown	unknown	unknown
183					northbound, south of Pear Tree Rd	31°21'25.9"	152°47'39.4"	bird	bird	unknown	unknown	na
184					northbound, north of Haydons Wharf Rd	31°18'15.8"	152°49'16.7"	bird	bird	unknown	unknown	na

ID record	Week Number	Date	Start Time	Finish Time	Location description	Latitude	Longitude	Species	Assigned Vertebrate Group	Sex	Age	Pouch Young
185					northbound, Ravenswood Rd	31°10'48.0"	152°49'25.2"	unidentified mammal	mammal	unknown	unknown	unknown
186					southbound, between Rodeo Dr south and Smiths Ck Rd	31°12'05.5"	152°49'23.4"	unidentified mammal	mammal	unknown	unknown	unknown
187					southbound Moores Rd	31°19'16.9"	152°48'00.3"	lizard	reptile	unknown	unknown	na
188					southbound, south of Pembrooke Rd	31°20'37.9"	152°47'34.3"	kangaroo	mammal	unknown	unknown	unknown
189	Week 38	29/04/2016	6:50am	9:45am	northbound, McInerney driveway	31°24'16.0"	152°49'08.2"	small marsupial	mammal	unknown	unknown	unknown
190	Week 39	06/05/2016	8:25am	9:55am	northbound, south of Rodeo Dr	31°13'14.8"	152°49'24.5"	small mammal	mammal	unknown	unknown	unknown
191					northbound, between Smiths Ck Rd and Rodeo (nth)	31°12'05.3"	152°49'22.7"	unidentifiable	unknown	unknown	unknown	unknown
192					southbound, Cooperabung acceleration lane	31°17'21.6"	152°49'06.4"	unidentifiable mammal	mammal	unknown	unknown	unknown
193					southbound, north of Haydons Wharf Rd	31°17'39.8"	152°49'15.1"	wood ducks	bird	unknown	ducklings	na
194					southbound, north of Blackmans Point Rd	31°23'00.8"	152°48'19.6"	unidentifiable	unknown	unknown	unknown	unknown
195					southbound, adjacent Cassegrain	31°26'18.2"	152°49'24.2"	bird	bird	unknown	unknown	na
196					northbound, south of Fernbank Ck	31°25'24.0"	152°49'26.1"	medium identifiable	unknown	unknown	unknown	unknown
197	Week 40	13/05/2016	11:20am	12:30pm	southbound, adjacent Cassegrain	31°26'07.0"	152°49'22.9"	small mammal	mammal	unknown	unknown	unknown
198					northbound, Mahogany Rd	31°22'35.2"	152°48'09.5"	unidentifiable mammal	mammal	unknown	unknown	unknown
199					southbound, Pembrooke Rd	31°20'29.9"	152°47'35.6"	wallaby	mammal	female	adult	empty
200					median acceleration lane north of Bill Hill Rd	31°21'08.7"	152°47'35.4"	small unidentifiable	unknown	unknown	unknown	unknown
201	Week 41	20/05/2016	11:05am	12:30pm	northbound, across from Mahogany Rd	31°22'35.5"	152°48'09.5"	small kangaroo or wallaby	mammal	unknown	unknown	unknown
202					northbound, north of Pembrooke Rd	31°20'24.9"	152°47'35.9"	bird	bird	unknown	unknown	na
203					northbound, north of Pembrooke Rd	31°20'22.7"	152°47'36.4"	lizard	reptile	unknown	adult	na
204					northbound, north of Moores Rd	31°19'06.9"	152°48'13.0"	kookaburra	bird	unknown	adult	na
205					northbound, north of Upper Smiths Ck Rd	31°13'33.0"	152°49'24.2"	unidentifiable mammal	mammal	unknown	unknown	unknown

ID record	Week Number	Date	Start Time	Finish Time	Location description	Latitude	Longitude	Species	Assigned Vertebrate Group	Sex	Age	Pouch Young
206					northbound, between Ravenswood Rds	31°11'03.3"	152°49'24.4"	wallaby	mammal	unknown	adult	unknown
207					southbound, Mooney St	31°19'39.0"	152°47'48.6"	small unidentifiable	unknown	unknown	unknown	unknown
208					northbound, south of Sancrox Bridge	31°26'53.2"	152°49'24.7"	bird	bird	unknown	unknown	na
209	Week 42	26/05/2016	12:15pm	1:30pm	northbound, Cooperabung Dr Tele Point	31°19'09.2"	152°48'09.4"	wallaby	mammal	unknown	adult	unknown
210					northbound, between Ravenswood Rds	31°11'11.5"	152°49'24.3"	unidentifiable	unknown	unknown	unknown	unknown
211					northbound, south of Sancrox bridge	31°26'54.0"	152°49'24.6"	unidentifiable	unknown	unknown	unknown	unknown
212					northbound, north of Sancrox bridge	31°26'37.8"	152°49'25.7"	unidentifiable	unknown	unknown	unknown	unknown
213					northbound, north of Sancrox bridge	31°26'41.4"	152°49'25.9"	unidentifiable	unknown	unknown	unknown	unknown
214					northbound, Mahogany Rd	31°26'41.4"	152°49'25.9"	fox	mammal	unknown	adult	na
215					northbound, Cairncross waste station	31°21'45.3"	152°47'48.4"	Tawny Frog Mouth	bird	unknown	adult	na
216	Week 43	03/06/2016	11:20am	12:15pm	northbound, Pembrooke Rd turning lane	31°20'28.6"	152°47'35.2"	unidentifiable	unknown	unknown	unknown	unknown
217					northbound, Cooperabung Dr overbridge	31°19'04.0"	152°48'19.1"	wallaby	mammal	unknown	adult	unknown
218					northbound, south of Cooperabung Close	31°17'52.7"	152°49'17.6"	wood duck	bird	unknown	adult	na
219					northbound, south of Cooperabung Close	31°17'49.5"	152°49'17.0"	wood duck	bird	unknown	adult	na
220					southbound, north of Barrys Creek	31°15'16.9"	152°49'04.9"	bird	bird	unknown	unknown	na
221					southbound, south of Cooperabung Drive overbridge	31°19'05.7"	152°48'16.6"	bird	bird	unknown	unknown	na
222					northbound, south of Sancrox Bridge	31°27'06.7"	152°49'22.0"	unidentifiable	mammal	unknown	unknown	unknown
223					northbound, north of Sancrox bridge	31°26'40.9"	152°49'25.9"	bird	bird	unknown	unknown	na
224					northbound, south of Fernbank Ck	31°25'49.2"	152°49'20.6"	unidentifiable	unknown	unknown	unknown	unknown
225	Week 44	10/06/2016	7:00am	8:30am	northbound, south of Pipers Ck Bridge	31°12'00.4"	152°49'22.9"	fox	mammal	unknown	adult	na
226					northbound, south of Hastings River Dr	31°25'00.8"	152°49'31.5"	fox	mammal	unknown	adult	na

ID record	Week Number	Date	Start Time	Finish Time	Location description	Latitude	Longitude	Species	Assigned Vertebrate Group	Sex	Age	Pouch Young
227	Week 45	17/06/2016	11:30am	12:30pm	median north of Pembrooke Rd	31°20'17.6"	152°47'38.3"	fox	mammal	unknown	unknown	na
228					northbound, south of Pipers Ck Bridge	31°11'50.3"	152°49'23.4"	unidentifiable	mammal	unknown	unknown	unknown
229	Week 46	23/06/2016	10:20am	11:30am	northbound, across from Watt Rd	31°18'59.4"	152°48'27.4"	unidentifiable	unknown	unknown	unknown	unknown
230					median, south of Haydons Wharf Rd	31°18'24.7"	152°49'13.9"	wallaby	mammal	unknown	unknown	unknown
231					northbound, south of Cooperabung Close	31°18'00.5"	152°49'18.3"	bird	bird	unknown	unknown	na
232					median, south of Barrys Ck Rd	31°16'27.0"	152°48'44.9"	unidentifiable	unknown	unknown	unknown	unknown
233					northbound, K2K gate 12	31°12'07.5"	152°49'22.7"	mammal	mammal	unknown	unknown	unknown
234					northbound, south of pet boarding Kempsey	31°08'13.9"	152°49'23.1"	lizard	reptile	unknown	unknown	na
235					southbound, south of Stumpy Ck bridge	31°08'01.0"	152°49'29.1"	unidentifiable	unknown	unknown	unknown	unknown
236					southbound, north of Wharf Rd	31°13'29.3"	152°49'24.9"	unidentifiable	unknown	unknown	unknown	unknown
237	Week 47	01/07/2016	11:40am	12:50pm	northbound, south of Haydons Wharf Rd	31°18'27.5"	152°49'12.0"	wallaby	mammal	unknown	unknown	unknown
238					northbound, Cut 23	31°16'01.0"	152°48'47.3"	unidentifiable	unknown	unknown	unknown	unknown
239					northbound, south of Sancrox bridge	31°26'58.1"	152°49'24.1"	unidentifiable	unknown	unknown	unknown	unknown
240	Week 48	08/07/2016	11:00am	12:25pm	northbound, north of Haydons Wharf Rd	31°18'21.0"	152°49'15.2"	bird	bird	unknown	unknown	na
241					median, south of Cooperabung Ck	31°17'39.5"	152°49'14.5"	bird	bird	unknown	unknown	na
242					median, north of Pembrooke Rd	31°20'16.7"	152°47'38.4"	fox	mammal	unknown	adult	na
243					bridge, south of Pembrooke	31°20'36.8"	152°47'34.3"	bird	bird	unknown	unknown	na
244					bridge, south of Pembrooke	31°20'36.9"	152°47'34.3"	rabbit	mammal	unknown	adult	na
245	Week 49	13/07/2016	10:00am	12:00pm	northbound, Mooney St	31°20'27.9"	152°47'35.5"	diamond python	reptile	unknown	adult	na
246					northbound, south of Pipers Ck	31°11'53.5"	152°49'23.0"	unidentifiable	unknown	unknown	unknown	unknown
247					southbound, south of Pembrooke Rd	31°20'29.8"	152°47'35.5"	unidentifiable	unknown	unknown	unknown	unknown
248	Week 50	22/07/2016	11:25am	12:15pm	median, Haydons Wharf Rd	31°18'22.4"	152°49'14.8"	kookaburra	bird	unknown	unknown	na

ID record	Week Number	Date	Start Time	Finish Time	Location description	Latitude	Longitude	Species	Assigned Vertebrate Group	Sex	Age	Pouch Young
249					Kundabung (dam house)	31°13'24.4"	152°49'24.6"	bird	bird	unknown	unknown	na
250					southbound, north of Ravenswood Rd (north)	31°10'29.6"	152°49'23.4"	unidentifiable	unknown	unknown	unknown	unknown
251					southbound, north of Cooperabung Drive	31°17'14.4"	152°49'01.9"	bandicoot	mammal	adult	unknown	unknown
252					southbound, adjacent Watt Rd	31°18'59.9"	152°48'27.5"	bird	bird	unknown	unknown	na
253					median, north of Pembrooke Rd	31°20'25.3"	152°47'36.2"	unidentifiable	unknown	unknown	unknown	unknown
254					southbound, north of East Rd	31°21'14.9"	152°47'36.9"	magpie	bird	adult	unknown	unknown
255					northbound, north of Sancrox bridge	31°26'37.3"	152°49'25.7"	small unidentifiable	mammal	unknown	unknown	unknown

Table 5: Road kill habitat details

ID record	Broad Habitat Type	Overstorey	Mid Stratum	Shrub layer	Groundcover	Hydrological Features	Rock	Log	Hollow Bearing Trees	Foraging resources Associated with fauna	Likely Attractant	Comments
1	dry sclerophyll forest	allocasuarina, tallowwood, mahogany	absent	lantana		none	none	none	none	potential past roadkill	unknown	
2	dry sclerophyll forest	Eucalypt species (predominantly blackbutt, tallowwood)	absent	lantana, blackberry, purple top verbena	pasture grasses dominated by setaria and rhodes grass	none	none	none	none	roadside grass	an open grassed area on the side of the road	kangaroo had been hit several days earlier and moved by road services potentially during recent roadside mowing.
3	grassland	absent	absent	absent	pasture grasses dominated by setaria and rhodes grass	drainage line parallel to highway	none	none	none	roadside grass	an open grassed area on the side of the road	
4	grassland	absent	absent	lantana, wild tobacco, purple top verbena, regrowth eculalypt species	pasture grasses dominated by setaria	none	none	none	none	Possibly blossoms in nearby eucalypts	Possibly blossoms in nearby eucalypts	
5	dry sclerophyll forest	tallowwood, grey gum,	regrowth allocasuarinas	absent	absent	none	none	none	none	unknown	unknown	roadside barrier in place

ID record	Broad Habitat Type	Overstorey	Mid Stratum	Shrub layer	Groundcover	Hydrological Features	Rock	Log	Hollow Bearing Trees	Foraging resources Associated with fauna	Likely Attractant	Comments
		spotted gum										
6	dry sclerophyll forest	blackbutt, tallowwood	swamp oaks, malaleuca	acacias, lantana	absent	adjacent to Maria River	none	none	unknown	possible prey such as small reptiles	nearby vegetation	
7	none, cleared	na	na	na	na	none	none	none	none	possible prey such as small reptiles	food	roadside barrier in place
8	dry sclerophyll forest	tallowwood, grey gum, spotted gum	regrowth allocasuarinas	absent	absent	none	none	none	none	possible prey such as small reptiles	food	
9	grasssland	absent	absent	wild tobacco, lantana	rhodes grass	Fernbank Ck	none	none	none	grasses	potentially food	
10	none, cleared	na	na	na	na	Barrys Ck, approximately 100m to the south	none	none	none	small mammals	Barrys Ck	
11	none, cleared	na	na	na	na	none	none	none	none	no	unsure	
12	none, cleared	na	na	na	na	Maria Ck	none	none	none	unknown	unknown	
13	grassland	na	occasional swamp oak regrowth	verbena, sateria	pasture grasses	Wilson River and associated floodplain	none	none	none	insects and roots	unknown	
14	wet sclerophyll forest	absent	swamp oaks, malaleuca	lantana, acacia, morning glory, easter cassia	pasture grasses	Wilson River and associated floodplain	none	none	none	na	unknown	
15	dry sclerophyll forest	Blackbutt	allocasuarinas	lantana, seteria	absent	small creek within 100m	none	none	unknown	grasses	unknown	
16	dry sclerophyll forest	ironbark	absent	lantana, verbena	pasture grasses	none	none	none	none	carrion, fruits, berries, grains	possible scavenging of previous roadkill	
17	none, cleared	na	na	na	na	none	none	none	none	berries, grasses, small mammals	unknown	roadside barrier in place
18	dry sclerophyll forest	tallowwood	allocasuarina regrowth	absent	bracken fern	none	none	none	none	insects and other small invertebrate	unknown, possible breeding	
19	none, bridge	na	na	na	na	Hastings River	none	none	na	unlikely	unknown	was on the bridge itself
20	wet sclerophyll forest	absent	melaleucas, allocasuarinas	lantana, morning glory	pasture grasses	Fernbank Ck	none	none	none	unknown	moving to a different water source	

ID record	Broad Habitat Type	Overstorey	Mid Stratum	Shrub layer	Groundcover	Hydrological Features	Rock	Log	Hollow Bearing Trees	Foraging resources Associated with fauna	Likely Attractant	Comments
21	grassland	absent	absent	absent	pasture grasses dominated by rhodes grass and setaria	none	none	none	na	possible prey such as small reptiles	food	
22	dry sclerophyll forest	grey gums, mahogany, blackbutt	regrowth swamp oaks	absent	absent	none	none	none	none	unknown	unknown	
23	none, cleared	na	na	na	na	none	none	none	none	na	na	roadside barriers in place
24	cleared both sides of the road (project related)	na	na	na	na	na	na	na	na	grasses	unknown	roadside barriers in place
25	cleared both sides of the road (project related)	na	na	na	na	na	na	na	na	ants	unknown	
26	cleared	na	na	na	na	dam, Smiths Ck	none	none	none	unknown	unknown	
27	dry sclerophyll forest	blackbutt	allocasuarinas	acacias	pasture grasses	none	none	none	none	unsure	unknown	photo
28	dry sclerophyll forest	ironbark	absent	lantana	pasture grasses	none	none	none	none	unknown	unknown	
29	none, cleared	na	na	na	na	none	none	none	none	unknown	unknown	
30	cleared both sides of the road (project related)	na	na	na	pasture grass	none	none	none	na	unknown	unknown	
31	wet sclerophyll forest	Swamp Oak	absent	lantana	pasture grass	Wilson River approximately 200m to the north	none	none	none	open grasslands both sides of the highway	unknown	
32	grassland	absent	absent	bracken fern	verbena, pasture grass	drainage line approximately 300m away	none	none	none	open grasslands both sides of the highway	unknown	not adjacent project works
33	grassland	absent	absent	bracken fern	verbena, pasture grass	directly adjacent drainage line	none	none	none	open grasslands both sides of the highway	unknown	not adjacent project works
34	dry sclerophyll forest	tallowwood, grey gum, mahogany	lillipilli	lantana	absent	Barrys Ck	none	none	none	unknown	Barrys Ck	
35	none, cleared	na	na	na	na	Barrys Ck, approximately 100m to the south	none	none	none	small mammals	Barrys Ck	

ID record	Broad Habitat Type	Overstorey	Mid Stratum	Shrub layer	Groundcover	Hydrological Features	Rock	Log	Hollow Bearing Trees	Foraging resources Associated with fauna	Likely Attractant	Comments
36	grassland	absent	absent	lantana	tobacco	seteria, pasture grasses	none	none	none	grasses	roadside grass	
37	cleared	na	na	na	na	none	none	none	none	no	no	roadside barrier in place
38	dry sclerophyll forest	blackbutt, tallowwood	swamp oaks, malaleuca	acacias, lantana	absent	close to Maria River	none	none	none	possibly roadkill or flowering trees	possibly roadkill or flowering trees	roadside barrier in place
39	dry forest	tallowwood, white mahogany	casuarina	bracken fern	dianella	none	none	none	none	unknown	unknown	project works on opposite side of road
40	dry sclerophyll forest	blackbutt	allocasuarinas	acacias	pasture grasses	none	none	none	none	possibly flowering trees	possibly flowering trees	
41	cleared for construction	na	na	na	na	none	none	none	none	no	unknown	entrance road off highway into construction site
42	none, over water	na	na	na	na	Wilson River	none	none	none	no	unknown	On bridge deck
43	cleared for construction	na	na	na	na	none	na	na	na	no	unknown	concrete barrier in place
44	moist slopes forest	blackbutt, tallowwod, ironbark	grey gum, turpentine	casuarina, tea-tree	dianella	none	none	none	none	no	unknown	not adjacent project works
45	na, on bridge	na	na	na	na	Fernbank Creek	none	yes	potentially	fruits, berries, grains, insects	food	on the bridge deck
46	grassland	absent	lantana	tobacco	seteria, pasture grasses	none	none	none	none	grasses	food	not adjacent project works
47	moist foresxt	blackbutt, tallowwood, grey gum	turpentine	absent	blady grass, ferns, lomandra	none	none	none	none	no	unknown	in middle of road
48	cleared	cleared	cleared	cleared	cleared	adjacent Scrubby Ck	none	none	none	unknown	unnknown	in middle of road
49	dry sclerophyll forest	ironbark	absent	lantana	pasture grasses	none	none	none	none	unknown	unknown	in middle of road
50	cleared	na	na	na	na	Barrys Creek	none	none	none	none	none	concrete barrier in place
51	moist floodplain	tallowwood, blackbutt, white mahogany	turpentine	acacia	na	none	none	none	none	none	unknown	not adjacent project works
52	grassland	absent	absent	lantana, wild tobacco, purple top verbena, regrowth	pasture grasses dominated by setaria	none	none	none	none	Possibly blossoms in nearby eucalypts		not adjacent project works

ID record	Broad Habitat Type	Overstorey	Mid Stratum	Shrub layer	Groundcover	Hydrological Features	Rock	Log	Hollow Bearing Trees	Foraging resources Associated with fauna	Likely Attractant	Comments
				eculalypt species								
53	grassland	absent	absent	lantana, wild tobacco, purple top verbena, regrowth eculalypt species	pasture grasses dominated by setaria	a lowpoint that holds water within 40m	none	none	none	not known	not known	not adjacent project works
54	grassland	absent	absent	lantana, wild tobacco, purple top verbena, regrowth eculalypt species	pasture grasses dominated by setaria	drainage line/small creek within 50m	none	none	none	not known	not known	not adjacent project works
55	predominantly cleared	absent	casuarinas	lantana, wild tabacco, cassia	absent	Hastings River	none	none	none	water source	water source	not directly adjacent works
56	wet sclerophyll forest	absent	melaleucas, allocasuarinas	lantana, morning glory	pasture grasses	Fernbank Ck	none	none	none	unknown	not known	
57	mostly cleared, regrowth eucalypts	absent	absent	regrowth eucalypts	native grasses	unnamed creek approximately 20m	none	none	none	not known	not known	directly adjacent project
58	cleared	cleared	cleared	cleared	cleared	none	none	none	none	not known	not known	directly adjacent project works, concrete barrier in place
59	grassland	absent	absent	bracken fern	verbena, pasture grass	directly adjacent drainage line	none	none	none	open grasslands both sides of the highway	unknown	not adjacent project works
60	grassland	absent	absent	bracken fern	verbena, pasture grass	none	none	none	potentially	open grasslands both sides of the highway	unknown	not adjacent project works
61	swamp oak forest	absent	Swamp Oaks	lantana	pasture grasses	within a few hundred m of the Wilson River	none	none	none	nearby open grasslands and close to water	unknown	not adjacent project works
62	cleared	cleared	cleared	cleared	cleared	none	none	none	none	not known	not known	directly adjacent project works, in median
63	cleared	cleared	cleared	cleared	cleared	none	none	none	none	not known	not known	directly adjacent project works, concrete barrier

ID record	Broad Habitat Type	Overstorey	Mid Stratum	Shrub layer	Groundcover	Hydrological Features	Rock	Log	Hollow Bearing Trees	Foraging resources Associated with fauna	Likely Attractant	Comments
												in place
64	moist forest	blackbutt, tallowwood, grey gum	turpentine	absent	lomandra, ferns	none	none	yes	potentially	not known	not known	not directly adjacent works
65	Paperbark swamp forest	absent	melaleaucas	absent	sedges	Fernbank Ck	none	some fallen melaleucas	yes	not known	not known	
66	mostly cleared, regrowth eucalypts	absent	absent	regrowth eucalypts	native grasses	unnamed creek approximately 20m	none	none	none	not known	not known	directly adjacent project
67	cleared	cleared	cleared	cleared	cleared	cleared	none	none	none	not known	not known	directly adjacent project works
68	roadside vegetation adjacent cleared pastures	casuarina, poplars	lantana, cassia, wild tobacco	absent	setaria, pasture grasses	none	none	none	none	not known	not known	
69	moist forest	blackbutt, tallowwood, spotted gum, ironbark	turpentine	paperbarks, tea tree	absent	Pipers Creek	none	none	none	no	unknown	
70	grassland	absent	absent	lantana, wild tobacco, purple top verbena, regrowth eculalypt species	pasture grasses dominated by setaria	drainage line/small creek within 50m	none	none	none	not known	not known	not adjacent project works
71	partially cleared, moist forest	absent	turpentine, allocasuarinas	acacia, tea trees	pasture grasses including setaria	none	none	none	none	not known	not known	adjacent project works, barrier soutbound
72	moist forest	blackbutt, tallowwood, spotted gum, ironbark	turpentine	absent	native grasses	close to Scrubby Ck	none	none	none	not known	not known	adjacent project works
73	riparian	flooded gums, red gums, tallowwood	absent	lantana, tobacco	lomandra, ferns	adjacent Scrubby Ck	none	none	potentially	food/water source	not known	
74	dry forest	blackbutt, tallowwood, bloodwood, stringybark	turpentine	acacia	absent	none	nnone	yes	potentially	no	not known	not directly adjacent works
75	cleared	cleared	cleared	cleared	cleared	none	none	none	none	not known	not known	directly adjacent project works

ID record	Broad Habitat Type	Overstorey	Mid Stratum	Shrub layer	Groundcover	Hydrological Features	Rock	Log	Hollow Bearing Trees	Foraging resources Associated with fauna	Likely Attractant	Comments
76												
77	cleared	cleared	cleared	cleared	cleared	cleared	none	none	none	not known	not known	directly adjacent project works
78	predominantly cleared	absent	absent	regrowth	cleared	none	none	none	none	not known	not known	monitoring was undertaken during christmas school holidays and following a rain event, as such roadkill is likely to remain on the road for very long affecting what can be found during a weekly monitoring event
79	partially cleared, moist forest	absent	turpentine, allocasuarinas	acacia, tea trees	pasture grasses including setaria	none	none	none	none	not known	not known	adjacent project works, barrier soutbound
80	cleared	cleared	cleared	cleared	cleared	none	none	none	none	not known	not known	entry to site gate
81	grassland	absent	absent	bracken fern	verbena, pasture grass	directly adjacent drainage line	none	none	none	open grasslands both sides of the highway	unknown	not adjacent project works
82	grassland	absent	absent	bracken fern	verbena, pasture grass	adjacent drainage line	none	none	potentially	open grasslands both sides of the highway	unknown	not adjacent project works
83	cleared	garden species	garden species	absent	absent	Wilson River	none	none	none	not known	not known	not adjacent project works
84	predominantly cleared	absent	absent	regrowth	cleared	none	none	none	none	not known	not known	
85	predominantly cleared	absent	absent	regrowth	cleared	none	none	none	none	not known	not known	
86	cleared	cleared	cleared	cleared	cleared	none	none	none	none	no	unknown	directly adjacent project works
87	predominantly cleared	absent	casuarinas	lantana, wild tabacco, cassia	absent	Hastings River	none	none	none	water source	water source	not directly adjacent works
88	roadside vegetation adjacent cleared pastures	absent	lantana, cassia, wild tobacco	absent	setaria, pasture grasses	none	none	none	none	no	unknown	not directly adjacent works

ID record	Broad Habitat Type	Overstorey	Mid Stratum	Shrub layer	Groundcover	Hydrological Features	Rock	Log	Hollow Bearing Trees	Foraging resources Associated with fauna	Likely Attractant	Comments
89	cleared	cleared	cleared	cleared	cleared	a lowpoint with a series of drainage lines nearby	none	none	none	no	unknown	concrete barriers in place
90	grassland	absent	absent	bracken fern	verbena, pasture grass	drainage line approximately 300m away	none	none	none	open grasslands both sides of the highway	unknown	not adjacent project works
91	swamp oak forest	absent	Swamp Oaks	lantana	pasture grasses	within a few hundred m of the Wilson River	none	none	none	nearby open grasslands and close to water	unknown	not adjacent project works
92	swamp oak forest	absent	Swamp Oaks	lantana	pasture grasses	within a few hundred m of the Wilson River	none	none	none	nearby open grasslands and close to water	unknown	not adjacent project works
93	cleared	cleared	cleared	cleared	cleared	close to Barrys Ck	none	none	none	no	unknown	concrete barrier on one side of the road, uncleared bush on the other
94	swamp oak forest	absent	Swamp Oaks	lantana	pasture grasses	within a few hundred m of the Wilson River	none	none	none	nearby open grasslands and close to water	unknown	not adjacent project works
95	grassland	absent	absent	lantana, wild tobacco, purple top verbena, regrowth eculalypt species	pasture grasses dominated by setaria	none	none	none	none	not known	not known	not adjacent project works
96	dry forest	blackbutt, tallowwood, bloodwood, stringybark	turpentine	absent	absent	none	none	none	potentially	no	not known	not directly adjacent works
97	moist forest	blackbutt, tallowwood, ironbark	she-oaks	acacia, tea tree	pasture grasses	none	none	none	none	no	unknown	not directly adjacent works
98	cleared	cleared	cleared	cleared	cleared	none	none	none	none	possibly roadkill for food	possibly roadkill	concrete barriers in place
99	cleared	cleared	cleared	cleared	pasture grasses	within a few hundred m of the Wilson River	none	none	none	no	unknown	not directly adjacent works

ID record	Broad Habitat Type	Overstorey	Mid Stratum	Shrub layer	Groundcover	Hydrological Features	Rock	Log	Hollow Bearing Trees	Foraging resources Associated with fauna	Likely Attractant	Comments
100	over water	over water	over water	over water	over water	over the Wilson River	none	none	none	no	unknown	not directly adjacent works
101	dry forest	blackbutt, tallowwood, stringybark, spotted gum	she-oaks	acacia	blady grass	none	none	none	none	no	unknown	
102	grassland	absent	absent	bracken fern	verbena, pasture grass	drainage line approximately 300m away	none	none	none	open grasslands both sides of the highway	unknown	not adjacent project works
103	Paperbark swamp forest	swamp oaks	paperbarks	lantana, wild tabacco	pasture grass	Fernbank Ck	none	none	none	no	unknown	
104	Paperbark swamp forest	swamp oaks	paperbarks	lantana, wild tabacco, cassia	pasture grass	Fernbank Ck	none	none	none	no	unknown	
105	cleared	cleared	cleared	cleared	pasture grasses	within a few hundred m of the Wilson River	none	none	none	no	unknown	not directly adjacent works
106	dry forest	blackbutt, tallowwood, stringybark, spotted gum	she-oaks	acacia	blady grass	none	none	none	none	no	unknown	
107	dry forest	blackbutt, tallowwood, stringybark, spotted gum	she-oaks	acacia	blady grass	none	none	none	none	no	unknown	
108	cleared	cleared	cleared	cleared	grass	none	none	none	none	no	unknown	cleared area due to previous land use
109	moist forest	blackbutt, tallowwood, mahogany	turpentine, she-oaks	absent	blady grass	none	none	none	none	no	unknown	
110	cleared	absent	absent	absent	lawn grass	none	none	none	none	no	unknown	
111	cleared	cleared	cleared	cleared	cleared	none	none	none	none	no	unknown	construction site, concrete barriers in place
112	cleared	cleared	cleared	cleared	cleared	none	none	none	none	no	unknown	construction site, concrete barriers in place
113	bridge	bridge	bridge	bridge	bridge	Wilson River	none	none	none	no	unknown	not adjacent project works
114	Paperbark swamp forest	swamp oaks	paperbarks	lantana, wild tabacco	pasture grass	none	none	none	none	no	unknown	

ID record	Broad Habitat Type	Overstorey	Mid Stratum	Shrub layer	Groundcover	Hydrological Features	Rock	Log	Hollow Bearing Trees	Foraging resources Associated with fauna	Likely Attractant	Comments
115	swamp oak forest	absent	Swamp Oaks	lantana	pasture grasses	within a few hundred m of the Wilson River	none	none	none	nearby open grasslands and close to water	unknown	not adjacent project works
116	cleared	cleared	cleared	cleared	pasture grasses	within a few hundred m of the Wilson River	none	none	none	no	unknown	not directly adjacent works
117	cleared	cleared	cleared	cleared	cleared	minor stream within 100m	none	none	none	water source	water source	concrete barriers in place on both sides of road
118	moist floodplain forest	blackbutt, tallowwood, mahogany, ironbark	turpentine, paperbark, she-oaks	absent	gahnia	none	none	none	none	no	unknown	
119	cleared	cleared	cleared	cleared	cleared	none	none	none	none	no	unknown	
120	moist forest	blackbutt, tallowwood, spotted gum, ironbark	turpentine, she-oaks, papaerbarks	acacias, tea tree	gahnia	none	none	none	none	no	unknown	
121	cleared	garden species	garden species	absent	absent	Wilson River	none	none	none	not known	not known	not adjacent project works
122	cleared	cleared	cleared	cleared	cleared	Fernbank Ck	none	none	none	no	unknown	
123	cleared	cleared	cleared	cleared	cleared	none	none	none	none	unknown	unknown	
124	cleared	cleared	cleared	cleared	cleared	Cooperabung Ck within 150m	none	none	none	no	unnknown	concrete barriers both sides of the road
125	cleared	cleared	cleared	cleared	cleared	none	none	none	none	no	unknown	concrete barriers in place
126	cleared	cleared	cleared	cleared	cleared	none	none	none	none	no	unknown	concrete barriers in place
127	cleared	cleared	cleared	cleared	cleared	none	none	none	none	no	unknown	concrete barriers in place
128	grassland	absent	absent	bracken fern	verbena, pasture grass	drainage line approximately 300m away	none	none	none	open grasslands both sides of the highway	unknown	not adjacent project works
129	dry forest	spotted gum, ironbark, grey gum	turpentine	absent	blady grass	none	present	none	potentially	no	unknown	not adjacent project works
130	cleared	cleared	cleared	cleared	blady grass	none	none	none	none	no	unknown	

ID record	Broad Habitat Type	Overstorey	Mid Stratum	Shrub layer	Groundcover	Hydrological Features	Rock	Log	Hollow Bearing Trees	Foraging resources Associated with fauna	Likely Attractant	Comments
131	swamp oak forest	absent	Swamp Oaks	lantana	pasture grasses	within a few hundred m of the Wilson River	none	none	none	nearby open grasslands and close to water	unknown	not adjacent project works
132	cleared	cleared	cleared	cleared	cleared	none	none	none	none	no	unknown	concrete barrier in place NB
133	moist forest	blackbutt, tallowwood, spotted gum, ironbark	turpentine, she-oaks, papaerbarks	acacias, tea tree	gahnia	none	none	none	none	no	unknown	
134	grassland	absent	absent	bracken fern	verbena, pasture grass	drainage line approximately 300m away	none	none	none	open grasslands both sides of the highway	unknown	not adjacent project works
135	dry forest	blackbutt, tallowwood, stringybark, spotted gum	she-oaks	acacia	blady grass	none	none	none	none	no	unknown	
136	dry forest	blackbutt, tallowwood, stringybark, spotted gum	she-oaks	acacia	blady grass	none	none	present	none	no	unknown	not adjacent project works
137	cleared	cleared	cleared	cleared	cleared	none	none	none	none	no	unknown	concrete barrier in place NB
138	moist forest	blackbutt, tallowwood, spotted gum, ironbark	turpentine, she-oaks, papaerbarks	acacias, tea tree	gahnia	none	none	none	none	no	unknown	
139	grassland	absent	absent	bracken fern	verbena, pasture grass	drainage line approximately 300m away	none	none	none	open grasslands both sides of the highway	unknown	not adjacent project works
140	cleared	absent	absent	absent	absent	none	none	none	none	no	unknown	
141	absent	absent	absent	bracken fern	pasture grass	none	none	none	none	grasses	unknown	
142	cleared	absent	absent	absent	pasture grass	none	none	none	none	no	unknown	
143	cleared	garden species	garden species	absent	absent	Wilson River	none	none	none	not known	not known	not adjacent project works
144	cleared	cleared	cleared	cleared	cleared	none	none	none	none	no	unknown	very squashed
145	cleared	cleared	cleared	cleared	cleared	none	none	none	none	no	unnknown	
146	cleared	cleared	cleared	cleared	cleared	Fernbank Ck	none	none	none	no	unknown	

ID record	Broad Habitat Type	Overstorey	Mid Stratum	Shrub layer	Groundcover	Hydrological Features	Rock	Log	Hollow Bearing Trees	Foraging resources Associated with fauna	Likely Attractant	Comments
147	dry forest	blackbutt, tallowwood, bloodwood, stringybark	turpentine	acacia	absent	none	none	yes	potentially	no	not known	not directly adjacent works
148	cleared	cleared	cleared	cleared	cleared	small drainage line	none	none	none	no	unknown	concrete barriers in place
149	cleared	cleared	cleared	cleared	cleared	small drainage line	none	none	none	no	unknown	middle of road
150	moist forest	blackbutt, tallowwood, spotted gum, ironbark	turpentine, she-oaks, papaerbarks	acacias, tea tree	gahnia	none	none	none	none	no	unknown	
151	cleared	cleared	cleared	cleared	cleared	Scrubby Creek nearby	none	none	none	no	unnknown	
152	cleared	cleared	cleared	cleared	cleared	none	none	none	none	no	unknown	concrete barriers in place
153	cleared	cleared	cleared	cleared	cleared	none	none	none	none	no	unknown	concrete barriers in place
154	moist forest	blackbutt, tallowwood, spotted gum, ironbark	turpentine, she-oaks, papaerbarks	acacias, tea tree	gahnia	none	none	none	none	no	unknown	
155	cleared	cleared	cleared	cleared	cleared	Cooperabung Ck within 150m	none	none	none	no	unknown	concrete barriers on northbound lane
156	cleared	garden species	garden species	absent	absent	Wilson River	none	none	none	not known	not known	not adjacent project works
157	dry forest	blackbutt, tallowwood, bloodwood, stringybark	turpentine	acacia	absent	none	none	none	none	no	not known	not directly adjacent works
158	dry forest	blackbutt, tallowwood, bloodwood, stringybark	turpentine	acacia	absent	none	none	yes	potentially	no	not known	not directly adjacent works
159	dry forest	blackbutt, tallowwood, bloodwood, stringybark	turpentine	acacia	absent	none	none	yes	potentially	no	not known	not directly adjacent works
160	cleared	cleared	cleared	cleared	cleared	none	none	none	none	no	unknown	concrete barriers in place
161	moist forest	blackbutt, tallowwood, spotted gum,	turpentine, she-oaks, papaerbarks	acacias, tea tree	gahnia	none	none	none	none	no	unknown	

ID record	Broad Habitat Type	Overstorey	Mid Stratum	Shrub layer	Groundcover	Hydrological Features	Rock	Log	Hollow Bearing Trees	Foraging resources Associated with fauna	Likely Attractant	Comments
		ironbark										
162	swamp oak forest	absent	Swamp Oaks	lantana	pasture grasses	within a few hundred m of the Wilson River	none	none	none	nearby open grasslands and close to water		
163	Swamp Forest	absent	paperbarks, mahogany	lantana, crofton weed	pasture grasses	near Fern-bank Creek	none	none	none	nearby water	unknown	
164	predominantly cleared	absent	absent	regrowth	cleared	none	none	none	none	not known	not known	
165	predominantly cleared	poplars	absent	lantana, wild tobacco	cobblers pegs, pasture grass	Fernbank Ck	none	none	none	not known	not known	
166	dry forest	blackbutt, tallowwood, bloodwood, stringybark	turpentine	acacia	absent	none	none	yes	potentially	no	not known	not directly adjacent works
167	grassland	absent	absent	bracken fern	verbena, pasture grass	drainage line approximately 300m away	none	none	none	open grasslands both sides of the highway	unknown	not adjacent project works
168	cleared	cleared	cleared	cleared	cleared	none	none	none	none	no	not known	
169	cleared	cleared	cleared	cleared	cleared	none	none	none	none	no	not known	
170	cleared	cleared	cleared	cleared	cleared	adjacent small drainage line	none	none	none	no	unknown	
171	dry forest	blackbutt, tallowwood	absent	verbena, sateria	pasture grass	none	none	none	none	no	unknown	
172	dry forest	blackbutt, tallowwood, bloodwood, stringybark	turpentine	acacia	absent	none	none	yes	potentially	no	not known	
173	cleared	cleared	cleared	cleared	cleared	none	none	none	none	no	not known	
174	cleared	cleared	cleared	cleared	cleared	none	none	none	none	no	not known	
175	cleared	cleared	cleared	cleared	cleared	none	none	none	none	no	not known	
176	moist forest	blackbutt, tallowwood, spotted gum, ironbark	turpentine, she-oaks, papaerbarks	acacias, tea tree	gahnia	none	none	none	none	no	unknown	
177	swamp oak forest	absent	Swamp Oaks	lantana	pasture grasses	within a few hundred m of the Wilson	none	none	none	nearby open grasslands and close to water	unknown	not adjacent project works

ID record	Broad Habitat Type	Overstorey	Mid Stratum	Shrub layer	Groundcover	Hydrological Features	Rock	Log	Hollow Bearing Trees	Foraging re-sources Associ-ated with fauna	Likely Attractant	Comments
						River						
178	predominantly cleared	absent	absent	regrowth	cleared	none	none	none	none	not known	not known	
179	cleared	cleared	cleared	cleared	cleared	none	none	none	none	no	not known	concrete barriers in place
180	cleared	cleared	cleared	cleared	cleared	Fernbank Ck within 200m	none	none	none	no	not known	
181	dry forest	blackbutt, tallowwood, bloodwood, stringybark	turpentine	acacia	absent	none	none	none	none	no	not known	
182	dry forest	blackbutt, tallowwood, bloodwood, stringybark	turpentine	acacia	absent	none	none	none	none	no	not known	
183	dry forest	blackbutt, tallowwood, bloodwood, stringybark	turpentine	acacia	absent	none	none	yes	none	no	not known	
184	cleared	cleared	cleared	cleared	cleared	none	none	none	none	no	not known	concrete barrier in place on both sides of the road
185	moist forest	blackbutt, tallowwood	she-oaks	verbena, sateria	pasture grass	none	none	none	none	no	not known	
186	cleared	cleared	cleared	cleared	cleared	none	none	none	none	no	not known	
187	cleared	cleared	cleared	cleared	cleared	none	none	none	none	no	not known	
188	grassland	absent	absent	bracken fern	verbena, pasture grass	drainage line approximately 300m away	none	none	none	open grasslands both sides of the highway	unknown	not adjacent project works
189	Paperbark swamp forest	swamp oaks	paperbarks	lantana, wild tabacco	pasture grass	none	none	none	none	no	unknown	not adjacent project works
190	mostly cleared	absent	absent	bracken fern and other weeds	pasture grass	none	none	none	none	no	unknown	
191	moist forest	Mahogany, blackbutt, tallowwood, stringybark	turpentine	bracken fern	absent	none	none	none	none	no	unknown	
192	pasture	absent	absent	absent	pasture grasses and weeds	none	none	none	none	no	unknown	

ID record	Broad Habitat Type	Overstorey	Mid Stratum	Shrub layer	Groundcover	Hydrological Features	Rock	Log	Hollow Bearing Trees	Foraging re-sources Associ-ated with fauna	Likely Attractant	Comments
193	cleared	cleared	cleared	cleared	cleared	none	none	none	none	no	unknown	concrete barriers in place
194	cleared	cleared	cleared	cleared	cleared	none	none	none	none	no	unknown	
195	predominantly cleared	absent	absent	regrowth	cleared	none	none	none	none	not known	not known	
196	moist forest	absent	paperbarks	lantana	pasture grass	Fernbank Ck	none	none	none	no	unknown	
197	predominantly cleared	absent	absent	regrowth	cleared	none	none	none	none	not known	not known	
198	dry forest	blackbutt, tallowwood, bloodwood, stringybark	turpentine	acacia	absent	none	none	none	none	no	not known	
199	grassland	absent	absent	bracken fern	verbena, pasture grass	drainage line approximately 300m away	none	none	none	open grasslands both sides of the highway	unknown	not adjacent project works
200	dry forest	blackbutt, tallowwood, bloodwood, stringybark	turpentine	acacia	absent	none	none	none	none	no	not known	
201	dry forest	blackbutt, tallowwood, bloodwood, stringybark	turpentine	acacia	absent	none	none	none	none	no	not known	
202	grassland	absent	absent	bracken fern	verbena, pasture grass	drainage line approximately 300m away	none	none	none	open grasslands both sides of the highway	unknown	not adjacent project works
203	grassland	absent	absent	bracken fern	verbena, pasture grass	drainage line approximately 300m away	none	none	none	open grasslands both sides of the highway	unknown	not adjacent project works
204	moist forest	blackbutt, tallowwood	she-oaks	verbena, sateria	pasture grass	none	none	none	none	no	not known	
205	grassland	absent	absent	absent	pasture grass	none	none	none	none	open grassland	unknown	
206	moist forest	blackbutt, tallowwood	she-oaks	verbena, sateria	pasture grass	none	none	none	none	no	not known	
207	grassland	absent	absent	bracken fern	verbena, pasture grass	drainage line approximately 300m away	none	none	none	open grasslands both sides of the highway	unknown	not adjacent project works
208	cleared	cleared	cleared	cleared	cleared	none	none	none	none	no	unknown	
209	cleared	cleared	cleared	cleared	cleared	none	none	none	none	no	unknown	concrete barriers in place

ID record	Broad Habitat Type	Overstorey	Mid Stratum	Shrub layer	Groundcover	Hydrological Features	Rock	Log	Hollow Bearing Trees	Foraging re-sources Associ-ated with fauna	Likely Attractant	Comments
210	moist forest	blackbutt, tallowwood	she-oaks	verbena, sateria	pasture grass	none	none	none	none	no	not known	
211	cleared	cleared	cleared	cleared	cleared	none	none	none	none	no	unknown	
212	cleared	cleared	cleared	cleared	cleared	none	none	none	none	no	unknown	
213	cleared	cleared	cleared	cleared	cleared	none	none	none	none	no	unknown	
214	dry forest	blackbutt, tallowwood, bloodwood, stringybark	turpentine	acacia	absent	none	none	none	none	no	not known	
215	dry forest	blackbutt, tallowwood, bloodwood, stringybark	turpentine	acacia	absent	none	none	none	none	no	not known	
216	grassland	absent	absent	bracken fern	verbena, pasture grass	drainage line approximately 300m away	none	none	none	open grasslands both sides of the highway	unknown	not adjacent project works
217	unknown	pine trees	bamboo	weeds	absent	none	none	none	none	no	unknown	not adjacent project works
218	cleared	cleared	cleared	cleared	cleared	none	none	none	none	no	unknown	concrete barriers in place
219	cleared	cleared	cleared	cleared	cleared	none	none	none	none	no	unknown	concrete barriers in place
220	cleared	cleared	cleared	cleared	cleared	none	none	none	none	no	unknown	
221	previously cleared	absent	cassia, garden species	absent	pasture/roadside grasses	none	none	none	none	no	unknown	not adjacent project works
222	cleared	cleared	cleared	cleared	cleared	none	none	none	none	no	unknown	
223	cleared	cleared	cleared	cleared	cleared	none	none	none	none	no	unknown	
224	cleared	cleared	cleared	cleared	cleared	none	none	none	none	no	unknown	
225	predominantly cleared	absent	absent	bracken fern, lantana	pasture grasses	Pipers Creek within 100m	none	none	none	no	unknown	
226	previously cleared	absent	cassia	lantana, wild tobacco	pasture grasses	Hastings River	none	none	none	no	unknown	not directly adja-cent works
227	grassland	absent	absent	bracken fern	verbena, pasture grass	drainage line approximately 300m away	none	none	none	open grasslands both sides of the highway	unknown	not adjacent project works
228	predominantly cleared	absent	absent	bracken fern, lantana	pasture grasses	Pipers Creek within 100m	none	none	none	no	unknown	

ID record	Broad Habitat Type	Overstorey	Mid Stratum	Shrub layer	Groundcover	Hydrological Features	Rock	Log	Hollow Bearing Trees	Foraging resources Associated with fauna	Likely Attractant	Comments
229	moist forest re-growth	absent	regrowth eucalypts	tea trees	pasture grass	none	none	none	none	no	unknown	not adjacent to work
230	cleared	cleared	cleared	cleared	cleared	none	none	none	none	no	unknown	concrete barriers in place
231	cleared	cleared	cleared	cleared	cleared	none	none	none	none	no	unknown	concrete barriers in place
232	cleared	cleared	cleared	cleared	cleared	none	none	none	none	no	unknown	
233	moist forest	blackbutt, tallowwood, spotted gum, ironbark	turpentine, she-oaks, papaerbarks	acacias, tea tree	gahnia	none	none	none	none	no	unknown	
234	cleared	absent	absent	absent	pasture grasses, verbena, sateria	none	none	none	none	no	unknown	
235	cleared	cleared	cleared	cleared	cleared	none	none	none	none	no	unknown	
236	cleared	cleared	cleared	cleared	cleared	none	none	none	none	no	unknown	
237	cleared	cleared	cleared	cleared	cleared	none	none	none	none	no	unknown	
238	cleared	cleared	cleared	cleared	cleared	none	none	none	none	no	unknown	
239	cleared	cleared	cleared	cleared	cleared	none	none	none	none	no	unknown	
240	cleared	cleared	cleared	cleared	cleared	none	none	none	none	no	unknown	
241	cleared	cleared	cleared	cleared	cleared	none	none	none	none	no	unknown	concrete barriers in place
242	grassland	absent	absent	bracken fern	verbena, pasture grass	drainage line approximately 300m away	none	none	none	open grasslands both sides of the highway	unknown	not adjacent project works
243	riparian	papaerbarks, turpentine	swamp oaks	lantana, castor oil plant	absent	small creek directly adjacent	none	none	none	water source	unknown	not adjacent works
244	riparian	papaerbarks, turpentine	swamp oaks	lantana, castor oil plant	absent	small creek directly adjacent	none	none	none	water source	unknown	not adjacent works
245	swamp oak forest	absent	Swamp Oaks	lantana	pasture grasses	within a few hundred m of the Wilson River	none	none	none	nearby open grasslands and close to water	unknown	not adjacent project works
246	predominantly cleared	absent	absent	bracken fern, lantana	pasture grasses	Pipers Creek within 100m	none	none	none	no	unknown	

ID record	Broad Habitat Type	Overstorey	Mid Stratum	Shrub layer	Groundcover	Hydrological Features	Rock	Log	Hollow Bearing Trees	Foraging resources Associated with fauna	Likely Attractant	Comments
247	grassland	absent	absent	bracken fern	verbena, pasture grass	drainage line approximately 300m away	none	none	none	open grasslands both sides of the highway	unknown	not adjacent project works
248	cleared	cleared	cleared	cleared	cleared	drainage line within 100m	none	none	none	unknown	unknown	
249	cleared	cleared	cleared	cleared	cleared	drainage line within 100m	none	none	none	unknown	unknown	
250	cleared	cleared	cleared	cleared	cleared	none	none	none	none	unknown	unknown	
251	dry forest	absent	turpentine	lantana, verbena, acacias	roadside grass	small drainage line within 30m	none	none	none	no	unknown	
252	regrowth	absent	turpentine regrowth	absent	roadside grasses	none	none	none	none	no	unknown	not directly adjacent works
253	grassland	absent	absent	bracken fern	verbena, pasture grass	drainage line approximately 300m away	none	none	none	open grasslands both sides of the highway	unknown	not adjacent project works
254	cleared	absent	absent	absent	roadside grasses	none	none	none	none	no	unknown	not directly adjacent works
255	cleared	cleared	cleared	cleared	cleared	none	none	none	none	no	unknown	

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Koala monitoring

Year 1 Surveys – Oxley Highway to Kempsey, Pacific Highway Upgrade

Prepared for Road and Maritime Services

27 July 2016

Document control

Document control item	Description
Project no.:	1702
Project client:	Road and Maritime Services
Project office:	Port Macquarie
Document description:	Koala Monitoring Report 2015
Project Director:	Rhidian Harrington
Project Manager:	Chris McEvoy
Authors:	Chelsea Hankin, Francesca Amorosi
Internal review:	Rhidian Harrington
Document status:	Rev1
Local Government Area:	Port Macquarie

Author	Revision	Internal review	Date issued	Signature
C Hankin	D1			
F Amorosi	Rev0	R Harrington	10/05/2016	
F Amorosi	Rev1	R Harrington	20/06/2016	
F Amorosi	Rev2	R Harrington	11/07/2016	

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Cover photograph: Koala from unrelated project on Liverpool Plains

Executive Summary

Context

This report documents findings from the Spring-Summer 2015 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 populations and habitat of the Koala within the study area.

Methods

Each monitoring location was surveyed in accordance with the monitoring method and design specified in SMEC-Hyder (2014).

Key results

The baseline surveys showed that the Koala was distributed across most of the study area apart from the Mingaletta-Smith Creek area, while in 2015 its recorded distribution was slightly more fragmented, particular in the northern portion of the project area. Koala presence was recorded in 83.33% of clusters during the baseline monitoring while in the 2015 monitoring Koala was present in only 45.16% of the clusters.

The overall Spot Assessment Technique (SAT) activity levels across the eight monitoring areas for the baseline survey was 4.91% (SD=7.95%), while for the 2015 monitoring it was 2.18% (SD=4.65%).

In both the baseline and 2015 surveys Koala were recorded more frequently in impact clusters than in control clusters. However, in 2015 there was no significant difference between control and impact sites.

Conclusions

Koala activity levels between the baseline and Year 1 monitoring survey appear to have decreased slightly, but for both control and impact sites. In 2015 impact sites recorded higher percentages of Koala presence than control sites. For this reason any decrease of Koala activity cannot be directly associated with the disturbance due to the Project. Therefore, with the data available to date, there is no observable change to the density, distribution, habitat use or movement patterns of Koala compared with the baseline surveys as a result of the Project.

SAT plots provide robust data compliance requirement of measuring Koala distribution, habitat use and activity levels, but only provide limited 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.

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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). Combined, these approvals outline 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 post construction periods.

Legal Status

The Koala (*Phascolarctos cinereus*) is listed as vulnerable under both the NSW *Threatened Species Conservation Act 1995* (TSC Act) and EPBC Act. Monitoring of the species is required under the Project's approval.

Monitoring Framework

The Project MCoA and SoC require the NSW Road and Maritime Services to manage and monitor the effectiveness of the biodiversity mitigation measures implemented as part of the Project. Monitoring of the Koala is to be performed in accordance with the Ecological Monitoring Program (EMP) (SMEC-Hyder 2014).

Baseline Data

In accordance with the EMP, baseline surveys for the Koala were undertaken to identify changes in habitat usage before and after construction of the Project, and to determine whether changes can be directly 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. The purpose of this baseline data is to enable before and after comparisons/analysis so that any change to the Koala population can be detected.

Purpose of this Report

This report details the findings obtained from the first monitoring period following the baseline surveys. It represents the first 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 2015 monitoring, and to compare the results with the baseline surveys to determine whether performance measures are being met and comment on whether additional measures need to be implemented.

1.2 Project objectives

The Project objectives for the Koala are specified in the MCoA, SoC and EPBC Act CoA, listed in Table 1.

Table 1. Project MCoAs, SoCs and EPBC Act CoAs for the Koala

Objective	Reference Number	Commitment	Timing
Determine the effectiveness of the flora and fauna mitigation measures.	SoC F21 MCoA 10	An adaptive monitoring program will be developed and implemented to allow the effectiveness of mitigation and offset measures to be assessed, and allow for their modification if necessary. The program will be for a minimum of six years after construction completion.	Pre-construction, construction and operation.
Prevention of wildlife mortality	SoC F19	Fauna exclusion fencing (e.g. floppy-top fencing) will be erected along the Proposal at appropriate locations to direct fauna movement towards wildlife crossing structures.	Construction.

1.3 Performance measures

The approved EMP specifies the following performance indicators for the Koala (SMEC-Hyder 2014):

- *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*
- *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.*

1.4 Monitoring timing

The monitoring program specifies that monitoring of all sites will continue in Year 1, 2 and 3 (construction phase) once substantial construction has 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. The location of field sites and the survey methodology are summarised in Section 2.

1.5 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 Infrastructure and the NSW Environment Protection Authority (EPA).

2. Survey Methodology

2.1 Project area

The Project is located on the NSW mid-north coast north from the Oxley Highway intersection with the Pacific Highway at Port Macquarie to south of the Kempsey bypass.

2.2 Monitoring design

In accordance with the baseline monitoring surveys, eight broad areas within a 20 km radius of the Project were surveyed and three types of monitoring sites were established within each:

- Treatment A: Sites with mitigation (i.e. sufficiently large culverts to allow Koalas to pass under the Highway and floppy top fencing)
- Treatment B: Sites where mitigation has not been proposed or only partial mitigation is proposed
- Treatment C: Control or reference sites located in areas at least 3 km and often 5-10 km from the Project.

These eight broad areas included 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.

Seventy two baseline SAT plots were established by Lewis (2014). Of these 72 sites 24 were mitigation, 3 part mitigation, 21 no mitigation and 24 control sites. To ensure a balanced monitoring design between impact (mitigation and not mitigation) and control sites, additional "new" control plots were established during the first monitoring event (2015) (this report).

In accordance with the baseline monitoring design these 24 "new" control sites were established at least 3 km from the project and they were grouped in clusters of 3 plots, one cluster for each of the eight broad areas.

Details of all the monitoring sites are presented in Table 2 and their locations in Figure 1.

Table 2. Monitoring sites

Monitoring Area	Treatment	Treatment sub category	Data Source	Site Name	Easting	Northing
South Sancrox	Impact	No Mitigation	Baseline	1 Sancrox East - Cassegrains	483348	6521736
South Sancrox	Impact	No Mitigation	Baseline	2 Sancrox East - Cassegrains	483455	6521789
South Sancrox	Impact	No Mitigation	Baseline	3 Sancrox East - Cassegrains	483412	6521882
South Sancrox	Impact	Mitigation	Baseline_Niche relocation	1 Sancrox South	483299	6520671
South Sancrox	Impact	Mitigation	Baseline_Niche relocation	2 Sancrox South	483254	6520383
South Sancrox	Impact	Mitigation	Baseline_Niche relocation	3 Sancrox South	483196	6520217
South Sancrox	Control	Control	Baseline	1 Cowarra State Forest	480608	6519056

Monitoring Area	Treatment	Treatment sub category	Data Source	Site Name	Easting	Northing
South Sancrox	Control	Control	Baseline	2 Cowarra State Forest	480658	6519496
South Sancrox	Control	Control	Baseline	3 Cowarra State Forest	481305	6519136
South Sancrox	Control	New Control	Niche	COWARRA NC1	479706	6518522
South Sancrox	Control	New Control	Niche	COWARRA NC2	479788	6517922
South Sancrox	Control	New Control	Niche	SAT COWARRA NC3	479795	6518227
North Sancrox	Impact	No Mitigation	Baseline	1 Sancrox North - Expressway Spares	483042	6521731
North Sancrox	Impact	No Mitigation	Baseline	2 Sancrox North - Expressway Spares	482869	6521683
North Sancrox	Impact	No Mitigation	Baseline	3 Sancrox North - Expressway Spares	482999	6521818
North Sancrox	Impact	Mitigation	Baseline	1 Fernbank Creek	483101	6523362
North Sancrox	Impact	Mitigation	Baseline	2 Fernbank Creek	483032	6523223
North Sancrox	Impact	Mitigation	Baseline	3 Fernbank Creek	483056	6523123
North Sancrox	Control	Control	Baseline	1 Lake Innes	488124	6518469
North Sancrox	Control	Control	Baseline	2 Lake Innes	488047	6518398
North Sancrox	Control	Control	Baseline	3 Lake Innes	488228	6518390
North Sancrox	Control	New Control	Niche	COWARRA NC3 -SAT COW4	479674	6516436
North Sancrox	Control	New Control	Niche	SAT COW5	479704	6516174
North Sancrox	Control	New Control	Niche	SAT COW6	479667	6515913
Cairncross State Forest (South)	Impact	No Mitigation	Baseline	1 Cairncross State Forest (South)	482428	6526536
Cairncross State Forest (South)	Impact	No Mitigation	Baseline	2 Cairncross State Forest (South)	482385	6526644
Cairncross State Forest (South)	Impact	No Mitigation	Baseline	3 Cairncross State Forest (South)	482393	6526416
Cairncross State Forest	Impact	No Mitigation	Baseline	16 Cairncross State Forest (south)	481655	6527256

Monitoring Area	Treatment	Treatment sub category	Data Source	Site Name	Easting	Northing
(south)						
Cairncross State Forest (south)	Impact	No Mitigation	Baseline	17 Cairncross State Forest (south)	481590	6527316
Cairncross State Forest (south)	Impact	No Mitigation	Baseline	18 Cairncross State Forest (south)	481637	6527175
Cairncross State Forest (South)	Impact	Mitigation	Baseline	4 Cairncross State Forest (South)	482249	6525930
Cairncross State Forest (South)	Impact	Mitigation	Baseline	5 Cairncross State Forest (South)	482125	6526077
Cairncross State Forest (South)	Impact	Mitigation	Baseline	6 Cairncross State Forest (South)	482488	6526226
Cairncross State Forest (South)	Control	Control	Baseline	1 Limeburners Creek ""The Hatch""	487011	6529909
Cairncross State Forest (South)	Control	Control	Baseline	2 Limeburners Creek ""The Hatch""	487014	6529455
Cairncross State Forest (South)	Control	Control	Baseline	3 Limeburners Creek ""The Hatch""	487035	6528694
Cairncross State Forest (South)	Control	New Control	Niche	SAT PEVI1	476817	6528422
Cairncross State Forest (South)	Control	New Control	Niche	SAT PEVI2	476730	6528225
Cairncross State Forest (South)	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
Cairncross State Forest (North)	Impact	No Mitigation	Baseline	8 Cairncross State Forest (North)	481695	6530786
Cairncross State Forest (North)	Impact	No Mitigation	Baseline	9 Cairncross State Forest (North)	481184	6530864

Monitoring Area	Treatment	Treatment sub category	Data Source	Site Name	Easting	Northing
Cairncross State Forest (North)	Impact	Mitigation	Baseline	10 Cairncross State Forest (north)	481238	6530264
Cairncross State Forest (North)	Impact	Mitigation	Baseline	11 Cairncross State Forest (north)	481173	6530319
Cairncross State Forest (North)	Impact	Mitigation	Baseline	12Cairncross State Forest (north)	481438	6530335
Cairncross State Forest (North)	Control	Control	Baseline	13 Cairncross State Forest (Pembrooke)	473751	6528881
Cairncross State Forest (North)	Control	Control	Baseline	14 Cairncross State Forest (Pembrooke)	473464	6528969
Cairncross State Forest (North)	Control	Control	Baseline	15 Cairncross State Forest (Pembrooke)	473424	6529115
Cairncross State Forest (North)	Control	New Control	Niche	SAT RR1	475284	6532709
Cairncross State Forest (North)	Control	New Control	Niche	SAT RR2	475113	6532603
Cairncross State Forest (North)	Control	New Control	Niche	SAT RR3	474816	6532732
Cooperabung Hill	Impact	No Mitigation	Baseline	1 Cooperabung	482793	6537012
Cooperabung Hill	Impact	No Mitigation	Baseline	2 Cooperabung	482755	6537093
Cooperabung Hill	Impact	No Mitigation	Baseline	3 Cooperabung	482876	6537115
Cooperabung Hill	Impact	Mitigation	Baseline_Niche relocation	4 Cooperabung	482481	6539327
Cooperabung Hill	Impact	Mitigation	Baseline_Niche relocation	5 Cooperabung	482364	6539761
Cooperabung Hill	Impact	Mitigation	Baseline	6 Cooperabung	482364	6538610
Cooperabung Hill	Control	Control	Baseline	1 Cooperabung Hill (Gum Scrub)	475489	6541854
Cooperabung Hill	Control	Control	Baseline	2 Cooperabung Hill (Gum Scrub)	475570	6541903

Monitoring Area	Treatment	Treatment sub category	Data Source	Site Name	Easting	Northing
Cooperabung Hill	Control	Control	Baseline	3 Cooperabung Hill (Gum Scrub)	475838	6541962
Cooperabung Hill	Control	New Control	Niche	SAT FL1	473693	6542127
Cooperabung Hill	Control	New Control	Niche	SAT ST1	473346	6543256
Cooperabung Hill	Control	New Control	Niche	SAT ST2	473682	6542890
Mingaletta to Smiths Creek	Impact	Mitigation	Baseline	1 Mingaletta-Smiths Creek	483304	6543632
Mingaletta to Smiths Creek	Impact	Mitigation	Baseline	2 Mingaletta-Smiths Creek	483444	6543585
Mingaletta to Smiths Creek	Impact	Mitigation	Baseline	3 Mingaletta-Smiths Creek	483100	6543670
Mingaletta to Smiths Creek	Control	Control	Baseline	1 Ballengara State Forest (Gregs Road)	477750	6543274
Mingaletta to Smiths Creek	Control	Control	Baseline	2 Ballengara State Forest (Gregs Road)	477644	6543623
Mingaletta to Smiths Creek	Control	Control	Baseline	3 Ballengara State Forest (Gregs Road)	477551	6543709
Mingaletta to Smiths Creek	Control	New Control	Niche	SAT BR1	477010	6544693
Mingaletta to Smiths Creek	Control	New Control	Niche	SAT BR2	476890	6544832
Mingaletta to Smiths Creek	Control	New Control	Niche	SAT BR3	476777	6544973
Kundabung Road to North of Pipers Creek	Impact	No Mitigation	Baseline	1 Kundabung	483095	6549036
Kundabung Road to North of Pipers Creek	Impact	No Mitigation	Baseline	2 Kundabung	482873	6549112
Kundabung Road to North of Pipers Creek	Impact	No Mitigation	Baseline	3 Kundabung	483285	6549374
Kundabung Road to North of Pipers Creek	Impact	Mitigation	Baseline	4 Kundabung	483369	6550655
Kundabung Road to North	Impact	Mitigation	Baseline	5 Kundabung	483331	6550938

Monitoring Area	Treatment	Treatment sub category	Data Source	Site Name	Easting	Northing
of Pipers Creek						
Kundabung Road to North of Pipers Creek	Impact	Mitigation	Baseline	6 Kundabung	483083	6550608
Kundabung Road to North of Pipers Creek	Control	Control	Baseline	1 Kumbatine National Park	476044	6549609
Kundabung Road to North of Pipers Creek	Control	Control	Baseline	2 Kumbatine National Park	476165	6549738
Kundabung Road to North of Pipers Creek	Control	Control	Baseline	3 Kumbatine National Park	475889	6549468
Kundabung Road to North of Pipers Creek	Control	New Control	Niche	SAT MAC1	476538	6552784
Kundabung Road to North of Pipers Creek	Control	New Control	Niche	SAT MAC2	476558	6552361
Kundabung Road to North of Pipers Creek	Control	New Control	Niche	SAT MAC3	476481	6552612
Maria River State Forest	Impact	Part Mitigation	Baseline_Niche relocation	1 Maria River	483074	6554460
Maria River State Forest	Impact	Part Mitigation	Baseline	2 Maria River	482836	6554330
Maria River State Forest	Impact	Part Mitigation	Baseline_Niche relocation	3 Maria River	482993	6554024
Maria River State Forest	Impact	Mitigation	Baseline	4 Maria River	482886	6552623
Maria River State Forest	Impact	Mitigation	Baseline	5 Maria River	482754	6552462
Maria River State Forest	Impact	Mitigation	Baseline	6 Maria River	483135	6552449
Maria River State Forest	Control	Control	Baseline	1 Maria River National Park	486965	6554366

Monitoring Area	Treatment	Treatment sub category	Data Source	Site Name	Easting	Northing
Maria River State Forest	Control	Control	Baseline	2 Maria River National Park	486971	6554479
Maria River State Forest	Control	Control	Baseline	3 Maria River National Park	487004	6554203
Maria River State Forest	Control	New Control	Niche	SAT CO1	486292	6552230
Maria River State Forest	Control	New Control	Niche	SAT CO3	486811	6552227
Maria River State Forest	Control	New Control	Niche	SAT MAR 1	486811	6552454

2.3 Methodology

2.3.1 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 utilised 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 minute 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. The activity level of a site is calculated as the percentage of surveyed trees within the site (of 30 trees) that has 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.

A total of 93 SAT plots were surveyed across the eight areas (Figure 1). These plots included the location of 69 of the existing 72 baseline SAT plots established by Lewis (2014), with the additional 24 control plots selected by Niche during the first monitoring event (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 propriety 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.

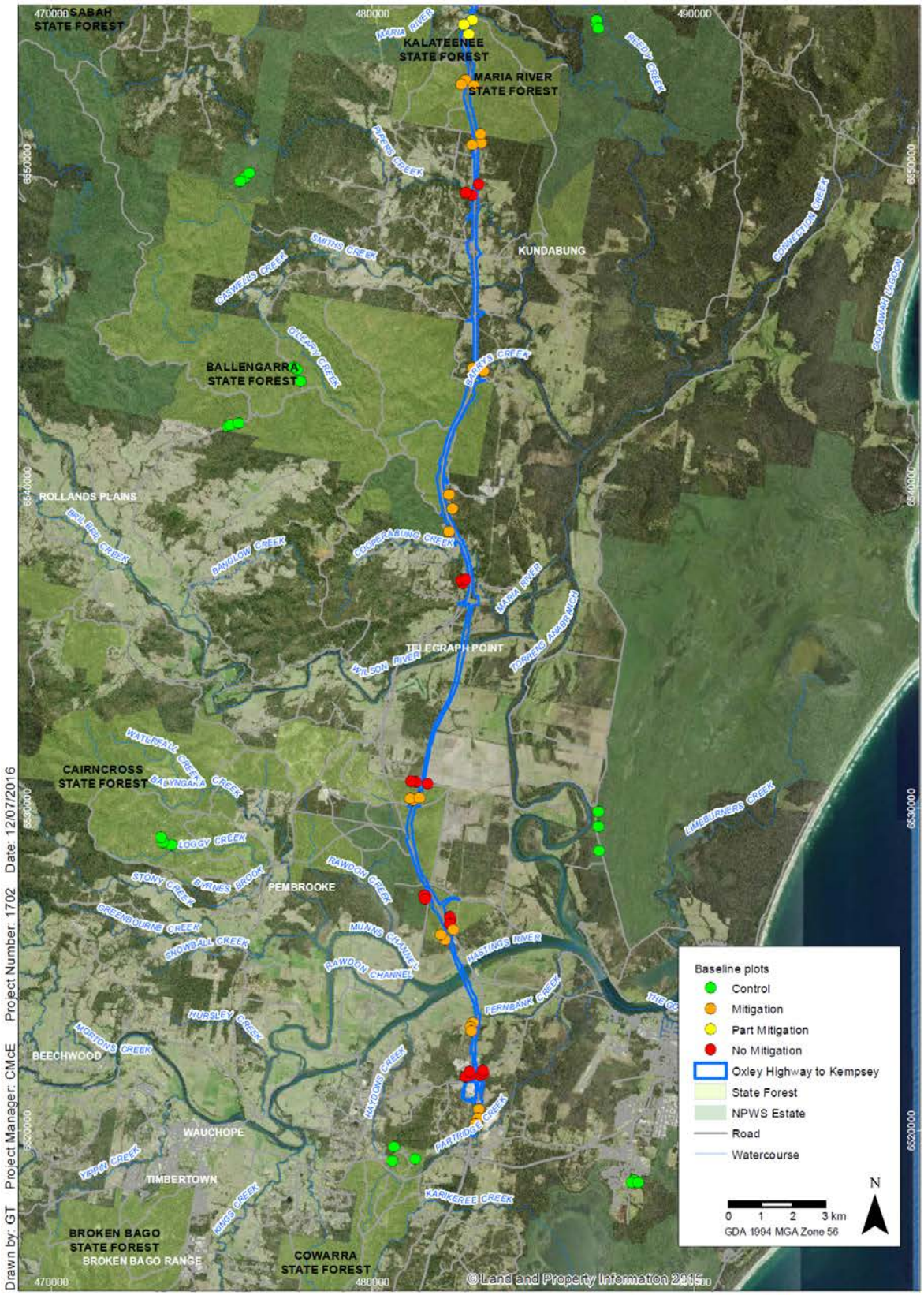
The presence (or absence) of scats was recorded, along with a number of other attributes including the species of the tree under which the scat was located. SAT plots were conducted from October to December 2015.

2.4 Analysis

The SAT results are presented separately by plot and by cluster, but most of the histograms and data analysis were undertaken by cluster only. Plots within the same cluster are not independent from each other and therefore cannot be used for most statistical analyses. Presence-absence of Koalas was allayed using data from clusters.

Given this is the first monitoring period after the baseline survey, statistical analysis was deemed unsuitable to determine a significant change in Koala tree use.

Figure 1. Koala SAT plot locations 2015



Koala SAT plot locations 2015

Oxley Highway to Kempsey - PI 5.1 Koala report

FIGURE 1

Imagery: (c) LPI NSW 2009

Path: T:\spatial\projects\a1700\a1702_OH2K_Ecology\Maps\PI_5_Ecology_OH2K\PI_51_Koala_SAT\Report\1702_Figure_1_PI51_SAT_SUR2015.mxd

3. Results

3.1 SAT plots

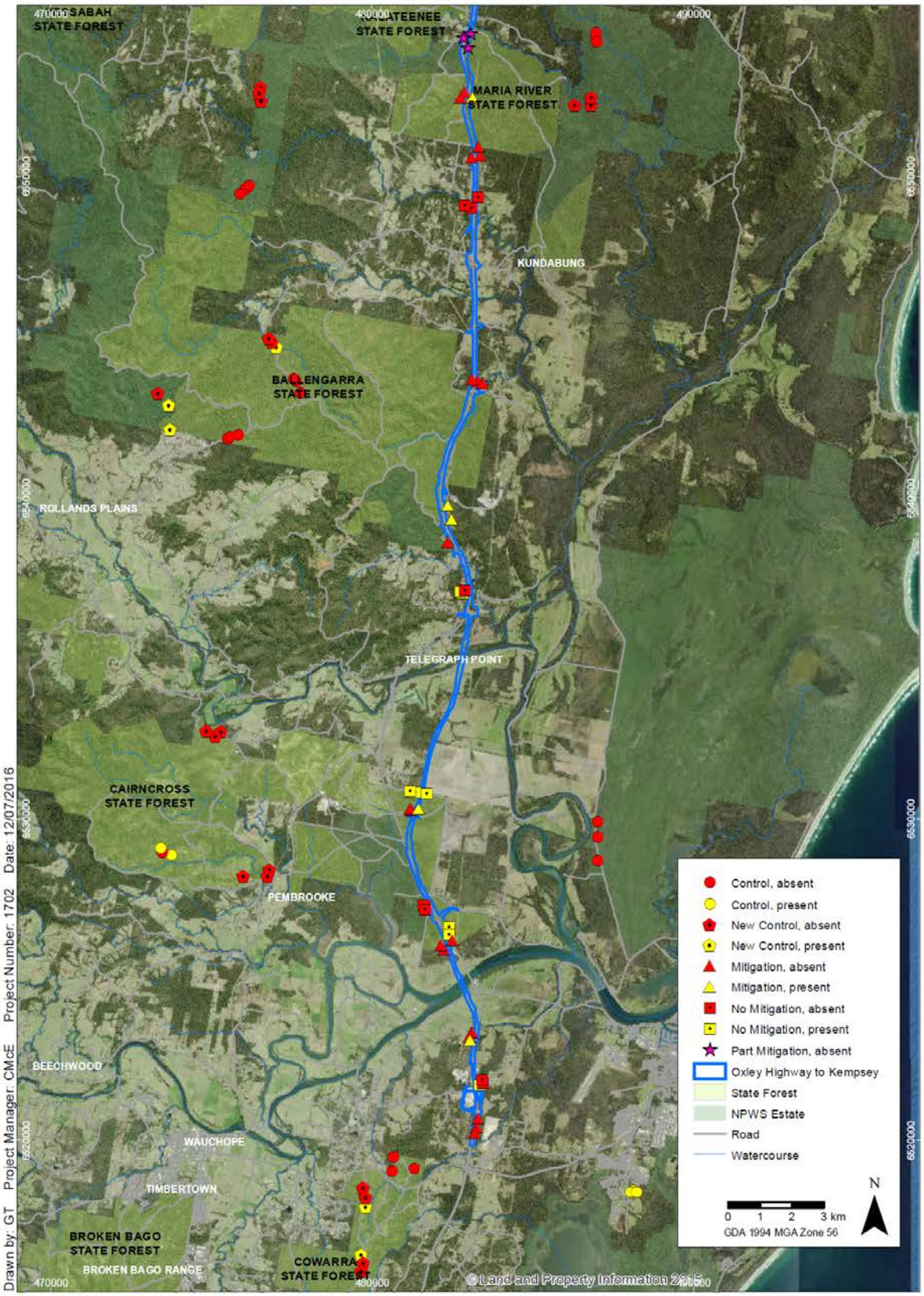
The mean SAT activity level across the 93 plots was 1.97% (SD=4.64%) (i.e. 1.97% of trees searched contained Koala faecal pellets). Koala activity was recorded from 22.81% of plots, ranging from 3.33% to 23.3% per plot.

The SAT plot activity was highest at the following locations:

- Cooperabung Hill area on the west side of the project between the Wilson River and Cooperabung Creek (chainage 18800) with activity levels reaching 23.3% (SD=8.89%)
- Southwest of Ballengarra State Forest (control sites for the Cooperabung Hill area)
- Cairncross State Forest (North) area on the east side of the road alignment (chainage 12200)
- Northeast of Lake Innes (control site for the Sancrox North area).

Based on the 2015 monitoring results Koala presence was mainly recorded in the southern and central portions of the Project area (Figure 2 and Table 3). The full data set collected during the monitoring survey is presented in Annex 1.

Figure 2. Koala SAT plots results 2015



Koala SAT plot results 2015

Oxley Highway to Kempsey - PI 5.1 Koala report

FIGURE 2

Imagery: (c) LPI NSW 2009

Path: T:\spatial\projects\a1700\a1702_OH2K_Ecology\Maps\PI_5_Ecology_OH2K\PI_51_Koala_SAT\Report\1702_Figure_2_PI51_SAT_Treat.mxd

Table 3. Koala SAT plots results 2015.

Monitoring Area	Cluster	Treatment	Data Source	Site ID	Baseline Activity	2015 Year 1 Plot Activity	Baseline	2015 Year 1
South Sancrox	1	Mitigation	Baseline_Niche relocation	SANCROX S1	13.33	0	Present	Absent
		Mitigation	Baseline_Niche relocation	SANCROX S2	3.33	0		
		Mitigation	Baseline_Niche relocation	SANCROX S3	9.99	0		
	2	No Mitigation	Baseline	SANCROX E1	9.99	3.33	Present	Present
		No Mitigation	Baseline	SANCROX E2	0.00	0.00		
		No Mitigation	Baseline	SANCROX E3	0.00	0.00		
	3	Control	Baseline	COWARRA SF1	0.00	0.00	Present	Absent
		Control	Baseline	COWARRA SF2	3.33	0.00		
		Control	Baseline	COWARRA SF3	9.99	0.00		
	4	New Control	Niche	SAT COWARRA NC1		0.00	na	Present
		New Control	Niche	SAT COWARRA NC2		3.33		
		New Control	Niche	SAT COWARRA NC3		0.00		
North Sancrox	5	No Mitigation	Baseline	SANCROX N1	3.33		Present	no access
		No Mitigation	Baseline	SANCROX N2	0.00			
		No Mitigation	Baseline	SANCROX N3	0.00			
	6	Mitigation	Baseline	FERNBANK CK1	33.33	0.00	Present	Present
		Mitigation	Baseline	FERNBANK CK2	30	0.00		
		Mitigation	Baseline	FERNBANK CK3	23.33	6.66		
	7	Control	Baseline	LAKE INNES1	26.67	13.33	Present	Present

Monitoring Area	Cluster	Treatment	Data Source	Site ID	Baseline Activity	2015 Year 1 Plot Activity	Baseline	2015 Year 1
		Control	Baseline	LAKE INNES2	13.33	6.66		
		Control	Baseline	LAKE INNES3	3.33	6.66		
	8	New Control	Niche	SAT COW4		9.999.99	na	Present
		New Control	Niche	SAT COW5		0.00		
		New Control	Niche	SAT COW6		0.00		
Cairncross State Forest (South)	9	No Mitigation	Baseline	CAINCROSS SF1	0.00	0.00	Present	Present
		No Mitigation	Baseline	CAINCROSS SF2	3.33	6.66		
		No Mitigation	Baseline	CAINCROSS SF3	0.00	3.33		
	10	No Mitigation	Baseline	CAINCROSS SF16	0.00	0.00	Present	Absent
		No Mitigation	Baseline	CAINCROSS SF17	0.00	0.00		
		No Mitigation	Baseline	CAINCROSS SF18	13.33	0.00		
	11	Mitigation	Baseline	CAINCROSS SF4	3.33	0.00	Present	Absent
		Mitigation	Baseline	CAINCROSS SF5	3.33	0.00		
		Mitigation	Baseline	CAINCROSS SF6	0.00	0.00		
	12	Control	Baseline	LIMEBURNERS CK1	0.00	0.00	Present	Absent
		Control	Baseline	LIMEBURNERS CK2	3.33	0.00		
		Control	Baseline	LIMEBURNERS CK3	0.00	0.00		
	13	New Control	Niche	SAT PEVI1		0.00	na	Absent
		New Control	Niche	SAT PEVI2		0.00		
		New Control	Niche	SAT PEVI3		0.00		

Monitoring Area	Cluster	Treatment	Data Source	Site ID	Baseline Activity	2015 Year 1 Plot Activity	Baseline	2015 Year 1
Cairncross State Forest (north)	14	No Mitigation	Baseline_Niche relocation	CAINCROSS SF7	0.00	3.33	Absent	Present
		No Mitigation	Baseline	CAINCROSS SF8	0.00	20.00		
		No Mitigation	Baseline	CAINCROSS SF9	0.00	9.99		
	15	Mitigation	Baseline	CAINCROSS SF10	3.33	0.00	Present	Present
		Mitigation	Baseline	CAINCROSS SF11	3.33	0.00		
		Mitigation	Baseline	CAINCROSS SF12	6.67	3.33		
	16	Control	Baseline	CAINCROSS SF13	6.67	3.33	Present	Present
		Control	Baseline	CAINCROSS SF14	0.00	0.00		
		Control	Baseline	CAINCROSS SF15	0.00	3.33		
	17	New Control	Niche	SAT RR1		0.00	na	Absent
		New Control	Niche	SAT RR2		0.00		
		New Control	Niche	SAT RR3		0.00		
Cooperabung Hill	18	No Mitigation	Baseline	COOPERABUNG1	3.33	3.33	Present	Present
		No Mitigation	Baseline	COOPERABUNG2	0.00	23.33		
		No Mitigation	Baseline	COOPERABUNG3	9.99	0.00		
	19	Mitigation	Baseline_Niche relocation	COOPERABUNG4	0.00	3.33	Present	Present
		Mitigation	Baseline_Niche relocation	COOPERABUNG5	3.33	3.33		
		Mitigation	Baseline	COOPERABUNG6	0.00	0.00		
	20	Control	Baseline	COOP HILL1	6.67	0.00	Present	Absent
		Control	Baseline	COOP HILL2	0.00	0.00		

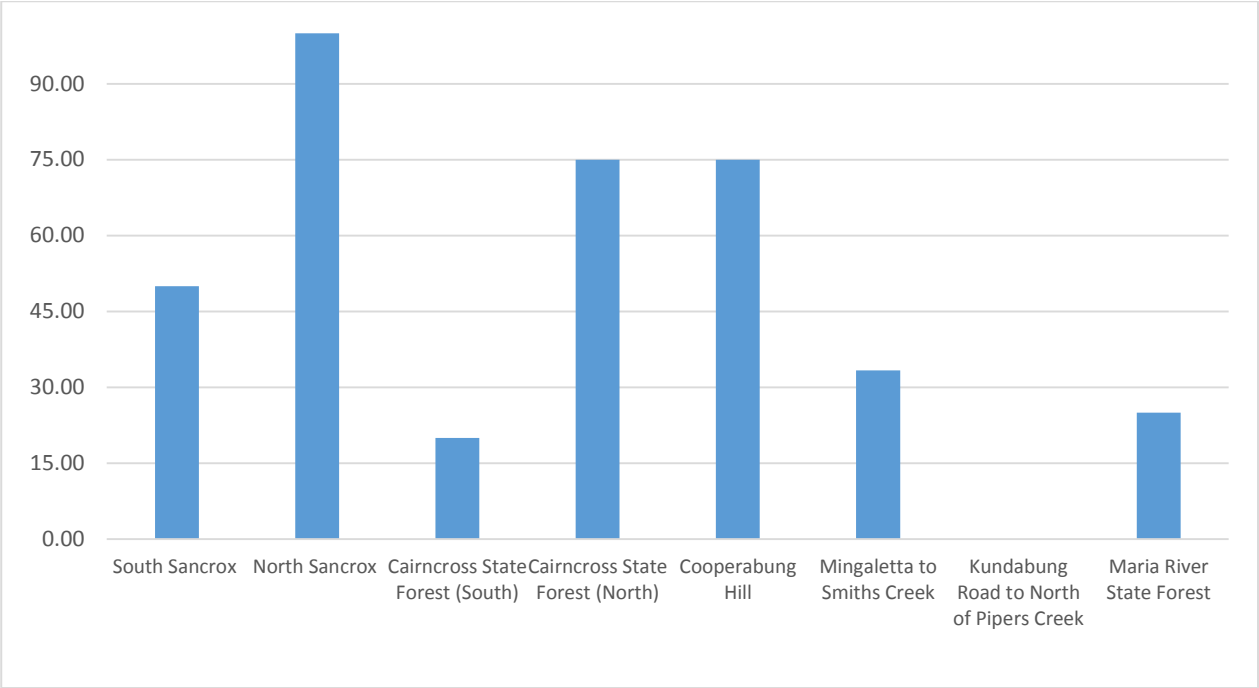
Monitoring Area	Cluster	Treatment	Data Source	Site ID	Baseline Activity	2015 Year 1 Plot Activity	Baseline	2015 Year 1
		Control	Baseline	COOP HILL3	0.00	0.00		
	21	New Control	Niche	SAT FL1		16.66	na	Present
		New Control	Niche	SAT ST1		0.00		
		New Control	Niche	SAT ST2		20.00		
Mingaletta to Smiths Creek	22	Mitigation	Baseline	MIN-SMITHS CK1	0.00	0.00	Absent	Absent
		Mitigation	Baseline	MIN-SMITHS CK2	0.00	0.00		
		Mitigation	Baseline	MIN-SMITHS CK3	0.00	0.00		
	23	Control	Baseline	BALLENGARA SF1	0.00	0.00	Absent	Absent
		Control	Baseline	BALLENGARA SF2	0.00	0.00		
		Control	Baseline	BALLENGARA SF3	0.00	0.00		
	24	New Control	Niche	SAT BR1		6.66	na	Present
		New Control	Niche	SAT BR2		0.00		
		New Control	Niche	SAT BR3		0.00		
Kundabung Road to North of Pipers Creek	25	No Mitigation	Baseline	KUNDABUNG 1	0.00	0.00	Present	Absent
		No Mitigation	Baseline	KUNDABUNG 2	9.99	0.00		
		No Mitigation	Baseline	KUNDABUNG 3	0.00	0.00		
	26	Mitigation	Baseline	KUNDABUNG 4	33.33	0.00	Present	Absent
		Mitigation	Baseline	KUNDABUNG 5	13.33	0.00		

Monitoring Area	Cluster	Treatment	Data Source	Site ID	Baseline Activity	2015 Year 1 Plot Activity	Baseline	2015 Year 1
		Mitigation	Baseline	KUNDABUNG 6	9.99	0.00		
	27	Control	Baseline	KUMBATINE NP1	3.33	0.00	Present	Absent
		Control	Baseline	KUMBATINE NP1	0.00	0.00		
		Control	Baseline	KUMBATINE NP1	0.00	0.00		
	28	New Control	Niche	SAT MAC1		0.00	na	Absent
		New Control	Niche	SAT MAC2		0.00		
		New Control	Niche	SAT MAC3		0.00		
Maria River State Forest	29	Part Mitigation	Baseline_Niche relocation	MARIA RIVER 1	0.00	0.00	Present	Absent
		Part Mitigation	Baseline	MARIA RIVER 2	3.33	0.00		
		Part Mitigation	Baseline_Niche relocation	MARIA RIVER 3	6.67	0.00		
	30	Mitigation	Baseline	MARIA RIVER 4	0.00	0.00	Absent	Present
		Mitigation	Baseline	MARIA RIVER 5	0.00	0.00		
		Mitigation	Baseline	MARIA RIVER 6	0.00	3.33		
	31	Control	Baseline	MARIA NP1	0.00	0.00	Present	Absent
		Control	Baseline	MARIA NP2	9.99	0.00		
		Control	Baseline	MARIA NP3	9.99	0.00		
	32	New Control	Niche	SAT CO1		0.00	na	Absent
		New Control	Niche	SAT CO3		0.00		
		New Control	Niche	SAT MAR 1		0.00		

The areas with the highest recorded Koala presence were: North Sancrox with three of three clusters positive for Koala presence; Cooperabung Hill and Cairncross State Forest (North) with three of four clusters containing Koala; and, South Sancrox with two of four clusters containing Koala.

No Koala scats were recorded in any of the four clusters surveyed in the Kundabung Road to north Pipers Creek area (Graph 1).

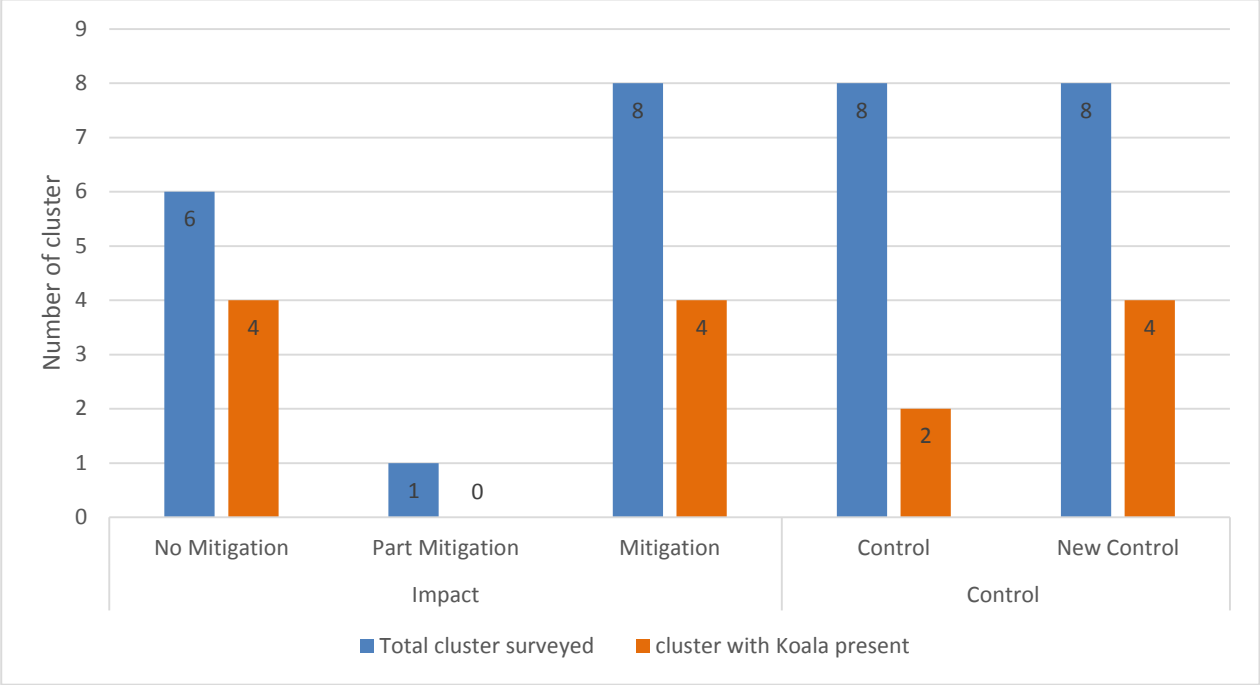
Graph 1. Percentage of clusters with Koala present by area



At a treatment level, Koala was present at 53.3% of impact clusters (8/15), but only 37.5% of control clusters (6/16).

Of the impact cluster 4/6 were No Mitigation, 0/1 Part Mitigation and 4/8 Mitigation had Koala present. Of the control clusters with Koala present 2/8 were Control, while 4/8 were new Control (Graph 2). In proportion to the number of clusters investigated per treatment class, the highest Koala presence was recorded in the No Mitigation class (66.7%) ,followed by Mitigation and New Control (50% each), and Control (25%). No Koalas were recorded in the Part Mitigation cluster.

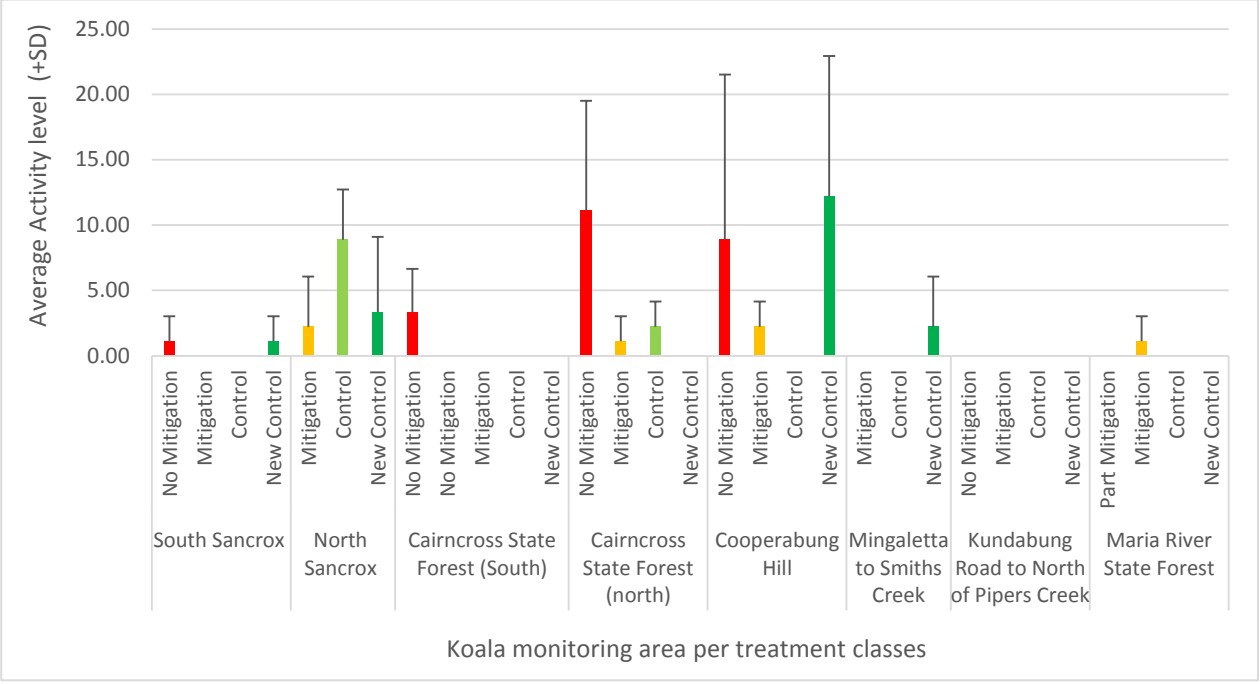
Graph 2. Koala present per treatment classes



If we compare the Koala presence/absence results between control and impact clusters using a chi-Square test there is no significant difference (p <0.05). The chi-square statistic is 0.7837 and the p-value is 0.376017.

For coherence with the baseline surveys, the 2015 monitoring results are presented per koala activity level by treatment class, and by the eight broad areas as identified during the baseline survey (see Graph 3).

Graph 3. Koala activity level per area and treatment classes



3.2 Tree species use

A total of 2,790 trees were surveyed from 31 tree species. Koala scats were recorded from 17 tree species with overall tree use of 1.78% (Table 4). The tree species Koala scats were most commonly recorded beneath was Tallowwood (*Eucalyptus microcorys*), comprising 18.54% of all recorded feed tree species.

Proportionally, Koala scats were most frequently recorded beneath White Mahogany (*Eucalyptus acmenoides*) and Swamp Mahogany (*Eucalyptus robusta*), 13.3% and 13.03% respectively, and also Forest Red Gum (*Eucalyptus tereticornis*) and Thick-leaved Mahogany (*Eucalyptus carnea)*, 6.67% and 5.88% respectively. However, these four tree species were uncommon at the SAT sites.

Other commonly used tree species included Tallowwood (*Eucalyptus microcorys*), Small-fruited Grey Gum (*Eucalyptus propinqua*), White Stringybark (*Eucalyptus globoidea*), Coastal Blackbutt (*Eucalyptus pilularis*) and Pink Bloodwood (*Corymbia intermedia*), with a percentage of use ranging from 1.26 to 2.78% (Table 4). Other species including Grey Ironbark (*Eucalyptus siderophloia*) and Turpentine (*Syncarpia glomulifera*) were used less often.

Table 4. Summary of tree species used by Koala during the SAT surveys

Common name	Species name	No. Trees surveyed	No. Trees with Koala scats	Proportion of use % per tree species
White Mahogany	*Eucalyptus acmenoides*	15	2	13.33
Swamp Mahogany	*Eucalyptus robusta*	23	3	13.04
Forest Red Gum	*Eucalyptus tereticornis*	45	3	6.67
Thick-leaved Mahogany	*Eucalyptus carnea*	17	1	5.88
Flooded Gum	*Eucalyptus grandis*	95	5	5.26
Broad-leaved Paperbark	*Melaleuca quinquenervia*	54	2	3.70
Prickly-leaved Tea Tree	*Melaleuca styphelioides*	28	1	3.57
Thin-leaved Stringybark	*Eucalyptus eugenioides*	98	3	3.06
Willow Bottlebrush	*Callistemon salignus*	37	1	2.70
Tallowwood	*Eucalyptus microcorys*	634	17	2.68
Small-fruited Grey Gum	*Eucalyptus propinqua*	270	4	1.48
Coastal Blackbutt	*Eucalyptus pilularis*	350	5	1.43
White Stringy bark	*Eucalyptus globoidea*	291	4	1.37
Pink Bloodwood	*Corymbia intermedia*	397	5	1.26
Forest Oak	*Allocasuarina torulosa*	314	3	0.96
Grey Ironbark	*Eucalyptus siderophloia*	139	1	0.72
Turpentine	*Syncarpia glomulifera*	305	1	0.33

3.3 Weather conditions

The weather conditions during the field surveys (from Kempsey weather station) are provided in Table 5.

Table 5. Weather conditions during Spring-Summer 2015

Date	Minimum temperature (°C)	Maximum temperature (°C)	Rainfall (mm)	Wind speed (km/hr)
27/10/2015	15	22	5.8	28
28/10/2015	11	21	2.6	11
29/10/2015	11	22	0	17
2/11/2015	15	31	0.4	37
3/11/2015	16	30	1.6	35
4/11/2015	19	24	36	37
5/11/2016	18	23	47	33
6/11/2015	18	30	10.6	33
7/12/2015	12	27	0	20
8/12/2015	14	29	0	28
9/12/2015	19	29	0	17
10/12/2015	18	29	40.2	15
21/12/2015	17	31	0	20
22/12/2015	21	26	0	20
23/12/2015	18	22	42	7

4. Discussion

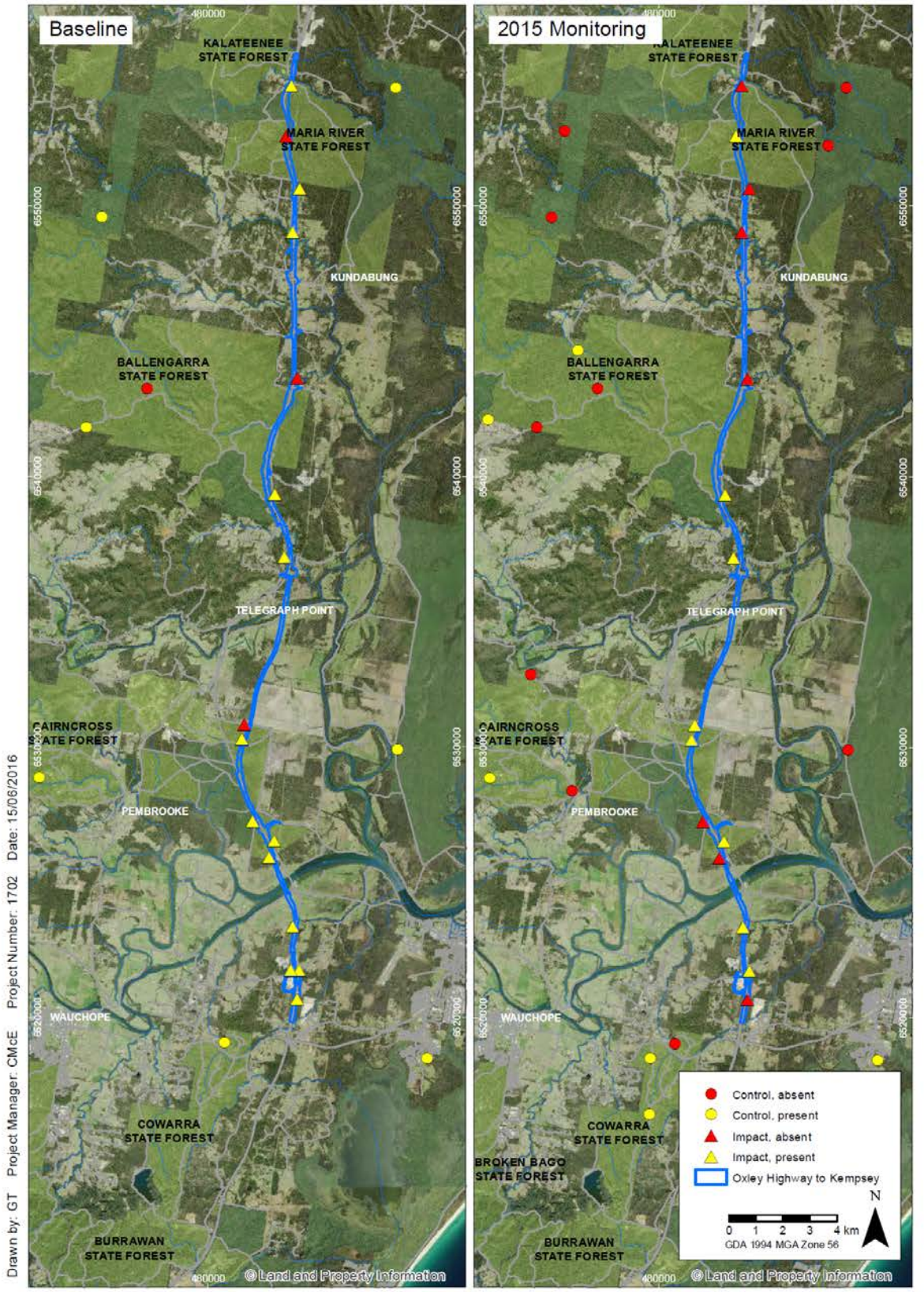
Results of SAT baseline surveys showed that Koalas were recorded across most of the study area, apart from the Mingaletta-Smith Creek area. During the 2015 monitoring Koala distribution was slightly patchier, in particular in the north portion of the Project, where Koala were only recorded from one site (Figure 3).

During the baseline monitoring Koala presence was recorded in 83.33% of clusters, while in the 2015 monitoring event Koala were present in only 45.16% of the clusters. The overall SAT activity levels across the eight monitoring areas for the baseline surveys was 4.91% (SD=7.95%), while for the 2015 monitoring it was 2.18% (SD=4.65%). Koala activity has decreased since the baseline but it is not possible to undertake any statistical analysis to compare the two monitoring periods because the baseline monitoring didn't have a balanced design (i.e. equal impact and control sites). This issues have been resolved in 2015 with the establishment of additional control sites. In both the baseline and 2015 surveys Koalas were more frequently recorded in impact clusters than in control clusters. In 2015 the difference in Koala numbers between control and impact sites was not significant.

The results of the 2015 (year 1) monitoring show that the average activity levels align with medium use on the east coast (low density area) (Philips and Callaghan, 2011), with some areas occasionally representing high use along the road corridor at Cooperabung Hill area and at Cairncross State Forest (North) area. High activity levels were also recorded in control locations southwest of Ballengarra State Forest and northeast of Lake Innes.

In future monitoring events it is recommended that the 2015 SAT plot monitoring design is maintained.

Figure 3. Koala baseline vs. 2015 monitoring



The tree species used by koala during the baseline and 2015 monitoring are almost the same, but the proportion of use for tree species it is not directly comparable because a larger sample of trees were used in 2015 compare to the baseline surveys (2,790 versus 2,160).

Following is a discussion of how the results obtained to date compare against the performance measures from the approved EMP (SMEC-Hyder 2014), and any recommendations arising from these results:

- **Monitoring is undertaken during baseline surveys from Year 1 – Year 6 & 8, or until mitigation measures are demonstrated to be effective.**
  This performance measure for Year 1 has been met. SAT plots monitoring in 2015 has been undertaken as per baseline surveys.

- **Monitoring during Year 1 – Year 6 & 8 is undertaken at the Impact and Control sites where monitoring was undertaken during baseline surveys.**
  This performance measure for Year 1 has been met for 95.83% of the sites. SAT plots monitoring has been undertaken in all baseline sites apart for one No Mitigation cluster in the North Sancrox area, where an access agreement with the landowner had not been finalised at the time of the survey. 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 propriety and access was not granted.

- **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 1.

- **Fauna fence is installed at a minimum in areas identified in Schedule 3 of the EPBC approval at Year 4.**
  Not applicable for Year 1.

- **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.**
  SAT plots provide robust data regarding Koala distribution, habitat use and activity levels, but only provide limited data on density as it is not possible to determine the number of Koala from scat records. Supplementing the SAT surveys with a direct survey technique such as spotlighting surveys would provide more robust data on Koala density.

  Koala activity levels between the baseline and Year 1 monitoring survey has appears to have decreased slightly, but for both control and impact sites. In 2015 impact sites recorded higher percentages of Koala presence than control sites. For this reason any decrease of koala activity cannot be directly associated with the disturbance due to the Project. Therefore, with the data available to date, there is no observable change to the density, distribution, habitat use or movement patterns of Koala compared with the baseline surveys as a result of the Project.

References

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Annex 1. Koala SAT results – 2015 monitoring

Area N.	Monitoring Area	Treatment	Treatment sub category	Site ID	Easting	Northing	2015_Activity	Selection criteria	DBH selection criteria tree	Radial Search area survey (distance from centre tree)	Note
1	South Sancrox	Impact	No Mitigation	SANCROX E1	483348	6521736	3.33	Tallowwood	31	40	
1	South Sancrox	Impact	No Mitigation	SANCROX E2	483455	6521789	0	Thin-leaved Stringybark	32	40	
1	South Sancrox	Impact	No Mitigation	SANCROX E3	483412	6521882	0	Tallowwood	43	40	
1	South Sancrox	Impact	Mitigation	SANCROX S1	483298.9	6520671	0	Thin-leaved Stringybark	57	80	Relocated inside RMS corridor
1	South Sancrox	Impact	Mitigation	SANCROX S2	483253.8	6520383	0	Tallowwood	30	80	Relocated inside RMS corridor
1	South Sancrox	Impact	Mitigation	SANCROX S3	483196.3	6520217	0	Tallowwood	48	80	Relocated inside RMS corridor
1	South Sancrox	Control	Control	COWARRA SF1	480608	6519056	0	Tallowwood			

Area N.	Monitoring Area	Treatment	Treatment sub category	Site ID	Easting	Northing	2015_Activity	Selection criteria	DBH selection criteria tree	Radial Search area survey (distance from centre tree)	Note
1	South Sancrox	Control	Control	COWARRA SF2	480658	6519496	0	Tallowwood			
1	South Sancrox	Control	Control	COWARRA SF3	481305	6519136	0	Tallowwood			
1	South Sancrox	Control	New Control	SAT COWARRA NC1	479706.5	6518522	0	Tallowwood		45	
1	South Sancrox	Control	New Control	SAT COWARRA NC2	479788.5	6517922	3.33	Tallowwood		45	
1	South Sancrox	Control	New Control	SAT COWARRA NC3	479795.2	6518227	0	Tallowwood	43	40	
2	North Sancrox	Impact	No Mitigation	SANCROX N1	483042	6521731		Swamp Mahogany			No access granted
2	North Sancrox	Impact	No Mitigation	SANCROX N2	482869	6521683		Tallowwood			No access granted
2	North Sancrox	Impact	No Mitigation	SANCROX N3	482999	6521818		Tallowwood			No access granted

Area N.	Monitoring Area	Treatment	Treatment sub category	Site ID	Easting	Northing	2015_Activity	Selection criteria	DBH selection criteria tree	Radial Search area survey (distance from centre tree)	Note
2	North Sancrox	Impact	Mitigation	FRENBANK CK1	483101	6523362	0	Tallowwood	64	50	
2	North Sancrox	Impact	Mitigation	FRENBANK CK2	483032	6523223	0	Tallowwood	38	50	
2	North Sancrox	Impact	Mitigation	FRENBANK CK3	483056	6523123	6.66	Tallowwood	46	50	
2	North Sancrox	Control	Control	LAKE INNES1	488124	6518469	13.33	Tallowwood		60	
2	North Sancrox	Control	Control	LAKE INNES2	488047	6518398	6.66	Swamp Mahogany		60	
2	North Sancrox	Control	Control	LAKE INNES3	488228	6518390	6.66	Swamp Mahogany		60	
2	North Sancrox	Control	New Control	SAT COW4	479673.5	6516436	10	Tallowwood			
2	North Sancrox	Control	New Control	SAT COW5	479703.9	6516174	0	Tallowwood	33	40	

Area N.	Monitoring Area	Treatment	Treatment sub category	Site ID	Easting	Northing	2015_Activity	Selection criteria	DBH selection criteria tree	Radial Search area survey (distance from centre tree)	Note
2	North Sancrox	Control	New Control	SAT COW6	479667.2	6515913	0	Tallowwood	29	40	
3	Cairncross State Forest (South)	Impact	No Mitigation	CAINCROSS SF1	482428	6526536	0	Tallowwood	36	50	
3	Cairncross State Forest (South)	Impact	No Mitigation	CAINCROSS SF2	482385	6526644	6.66	Tallowwood	55	50	
3	Cairncross State Forest (South)	Impact	No Mitigation	CAINCROSS SF3	482393	6526416	3.33	Tallowwood	54	50	
3	Cairncross State Forest (south)	Impact	No Mitigation	CAINCROSS SF16	481655	6527256	0	Tallowwood		50	
3	Cairncross State Forest (south)	Impact	No Mitigation	CAINCROSS SF17	481590	6527316	0	Tallowwood		50	
3	Cairncross State Forest (south)	Impact	No Mitigation	CAINCROSS SF18	481637	6527175	0	Tallowwood		50	
3	Cairncross State Forest (South)	Impact	Mitigation	CAINCROSS SF4	482249	6525930	0	Tallowwood			

Area N.	Monitoring Area	Treatment	Treatment sub category	Site ID	Easting	Northing	2015_Activity	Selection criteria	DBH selection criteria tree	Radial Search area survey (distance from centre tree)	Note
3	Cairncross State Forest (South)	Impact	Mitigation	CAINCROSS SF5	482125	6526077	0	Tallowwood			
3	Cairncross State Forest (South)	Impact	Mitigation	CAINCROSS SF6	482488	6526226	0	Blackbutt	74	45	
3	Cairncross State Forest (South)	Control	Control	LIMEBURNERS CK1	487011	6529909	0	Scribbly Gum		70	possible Koala scratches
3	Cairncross State Forest (South)	Control	Control	LIMEBURNERS CK2	487014	6529455	0	Scribbly Gum		70	
3	Cairncross State Forest (South)	Control	Control	LIMEBURNERS CK3	487035	6528694	0	Scribbly Gum		70	
3	Cairncross State Forest (South)	Control	New Control	SAT PEVI1	476816.5	6528422	0	Tallowwood	47	30	
3	Cairncross State Forest (South)	Control	New Control	SAT PEVI2	476729.8	6528225	0	Tallowwood	48	30	
3	Cairncross State Forest (South)	Control	New Control	SAT PEVI3	475996.1	6528211	0	Tallowwood			

Area N.	Monitoring Area	Treatment	Treatment sub category	Site ID	Easting	Northing	2015_Activity	Selection criteria	DBH selection criteria tree	Radial Search area survey (distance from centre tree)	Note
4	Cairncross State Forest (north)	Impact	No Mitigation	CAINCROSS SF7	481346.4	6530835	3.33	Blackbutt	68	40	relocated in SF
4	Cairncross State Forest (north)	Impact	No Mitigation	CAINCROSS SF8	481695	6530786	20	Tallowwood	55	30	
4	Cairncross State Forest (north)	Impact	No Mitigation	CAINCROSS SF9	481184	6530864	10	Tallowwood	31	30	
4	Cairncross State Forest (north)	Impact	Mitigation	CAINCROSS SF10	481238	6530264	0	Swamp Mahogany			
4	Cairncross State Forest (north)	Impact	Mitigation	CAINCROSS SF11	481173	6530319	0	Tallowwood			
4	Cairncross State Forest (north)	Impact	Mitigation	CAINCROSS SF12	481438	6530335	3.33	Tallowwood	75	40	
4	Cairncross State Forest (north)	Control	Control	CAINCROSS SF13	473751	6528881	3.33	Tallowwood		45	
4	Cairncross State Forest (north)	Control	Control	CAINCROSS SF14	473464	6528969	0	Tallowwood		45	

Area N.	Monitoring Area	Treatment	Treatment sub category	Site ID	Easting	Northing	2015_Activity	Selection criteria	DBH selection criteria tree	Radial Search area survey (distance from centre tree)	Note
4	Cairncross State Forest (north)	Control	Control	CAINCROSS SF15	473424	6529115	3.33	Tallowwood		45	
4	Cairncross State Forest (north)	Control	New Control	SAT RR1	475283.5	6532709	0	Tallowwood	84	40	
4	Cairncross State Forest (north)	Control	New Control	SAT RR2	475112.7	6532603	0	Tallowwood	46	40	
4	Cairncross State Forest (north)	Control	New Control	SAT RR3	474815.7	6532732	0	Tallowwood	61	40	
5	Cooperabung Hill	Impact	No Mitigation	COOPERABUNG1	482793	6537012	3.33	Tallowwood	68	50	
5	Cooperabung Hill	Impact	No Mitigation	COOPERABUNG2	482755	6537093	23.33	Forest Red Gum	33	50	
5	Cooperabung Hill	Impact	No Mitigation	COOPERABUNG3	482876	6537115	0	Forest Red Gum	38	50	
5	Cooperabung Hill	Impact	Mitigation	COOPERABUNG4	482480.9	6539327	3.33	Tallowwood	38	25	Relocated about 500 m north in

Area N.	Monitoring Area	Treatment	Treatment sub category	Site ID	Easting	Northing	2015_Activity	Selection criteria	DBH selection criteria tree	Radial Search area survey (distance from centre tree)	Note
											SF
5	Cooperabung Hill	Impact	Mitigation	COOPERABUNG5	482363.7	6539761	3.33	Tallowwood	33	50	Relocated about 500 m North in SF
5	Cooperabung Hill	Impact	Mitigation	COOPERABUNG6	482364	6538610	0	Tallowwood		45	burn approx. 6 months prior
5	Cooperabung Hill	Control	Control	COOP HILL1	475489	6541854	0	Tallowwood		45	
5	Cooperabung Hill	Control	Control	COOP HILL2	475570	6541903	0	Tallowwood		45	
5	Cooperabung Hill	Control	Control	COOP HILL3	475838	6541962	0	Tallowwood		45	
5	Cooperabung Hill	Control	New Control	SAT FL1	473693	6542127	16.66	Flooded Gum			

Area N.	Monitoring Area	Treatment	Treatment sub category	Site ID	Easting	Northing	2015_Activity	Selection criteria	DBH selection criteria tree	Radial Search area survey (distance from centre tree)	Note
5	Cooperabung Hill	Control	New Control	SAT ST1	473346.4	6543256	0	Tallowwood			
5	Cooperabung Hill	Control	New Control	SAT ST2	473682.4	6542890	20	Flooded Gum			
6	Mingaletta to Smiths Creek	Impact	Mitigation	MIN-SMITHS CK1	483304	6543632	0	Tallowwood		45	
6	Mingaletta to Smiths Creek	Impact	Mitigation	MIN-SMITHS CK2	483444	6543585	0	Tallowwood		45	
6	Mingaletta to Smiths Creek	Impact	Mitigation	MIN-SMITHS CK3	483100	6543670	0	Forest Red Gum	38	40	
6	Mingaletta to Smiths Creek	Control	Control	BALLENGARA SF1	477750	6543274	0	Tallowwood		45	
6	Mingaletta to Smiths Creek	Control	Control	BALLENGARA SF2	477644	6543623	0	Small-fruited Grey Gum		45	
6	Mingaletta to Smiths Creek	Control	Control	BALLENGARA SF3	477551	6543709	0	Tallowwood		45	

Area N.	Monitoring Area	Treatment	Treatment sub category	Site ID	Easting	Northing	2015_Activity	Selection criteria	DBH selection criteria tree	Radial Search area survey (distance from centre tree)	Note
6	Mingaletta to Smiths Creek	Control	New Control	SAT BR1	477009.7	6544693	6.66	Tallowwood	38	40	
6	Mingaletta to Smiths Creek	Control	New Control	SAT BR2	476889.9	6544832	0	Tallowwood	51	40	
6	Mingaletta to Smiths Creek	Control	New Control	SAT BR3	476776.7	6544973	0	Flooded Gum	62	40	
7	Kundabung Road to North of Pipers Creek	Impact	No Mitigation	KUNDABUNG 1	483095	6549036	0	Tallowwood		45	
7	Kundabung Road to North of Pipers Creek	Impact	No Mitigation	KUNDABUNG 2	482873	6549112	0	Tallowwood	77	40	
7	Kundabung Road to North of Pipers Creek	Impact	No Mitigation	KUNDABUNG 3	483285	6549374	0	Tallowwood		45	
7	Kundabung Road to North of Pipers Creek	Impact	Mitigation	KUNDABUNG 4	483369	6550655	0	Tallowwood		45	

Area N.	Monitoring Area	Treatment	Treatment sub category	Site ID	Easting	Northing	2015_Activity	Selection criteria	DBH selection criteria tree	Radial Search area survey (distance from centre tree)	Note
7	Kundabung Road to North of Pipers Creek	Impact	Mitigation	KUNDABUNG 5	483331	6550938	0	Tallowwood		45	
7	Kundabung Road to North of Pipers Creek	Impact	Mitigation	KUNDABUNG 6	483083	6550608	0	Forest Red Gum	24	50	
7	Kundabung Road to North of Pipers Creek	Control	Control	KUMBATINE NP1	476044	6549609	0	Tallowwood			
7	Kundabung Road to North of Pipers Creek	Control	Control	KUMBATINE NP1	476165	6549738	0	Tallowwood			
7	Kundabung Road to North of Pipers Creek	Control	Control	KUMBATINE NP1	475889	6549468	0	Tallowwood			
7	Kundabung Road to North of Pipers Creek	Control	New Control	SAT MAC1	476537.9	6552784	0	Tallowwood			
7	Kundabung Road to North of Pipers Creek	Control	New Control	SAT MAC2	476558.1	6552361	0	White Stringy bark			

Area N.	Monitoring Area	Treatment	Treatment sub category	Site ID	Easting	Northing	2015_Activity	Selection criteria	DBH selection criteria tree	Radial Search area survey (distance from centre tree)	Note
7	Kundabung Road to North of Pipers Creek	Control	New Control	SAT MAC3	476480.9	6552612	0	Spotted Gum	59	45	
8	Maria River State Forest	Impact	Part Mitigation	MARIA RIVER 1	483074	6554460	0	Tallowwood		60	relocated about 50 m east as original point now cleared
8	Maria River State Forest	Impact	Part Mitigation	MARIA RIVER 2	482836	6554330	0	Tallowwood		50	burn in previous winter
8	Maria River State Forest	Impact	Part Mitigation	MARIA RIVER 3	482993.4	6554024	0	Tallowwood		50	relocated about 80 m east as original point now cleared
8	Maria River State Forest	Impact	Mitigation	MARIA RIVER 4	482886	6552623	0	Tallowwood			burn approx. 12 months prior
8	Maria River State Forest	Impact	Mitigation	MARIA RIVER 5	482754	6552462	0	Tallowwood			burn approx. 12 months prior

Area N.	Monitoring Area	Treatment	Treatment sub category	Site ID	Easting	Northing	2015_Activity	Selection criteria	DBH selection criteria tree	Radial Search area survey (distance from centre tree)	Note
8	Maria River State Forest	Impact	Mitigation	MARIA RIVER 6	483135	6552449	3.33	Tallowwood	35	50	
8	Maria River State Forest	Control	Control	MARIA NP1	486965	6554366	0	Tallowwood	39	30	
8	Maria River State Forest	Control	Control	MARIA NP2	486971	6554479	0	Tallowwood	51	30	
8	Maria River State Forest	Control	Control	MARIA NP3	487004	6554203	0	Tallowwood	53	30	
8	Maria River State Forest	Control	New Control	SAT CO1	486291.7	6552230	0	White Stringy bark			
8	Maria River State Forest	Control	New Control	SAT CO3	486811.4	6552227	0	Blackbutt	74	50	
8	Maria River State Forest	Control	New Control	SAT MAR 1	486810.5	6552454	0	Tallowwood			

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October 2016