Transport Roads & Maritime Services

Foxground and Berry Bypass

2018 POST-CONSTRUCTION ECOLOGICAL MONITORING REPORT

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DEFINITIONS

SoC	The Roads and Maritime Statement of Commitments
CoA	Minister's Conditions of Approval
CEMP	Construction environmental management plan
EA	Environmental Assessment
EIA	Environmental impact assessment
Km	kilometres
M	Metres
NSW	New South Wales
NV Act	*Native Vegetation Act 2003* (NSW)
OEH	(NSW) Office of Environment and Heritage, formerly Department of Environment, Climate Change and Water
sp./spp.	Species/multiple species

1 INTRODUCTION

Roads and Maritime Services (Roads and Maritime) have upgraded 12.5 km of the Princes Highway between Toolijooa Road north of Foxground, to Schofields Lane (the project) and between Schofields Lane to Croziers Lane south of Berry (Figure 1-1).

NGH Environmental have been engaged by Roads and Maritime to provide post-construction ecological monitoring in accordance with the approved Ecological Monitoring Program (EcMP). Services provided by NGH Environmental include the following:

- Nest box monitoring
- Aquatic monitoring
- Weed monitoring
- Road kill monitoring, camera surveys, and transect fauna monitoring as per the EcMP (the subject of this report)

1.1 PURPOSE OF THE REPORT

This report provides the results of the first year of annual post-construction monitoring data. Requirements regarding ecological monitoring during the post-construction period are outlined in the following documents:

- Minister's Condition of Approval (CoA) B9 whereby Roads and Maritime are required to develop an Ecological Monitoring Program to monitor the effectiveness of the biodiversity mitigation measures implemented as part of the project.
- The Roads and Maritime Statement of Commitments (SoC)
- Construction Flora and Fauna Management Plan sub-plan (CFFMP) (Roads and Maritime 2014)
- Ecological Monitoring Program (EcMP) (PB 2014)
- The mitigation measures listed in the Foxground and Berry Bypass Environmental Assessment (EA) (AECOM 2012)

The CFFMP (Roads and Maritime 2014) and EcMP (PB 2014) prepared for the Project detail the actions that need to be taken to meet those requirements (see Table 1-1 below).

In accordance with Section 6.2 of the EcMP (PB 2014), annual reporting is to be completed for all monitoring surveys outlined in the EcMP. This includes monitoring during the pre-construction, construction and post-construction periods. The Baseline Ecological Monitoring Results Report (PB 2015) has been used to compare pre-construction monitoring results with post-construction monitoring results.

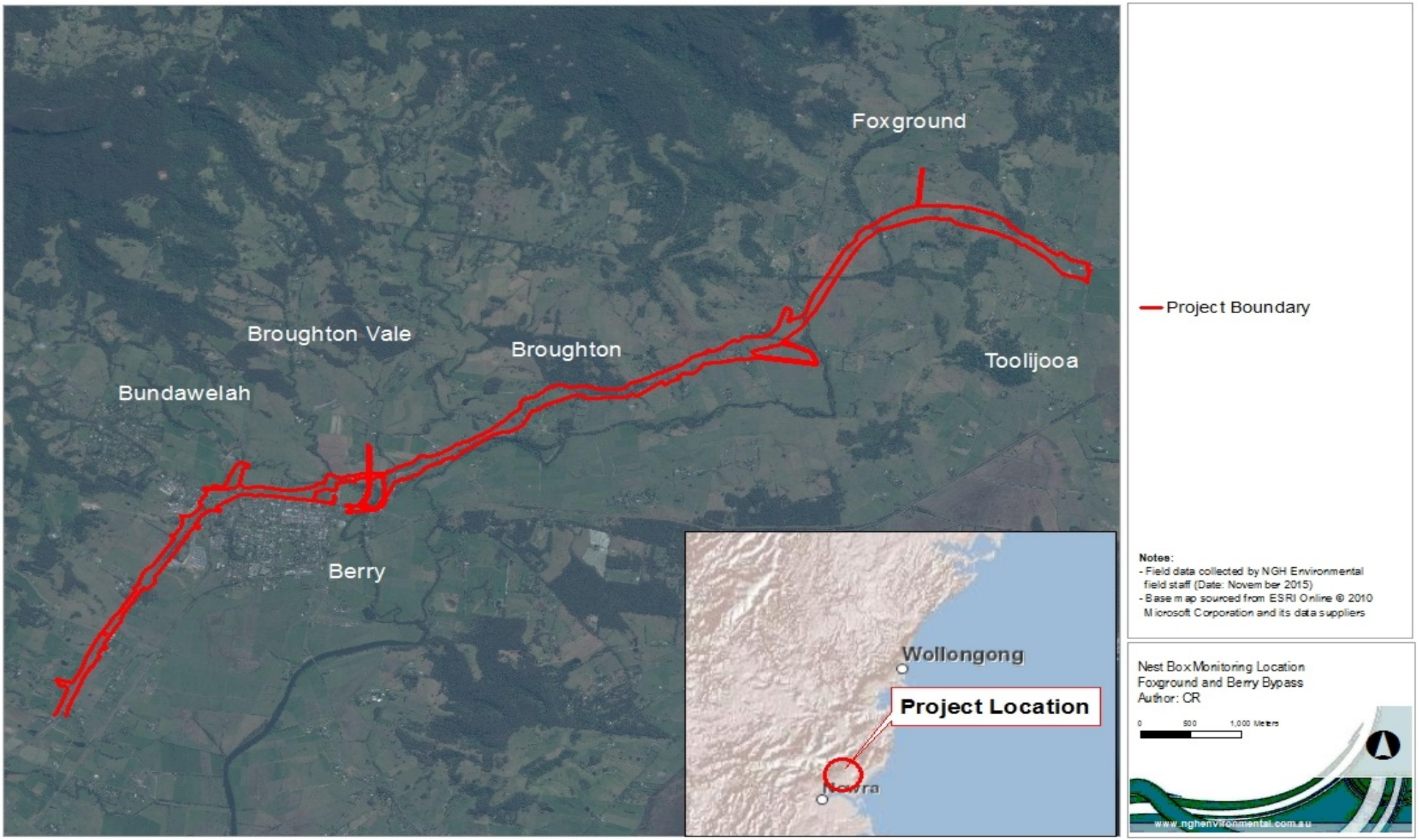

Figure 1-1 Location of the Foxground and Berry Bypass Project

Table 1-1 Conditions relevant to ecological monitoring requirements during the post-construction period

ID	Condition	Limitations	Fulfilment of commitments	Reference
Minister of Planning and Infrastructure - Conditions of Approval				
A1	The proponent shall carry out the project generally in accordance with the: Major Project Application MP10_0240 Princess Highway upgrade – Foxground and Berry bypass – Environmental Assessment (Volumes 1-2), prepared by AECOM Australia Pty Ltd for Roads and Maritime Services and dated November 2012 Princess Highway upgrade – Foxground and Berry bypass – Submissions Report, prepared by AECOM Australia Pty Ltd for Roads and Maritime Services and dated May 2013, including the revised Statement of Commitments contained therein Conditions of Approval	Discussed below	EcMP prepared in accordance with the documents outlined in A1 where applicable	EcMP - Section 1.1
B9	The proponent shall develop an **Ecological Monitoring Program** to monitor the effectiveness of the biodiversity mitigation measures implemented as part of the project. The program shall be developed by a suitably qualified and experienced ecologist in consultation with the OEH and DPI (Fishing and Aquaculture) and shall include but not necessarily be limited to:	Aspects of the EcMP are likely to be modified if changes in habitat usage are detected	The Ecological Monitoring Program (EcMP) was developed by a qualified and experienced ecologist and been completed in consultation with OEH and DPI (Fishing and Aquaculture)	The EcMP
	(a) An adaptive monitoring program to assess the effectiveness of the mitigation measures identified in conditions B3 and B36 (b) and shall amendment to the measures as necessary. The monitoring program shall nominate performance parameters and criteria against which effectiveness of fauna	-	An adaptive EcMP was prepared to monitor the effectiveness of the biodiversity mitigation measures in accordance with the conditions and commitments of the project.	EcMP - Sections 3, 4, 5 and 6 This report – Section 4.4

ID	Condition	Limitations	Fulfilment of commitments	Reference
	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 in the Project in the documents listed under Condition A1)	-	The EcMP provides monitoring methodologies, performance parameters, potential contingency measures and reporting requirements of the Project	EcMP - Sections 3, 4, 5 and 6 This report – Section 4.4 and 5
	(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 the mitigation measures can be demonstrated to have been achieved over a minimum of three successive monitoring periods 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	-	Monitoring to be undertaken pre- construction, during construction and post-construction as specified in this condition	EcMP - Sections 3, 4, 5 and 6 This report
	(d) Provision for the assessment of data to identify changes to habitat usage and whether this can be directly attributed to the project	-	The EcMP outlines data collection and assessment processes	EcMP - Sections 3, 4, 5 and 6
	(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	-	Contingency measures are outlined in this EcMP	EcMP - Section 5

ID	Condition	Limitations	Fulfilment of commitments	Reference
	(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	-	This report is the first post-construction annual report of results that will be sent to the Director General and OEH and DPI (Fishing and Aquaculture)	EcMP - Section 6 This report
	The program shall be submitted to the Director General for approval no later than 6 weeks prior to the commencement of construction that would result in the disturbance of native vegetation (unless otherwise agreed by the Director General)	-	The EcMP program was submitted to the Director General over 6 weeks prior to commencement of construction resulting in disturbance of native vegetation	Not applicable.
B36 (b)	A **Construction Flora and Fauna Management Sub-plan (CFFMP)** to detail how construction impacts on ecology will be minimised and managed. The sub-plan shall be developed in consultation with the OEH and DPI (Fishing and Aquaculture) and shall include, but not necessarily be limited to	-	A separate CFFMP has been prepared to address and manage the impacts of construction for the Project. The EcMP outlines monitoring requirements for the aspects specified below	EcMP - Section 2
	Detail of pre-construction surveys undertaken by a suitably qualified and experienced ecologist to verify the construction boundaries/footprint of the project based on detailed design and to confirm the vegetation to be cleared as part of the project (including hollow, threatened flora and fauna species and riparian vegetation)	-	Refer to CFFMP for detail. EcMP includes requirement for report and monitoring results as part of overall ecological performance monitoring	EcMP - Section 2
	Updated sensitive area/vegetation maps based on (i) above and previous survey work	-	Refer to CFFMP for detail. EcMP includes requirement for report and monitoring results as part of overall ecological performance monitoring	EcMP - Section 2
	Details of general work practices and mitigation measures to be implemented during construction to minimise impacts on native fauna and native vegetation (particularly threatened species and EECs) not proposed to be cleared as part of the project, including, but not necessarily limited to:	-	Refer to CFFMP for detail. EcMP includes requirement for report and monitoring results as part of overall ecological performance monitoring	EcMP - Section 2

ID	Condition	Limitations	Fulfilment of commitments	Reference
	fencing of sensitive areas, a protocol for the removal and relocation of fauna during clearing, engagement of a suitably qualified and experiences ecologist to identify locations where they would be present to oversee clearing activities and facilitate fauna recues and re- location, clearing timing with consideration to breeding periods, measures for maintaining existing habitat features (such as bush rock and tree branches etc.), seed harvesting and appropriate topsoil management construction worker education, weed management (including controls to prevent the introduction or spread of *Phytophthora cinnamomi*), erosion and sediment control and progressive re-vegetation			
	Specific procedures to deal with EEC/threatened species anticipated to be encountered within the project corridor including re-location, translocation and/or management and protection measures	-	Refer to CFFMP for detail. EcMP includes requirement for report and monitoring results as part of overall ecological performance monitoring	EcMP - Section 2
	A procedure for dealing with unexpected EEC/threatened species identified during construction including cessation of work and notification of the OEH, determination of appropriate mitigation measures in consultation with the OEH (including relevant re-location measures) and update of ecological monitoring and/or biodiversity offset requirements consistent with conditions B7 and B8	-	Refer to CFFMP for detail. EcMP includes requirement for report and monitoring results as part of overall ecological performance monitoring	EcMP - Section 2
Revised Statement of Commitments – from within the Submissions Report				
Manage impacts on flora and fauna				
BD2	Pre-clearing fauna surveys, clearing procedures, including staged clearing where there are hollow trees, and methods to control noxious and	-	Refer to CFFMP for detail. EcMP includes requirement for report and monitoring results	EcMP - Section 2

ID	Condition	Limitations	Fulfilment of commitments	Reference
	environmental weeds and pests will be developed and implemented prior to clearing activities, in consultation with a suitably qualified and experienced ecologist		as part of overall ecological performance monitoring	
BD3	Natural and artificial habitat features, such as bat roost and nest boxes, will be installed to replace hollow-bearing trees that are removed	-	Refer to CFFMP for detail. EcMP includes requirement for report and monitoring results as part of overall ecological performance monitoring	EcMP - Section 2
BD4	A fauna monitoring program will be developed in consultation with OEH. This program will allow the assessment of the effectiveness of fauna mitigation measures including nest boxes, bat roost boxes, fauna underpasses, rope bridges and fauna fencing	-	The EcMP addresses the fauna monitoring requirements of the project such that effectiveness of the mitigation measures can be assessed. It has been prepared in consultation with OEH and DPI (Fishing and Aquaculture)	EcMP - Section 3
Foxground and Berry Bypass Submissions Report Sections				
Section 2.10 (Page 152)	Vegetation clearing would be restricted to those areas where it is necessary and opportunities to minimise clearing would be considered during detailed design with a particular focus on retention of habitat trees. During construction, retained vegetation such as individual trees, stands of trees or patches of native vegetation would be fenced with highly visible temporary fencing. This would be undertaken in accordance with 'Guide 2 Exclusion zones' of Roads and Maritime' Biodiversity Guidelines: Protecting and managing biodiversity on Roads and Maritime projects (RTA 2011)	-	Refer to CFFMP for detail. EcMP includes requirement for report and monitoring results as part of overall ecological performance monitoring	EcMP - Section 2
	The ancillary areas assessment methodology is detailed in Section 2.7 (pages F22 to F23) of Appendix F - Technical paper: Terrestrial Flora and Fauna to the environmental assessment. The assessment criteria for terrestrial biodiversity aim	-	Refer to CFFMP for detail. EcMP includes requirement for report and monitoring results as part of overall ecological performance monitoring. Ancillary sites are not expected to require any monitoring as they have been	EcMP - Section 2

ID	Condition	Limitations	Fulfilment of commitments	Reference
	to identify ancillary areas where there would be: n no substantial vegetation clearing (unless required for project alignment) n low conservation significance for flora and fauna n no removal of EECs, threatened species or threatened fauna habitat (unless required for project alignment)		located in areas of low environmental significance, as per the requirements of the EA. Where any ancillary sites are located within the project footprint, and require staged vegetation removal, the monitoring and reporting proposed for all clearing as part of the project would apply. This is addressed in the first row of Table 3.2 in this EcMP	
	In addition no physical disturbance would occur outside the boundaries of the proposed ancillary sites. In accordance with 'Guide 2 – Exclusion Zones' (RTA 2011), buffers and temporary fencing would be installed to mark 'no-go' areas if ancillary sites are located directly adjacent to EECs or areas of medium-high conservation significance. According to the ancillary facility assessment criteria, the definition of medium-high conservation significance includes: n an area with native vegetation which may be EEC or not n threatened (or migratory) flora or fauna records/occurrences n moderate to good potential habitat for threatened (or migratory) species including intact soil profile, intact structural layers, mature fruiting trees, hollow- bearing trees and fallen woody debris n water source	-	Refer to CFFMP for detail. EcMP includes requirement for report and monitoring results as part of overall ecological performance monitoring	EcMP - Section 2
	Further to the safeguards highlighted above, refinements may be made to the design features and construction methods to further minimise vegetation clearing during the detailed design phase of the project	-	Refer to CFFMP for detail. EcMP includes requirement for report and monitoring results as part of overall ecological performance monitoring	EcMP - Section 2

ID	Condition	Limitations	Fulfilment of commitments	Reference
	As detailed above, a vegetation management plan would be prepared to guide revegetation and restoration works. The vegetation management plan would be prepared in consultation with local Landcare groups, the Southern Rivers CMA and affected land owners and would consider the opportunities and constraints surrounding ownership and continuing management of specific parcels of land	-	Refer to separate Vegetation Management Plan for the project	Not Applicable
Section 2.10 (Page 154)	Mitigation measures such as fauna fencing, fauna underpasses and rope bridges have been located in areas with the greatest potential for impact based on existing constraints, movement patterns and fauna habitat utilisation (in areas with remnant vegetation). Some of these include:	Baseline monitoring limited to spring / summer. Post-construction monitoring methodology may require modification if any significant changes in habitat usage are detected	This EcMP addresses the fauna monitoring requirements of the project such that effectiveness of the mitigation measures can be assessed.	EcMP - Section 2 and Section 3 This report – Section 2.4
	In areas along Broughton Mill Creek identified as potential dispersal habitat for the Green and Golden Bell Frog (*Litoria aurea*), a frog-proof fence would also be provided to encourage movement of this species beneath the bridge	-	EcMP includes requirement for report and monitoring results as part of overall ecological performance monitoring	EcMP - Section 2 and Section 3 This report – not applicable
	Rope bridges would be provided to facilitate movement of arboreal mammals. Use of barbed wire in the vicinity of rope bridges and associated structures is not recommended due to the potential for gliders to become caught and killed in barbed wire fences	-	EcMP includes requirement for report and monitoring results as part of overall ecological performance monitoring	EcMP - Section 2 and Section 3 This report
	Fauna fencing would be provided to avoid or minimise impacts to and improve the safety of native fauna by guiding fauna to crossing points. The current concept design generally includes wire rope safety barriers, except in locations were space	-	EcMP includes requirement for report and monitoring results as part of overall ecological performance monitoring	EcMP - Section 2 and Section 3

ID	Condition	Limitations	Fulfilment of commitments	Reference
	is constrained (such as bridges) where concrete barriers would be required. In these locations, Roads and Maritime would use Type F concrete barriers to allow for movement of small mammals, amphibians and reptiles across these areas. Fauna fencing for the project would consist of a 1.8 metre high chain link fence**.**			
	Farm boundary fencing will be provided in some areas. Roads and Maritime would encourage the use of fauna-friendly fencing design when fencing farm boundaries along the road corridor. The type of fencing used would be subject to agreements with landholders. In open agricultural land between areas of remnant vegetation the potential for small native mammals to occur is limited. Therefore, installing fauna fencing in these areas is not considered to be warranted	-	EcMP includes requirement for report and monitoring results as part of overall ecological performance monitoring	EcMP - Section 2 and Section 3
	Monitoring of fauna – vehicle collisions would be undertaken during the operation phase of the Project If road kill becomes an issue during the operational phase of the project additional fencing of these locations would be considered	-	The EcMP includes specific road kill monitoring requirements for the Project	EcMP - Section 2 and Section 3 This report – Section 2.3, 3.1 and 4.1
Section 2.10 (Page 155)	In summary Roads and Maritime Biodiversity Guidelines (Guide 6 Weed management) outlines the requirements for management of terrestrial and aquatic environmental and noxious weeds during construction and suggests best practice methods for weed management during maintenance works. In addition to implementing the management practices recommended in Roads and Maritime' Biodiversity Guidelines: Protecting and managing biodiversity on Roads and Maritime	-	The EcMP refers to the Weed Management Strategy in the CFFMP. EcMP includes requirement for report and monitoring results as part of overall ecological performance monitoring	EcMP - Section 2.4, Section 3 See Weed Monitoring Reports (NGH)

ID	Condition	Limitations	Fulfilment of commitments	Reference
	projects (RTA, 2011), the following mitigation measure would be implemented: • Control drainage that may contain weed seeds or high levels of nutrients. • Use weed-free topsoil in landscaping and re-vegetate disturbed sites with locally indigenous species (local provenance). • Monitor and control weed populations that establish in disturbed areas, with particular attention to eradication of noxious weeds. Weed invasions would be monitored and controlled by a person experienced in weed management. • Incorporate weed management strategies into the vegetation management plan, detailing necessary weed control works, particularly in areas where the weeds may impact on threatened species and/or their habitats.			
Environment Assessment Report – Biodiversity mitigation and management measures				
Pre-construction				
General construction impacts on flora and	Conduct a hollow-bearing tree/stag watch survey prior to construction. Undertake stag-watching to identify the number and type of nest boxes required and where to install them. The optimal season for stag-watching is spring; a hollow-bearing tree/stag survey however, can be conducted any time of year	-	EcMP outlines methodology for undertaking hollow bearing tree and stag watching survey within full extent of the project.	EcMP - Sections 3, 4, 5 and 6
Fauna	Install bat roost and nest boxes at a ratio of 1:1 for each hollow removed by the project	-	EcMP outlines surveys that would inform the number of bat roosts and nest boxes required to be installed at a 1:1 ratio for each hollow that will be removed. Nest box installation and management also discussed in accordance with Roads and Maritime Biodiversity Guidelines	EcMP - Sections 3, 4, 5 and 6 See Nest Box Monitoring Reports (NGH)

ID	Condition	Limitations	Fulfilment of commitments	Reference
	Installation of bat roost and nest boxes would take place at least one month prior to the commencement of construction	-	EcMP outlines surveys that would inform the number of bat roosts and nest boxes required to be installed at a 1:1 ratio for each hollow that will be removed. Nest box installation and management also discussed in accordance with Roads and Maritime Biodiversity Guidelines	EcMP - Sections 3, 4, 5 and 6
	Install nest boxes in accordance with Roads and Maritime 'Biodiversity Guidelines: Guide 8 – Nest Boxes' (RTA 2011)	-	EcMP outlines methodology for surveys of bridges and culverts to detect roosting microbats. Refers to the need of a Bat Management Plan if bats are detected during surveys	EcMP - Sections 3, 4, 5 and 6 See Nest Box Monitoring Reports (NGH)
	Prior to construction, conduct a survey of any bridges or culverts scheduled for removal in order to detect roosting microbats. If detected, prepare and implement a Bat Management Plan	-	EcMP outlines methodology for surveys of bridges and culverts to detect roosting microbats. Refers to the need of a Bat Management Plan if bats are detected during surveys	EcMP - Sections 3, 4, 5 and 6
Construction				
Mortality of individuals	Ensure that vegetation clearance complies with Roads and Maritime Biodiversity Guidelines: Guide 4 - Clearing of vegetation and removal of bushrock (RTA, 2011)		Refer to CFFMP for detail. EcMP includes requirement for report and monitoring results as part of overall ecological performance monitoring	EcMP - Section 2
Monitoring - Monitoring impacts during pre-construction, construction and operational phases				
	Prepare pre-construction, construction and operational monitoring programs which would use the 'Before and After at Control and Impact sites' approach and set out the type and frequency of monitoring to be carried out, allocate responsibilities and monitoring parameters where relevant	Data likely to be highly qualitative therefore data analysis will be conducted where possible. Baseline monitoring limited to spring/ summer only	EcMP outlines the developed ecological monitoring program. A 'Before and After at Control and impact sites' (BACI) approach is not to be strictly applied, as outlined in Section 3. The type and frequency of monitoring, and monitoring parameters are also provided	EcMP - Section 3 and Section 4 This report

ID	Condition	Limitations	Fulfilment of commitments	Reference
	Ensure a qualified ecologist is present for staged habitat removal in accordance with the Roads and Maritime' Biodiversity Guidelines (RTA 2011) and fauna rescue/relocation	-	Refer to CFFMP for detail. EcMP includes requirement for report and monitoring results as part of overall ecological performance monitoring	EcMP - Section 2
	Undertake monitoring of edge effects and weed management measures as outlined in the Flora and Fauna Management Plan	-	Refer to CFFMP for detail. EcMP includes requirement for report and monitoring results as part of overall ecological performance monitoring	EcMP - Section 2.4, Section 3 See Weed Monitoring Reports (NGH)
	Undertake bi-annual monitoring of nest boxes and bat roost boxes by a qualified and licensed ecologist during construction and annual monitoring for a period of three years post completion of construction with the provision to review the continuation and/or frequency of monitoring after the completion of three years monitoring	-	EcMP outlines a 3 year bi-annual monitoring program for nest boxes.	EcMP - Section 2.1. Section 2.3, Section 3 and Section 4 See Nest Box Monitoring Reports (NGH)
	Undertake bi-annual monitoring of dedicated fauna underpasses and rope bridges (using equipment such as remote cameras) by a qualified and licensed ecologist for a period of three years post completion of construction with the provision to review the continuation and/or frequency of monitoring for a further two years in the event a negative impact on species is detected	Baseline monitoring limited to spring only as a result of time restrictions Due to inadequate planning for remote camera installation, post-construction monitoring was delayed until Spring 2018.	EcMP outlines a 3 year bi-annual monitoring program. Discussions with Roads and Maritime confirmed that only annual monitoring would be required.	EcMP - Section 2.2, Section 3 and Section 4 This report – Sections 2.4, 3.2 and 4.2
	Conduct road kill monitoring during operation of the project over a 12 month period at weekly intervals. The monitoring would include a record of the species (if possible) and the GPS location. The local council road cleansing teams or Wildlife Rescue South Coast may be contracted to	Additional baseline monitoring will be limited to the number of weeks remaining until construction in	EcMP outlines the weekly road kill monitoring methodology. This has included pre-construction road kill monitoring on the existing Princes Highway section.	EcMP - Section 3 and Section 4 This report – Section 2.1, 3.1 and 4.1

ID	Condition	Limitations	Fulfilment of commitments	Reference
	undertake the monitoring or alternatively Roads and Maritime Southern Region would undertake the monitoring	approximately January 2015	Weekly monitoring during the post-construction phase was completed by NGH Environmental for 52 weeks	
	Conduct aquatic ecology monitoring during the pre-construction, construction and operational periods of the project in accordance with the aquatic ecology monitoring program outlined in Appendix G of the Aquatic Ecology and Water Quality Management Technical Paper provided at Appendix G of this environmental assessment. Sampling would be undertaken during Spring and Autumn, with the monitoring to continue for a minimum of one year after the project is opened to traffic. Monitoring locations would include the created diversion channel between Town Creek and Bundewallah Creek in order to provide an indication of the successful establishment of a natural creek ecosystem	Baseline monitoring limited to spring/ summer only as a result of time restrictions	EcMP outlines aquatic ecology monitoring program in accordance with the program outlined in the Environmental Assessment. Aquatic ecology monitoring to occur downstream of impact areas, with reference to upstream water quality monitoring results also to be provided	EcMP - Section 2.5, Section 3 and Section 4. See Aquatic Monitoring Reports (NGH)
	In accordance with the aquatic ecology monitoring program, periodically review and evaluate the results of the monitoring to identify improvements to existing mitigation measures or maintenance regimes. Use the results of the monitoring to identify the need for additional mitigation or management responses to address any unforeseen impacts on biodiversity	-	EcMP outlines the requirement of periodic review of aquatic monitoring and the use of results to address unforseen impacts on biodiversity, including consideration for the potential of additional mitigation requirements	EcMP - Section 2.5, Section 3 and Section 4. See Aquatic Monitoring Reports (NGH)
	Use the results of the monitoring to identify the need for additional mitigation or management responses to address any unforseen impacts on biodiversity	General responses to address unforseen impacts provided only	EcMP outlines an adaptive ecological monitoring program, result assessment and recommends performance criteria and potential contingency measures to address unforseen impacts on biodiversity	EcMP - Section 3 and Section 4

The annual report includes the following information:

- **Introduction** – background description and aims of the monitoring (refer to Section 1)
- **Methodology** – description of methodology undertaken including site location and specific survey site locations (refer to Section 2)
- **Results -** description of monitoring results (refer to Section 3)
- **Discussion** –comparison of results to performance indicators (refer to Section 4)
- **Review of mitigation measures** – the effectiveness of each mitigation measure will be reviewed (where appropriate) at the end of the monitoring period (refer to Section 4.4)
- **Recommendations** – suggestion of adaptive responses and contingency measures potentially required (where appropriate) based on the results of the monitoring session such as the implementation of contingency measures or modification of monitoring timing, frequency or methodology (refer to Section 5).

This report will be provided to the Director General, OEH, DPI (Fishing and Aquaculture), environmental manager and any other relevant agencies.

2 METHODOLOGY

2.1 PERSONNEL

The personnel that undertook each stage of monitoring is presented in Table 2-1.

Table 2-1 Personnel and their roles

Name	Position	Role
Aleksei Atkin	Senior Ecologist	Technical review
Elijah Elias	Ecologist	Project manager, report preparation, transect surveys, road kill monitoring
Cameron Radford	Ecologist	Transect surveys
Freya Gordon	Senior Ecologist	Project manager, road kill monitoring
Sarah Ann Raymond	Ecologist	Road kill monitoring
Narawan Williams	Fauna Ecologist	Camera automated detection
Amy Rowles	Fauna Ecologist	Camera automated detection
Natascha Arens	Director – Sydney Office	High level review

2.2 POST-CONSTRUCTION MONITORING SUMMARY

Table 2-2 below provides a summary of the post-construction ecological monitoring requirements as stated in the EcMP. Any deviations from those requirements are also provided, including reasons for alterations to the methodology.

Table 2-2 Post-construction ecological monitoring requirements as stated in the EcMP (relevant to this report).

Survey Type	Post construction Monitoring - Location	Post construction monitoring - Timing and frequency	Monitoring requirements as per the EcMP	Departures from the EcMP
Roadkill surveys	Along the upgraded stretch of the Princes Highway between Toolijoola Road and O'Keefes Lane in Berry, NSW	Weekly basis for a period of up to 52 weeks to commence at the start of the operational phase (31 October 2017)	Conduct roadkill monitoring during operation of the project over a 12 month period at weekly intervals. The monitoring would include a record of the species (if possible) and the GPS location. The local council road cleansing teams or Wildlife Rescue South Coast may be contracted to undertake the monitoring or alternatively Roads and Maritime Southern Region would undertake the monitoring	Roadkill Monitoring was undertaken by Fulton Hogan from November 1 2017 to December 25, 2017. Roadkill monitoring by NGH Environmental did not begin until 20 February 2018, as that was when the contract was awarded. NGH Environmental carried out 52 weeks of roadkill monitoring from February 2019 to February 2020.
Camera – automated motion detection	At locations where connectivity structures have been constructed (e.g. underpasses, rope crossings) See Figures 2-1 to 2-10 below.	Annually (within spring/ summer) for a 3 year period to commence at the start of the operation al phase. The monitoring session would involve 15 units, each recording constantly for one, 11 day session per year.	Cameras will be strategically placed in areas likely to be used as movement pathways by native wildlife such as: • Above ephemeral waterways established animal tracks • Existing bridges/culverts. • Cameras would be triggered by animal motion and would operate at day and night to record both nocturnal and diurnal animals.	Figure 2-1 of the EcMP map identified rope crossings and underpasses where cameras should be placed. Some locations are different to those identified within the EcMP due to those crossing structures being placed in different locations during the construction phase. Roads and Maritime was consulted throughout and approved the locations monitored in this report.

Survey Type	Post construction Monitoring - Location	Post construction monitoring - Timing and frequency	Monitoring requirements as per the EcMP	Departures from the EcMP
Transect surveys - Spotlighting	Along each transect (Figures 2-1 to 2-10)	Annually (within spring / summer) for a 3 year period to commence at the start of the operational phase.	Spotlighting would be completed after dusk along each transect at a rate of approximately one kilometre per hour using 50 watt spotlights. Animals observed, including arboreal, flying and ground-dwelling mammals as well as nocturnal amphibians, reptiles and birds will be identified by their distinctive vocalisations or by sight with the aid of binoculars and recorded. Spotlighting would be concentrated on areas that contain suitable habitat features for nocturnal species including trees, shrubbery, rock outcrops, water bodies/wet areas and the ground surface.	None
Transect surveys - Call Playback	At one point along each transect (Figures 2-1 to 2-10)	Annually (within spring / summer) for a 3 year period to commence at the start of the operational phase. Each monitoring session would involve one call playback session along each transect.	Call playback targeting threatened species of nocturnal bird (e.g. Bush Stone-curlew), mammals (e.g. Koala, Yellow-bellied Glider) and frogs (e.g. Green and Golden Bell Frog) would be conducted using standard methods as per below that are most often used for owls (Debus 1995). Calls for target species would be broadcast via megaphone after dusk. The survey would involve an initial listening period of 5-10 minutes, followed by a spotlight search of 10 minutes to detect any animals in the vicinity. The calls of the targeted species would then be played intermittently for 5 minutes followed by a 10 minute listening period. After the calls are played, another 10 minutes of spotlighting would be done in the vicinity to check for animals attracted by the calls, but might not be vocalising The direction and estimated distance of response calls will be recorded to provide data on the location	None

Survey Type	Post construction Monitoring - Location	Post construction monitoring - Timing and frequency	Monitoring requirements as per the EcMP	Departures from the EcMP
			of targeted species with respect to proposed structure locations.	
Transect surveys - Tracks, Scats, and signs searches	Along each transect (Figures 2-1 to 2-10)	Annually (within spring / summer) for a 3 year period to commence at the start of the operational phase. Each monitoring session will involve one, one hour search along each transect.	Searches will be conducted for signs of animal activity along each transect and would include searches of: • tree trunks for scratches (e.g. Koala) and feeding wounds (e.g. Yellow-bellied Glider) • the base of trees for scats of arboreal mammals • the ground layer for scats of kangaroos, wallabies and the Common Wombat • the soil surface for characteristic diggings of terrestrial mammals (e.g. Short-beaked Echidna, Long-nosed Potoroo) • sandy and muddy areas for animal tracks	None
Transect surveys - Herpetology searches	Along each transect (Figures 2-1 to 2-10)	Annually (within spring / summer) for a 3 year period to commence at the start of the operational phase. Each monitoring session will involve one, one hour search along each transect.	Herpetofauna (frogs and reptiles) active searches would involve looking for active specimens and eye shine (frogs only) within suitable habitat within the study area. The survey would involve searches for: • active or basking reptiles in sunlit areas • sheltering frogs and reptiles: • underneath logs and rocks • in rock crevices • under decorticating bark on trees • amongst leaf litter. Specimens would be identified visually, by aural recognition of call (frogs only) or collected by hand for identification.	None

Survey Type	Post construction Monitoring - Location	Post construction monitoring - Timing and frequency	Monitoring requirements as per the EcMP	Departures from the EcMP
			Frogs and reptiles would also be surveyed during spotlighting and call playback events and opportunistically across the study area.	

2.3 ROADKILL MONITORING

NGH Environmental undertook roadkill monitoring weekly at dawn for 52 weeks from 20th February 2018 to 25th February 2019. In accordance with the EcMP, roadkill monitoring from the start of the Foxground to Berry Bypass operational phase (31 October 2017) was undertaken by Fulton Hogan until monitoring by NGH Environmental began. Details of monitoring undertaken by Fulton Hogan did not include GPS points for records, thus cannot be added to mapping. The entire project alignment was driven once in each direction, focussing on (but not limited to) a 3-metre width from the road edge. The species, meters from the edge, GPS location, and closest habitat were recorded. The sex, number of offspring in pouch, and a photo were also recorded if possible and/or applicable. Where safe to do so, once individuals were recorded, they were spray painted with fluoro pink marking paint to avoid recording the same individuals on multiple occasions.

2.3.1 Limitations

The pink fluoro spray paint washed off individuals after heavy or consistent rain, which made ensuring no double handling of individuals difficult at times. Additionally, surveying during rain made it unsafe to stop in some areas, where photos either could not be taken or were taken at a distance. Individuals that were run over on the road or in the median were difficult to identify correctly or not possible in some instances. In these cases, an identification was provided based on what features could be seen from the safety of the roadside.

2.4 CAMERA AUTOMATED DETECTION

Cameras were strategically placed at locations where connectivity structures have been constructed (e.g. underpasses and rope crossings), with locations shown in Figures 2-1 to 2-10. Cameras were set to burst photo mode, triggered by animal motion, and operated at day and night to record both nocturnal and diurnal fauna utilising connectivity structures. The monitoring session involved the deployment of 15 Reconyx infrared motion detecting cameras. Each unit recorded constantly for a minimum 11-day session during October 2018. All cameras were retrieved on 15 November 2018. Detailed locations and site notes are provided in Table 2-3 below.

Table 2-3 Deployed cameras and installation notes

Camera ID	Date installed	Easting	Northing	Notes	Crossing structure type	Crossing (from PB 2015)
1	22/10/2018	289632	614986	Bundewallah Creek, west of Woodhill Mountain Rd. Northbound.	Rope bridge	BABN
4	23/10/2018	289627	6149930	Broughton Mill Creek, east of Woodhill Mountain Rd. Southbound.	Rope bridge	BMCS
9	23/10/2018	291875	6150926	Northbound	Rope bridge	PH5N
14	22/10/2018	291938	6150933	Northbound	Fauna underpass	PH4N

Camera ID	Date installed	Easting	Northing	Notes	Crossing structure type	Crossing (from PB 2015)
11	23/10/2018	292230	6150878	Southbound	Rope bridge	PH3S
6	23/10/2018	292290	6150916	Southbound	Dual use underpass	PH2N
7	23/10/2018	294140	6151765	Broughton Creek. Southbound	Rope bridge	BCC3N
12	23/10/2018	294157	6151729	Broughton Creek. Southbound	Rope bridge	BCC3S
2	22/10/2018	294393	6152199	Broughton Creek. Southbound	Rope bridge	BCC2W
10	23/10/2018	294826	6152825	Broughton Creek. Northbound.	Rope bridge	BCC1N
3	23/10/2018	294872	6152755	Broughton Creek. Southbound	Rope bridge	BCC1S
15	23/10/2018	296216	6152703	Toolijooa. Southbound	Rope bridge	TR2S
8	22/10/2018	294430	6152193	Broughton Creek. Northbound	Rope bridge	BCC2E
13	22/10/2018	292797	6151078	Broughton. Southbound	Dual use underpass	PH1S
5	23/10/2018	296328	6152636	Toolijooa. Northbound	Fauna underpass	TR1S

2.4.1 Limitations

Camera surveys were planned for early 2018, however due to a lack of appropriate planning or consideration of camera installation during the construction phase, the cameras could not be placed in desired locations as some rope bridges and other fauna crossings were too high and therefore inaccessible. After discussions with Roads and Maritime, a subcontractor with accredited working at heights tickets was used to deploy the cameras during October 2018.

The cameras were set to burst photo mode to ensure correct identification, and only one photo from each burst was added to the data set tally to mitigate double counts of individual animals. Where animals were clearly the same animal triggering the camera with multiple bursts, a period of five (5) minutes from the detection of the first animal to the next count of the same species was implemented. As the camera time between bursts was set lower than expected to ensure all species/individuals were recorded, sightings of the same species within the same/similar time and location were only counted as one sighting. If an individual would return at a later time, there would be no definitive way of determining from this survey method if it is a new or returning individual.

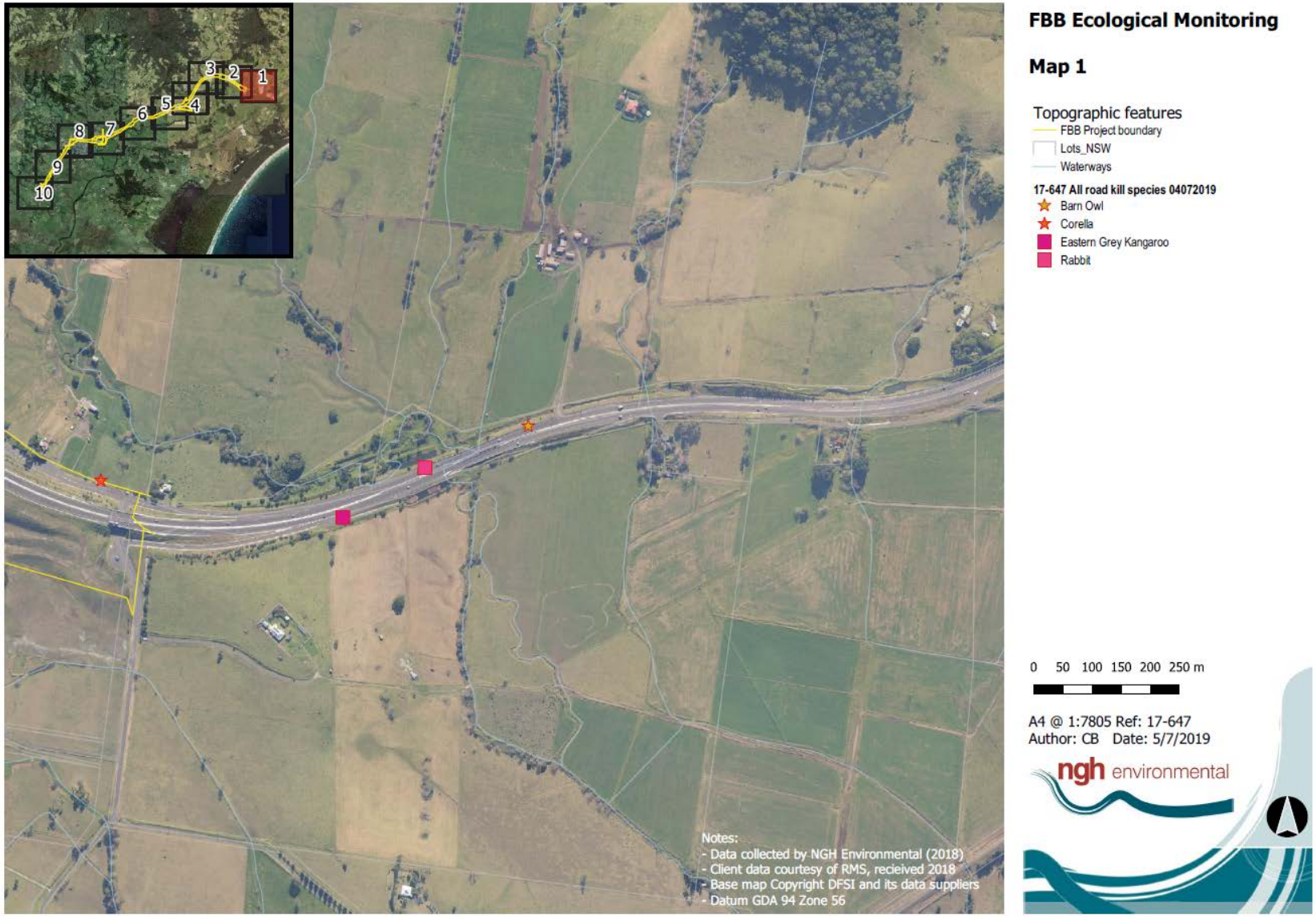

Figure 2-1 Biodiversity Monitoring Locations and Roadkill Results Map 1

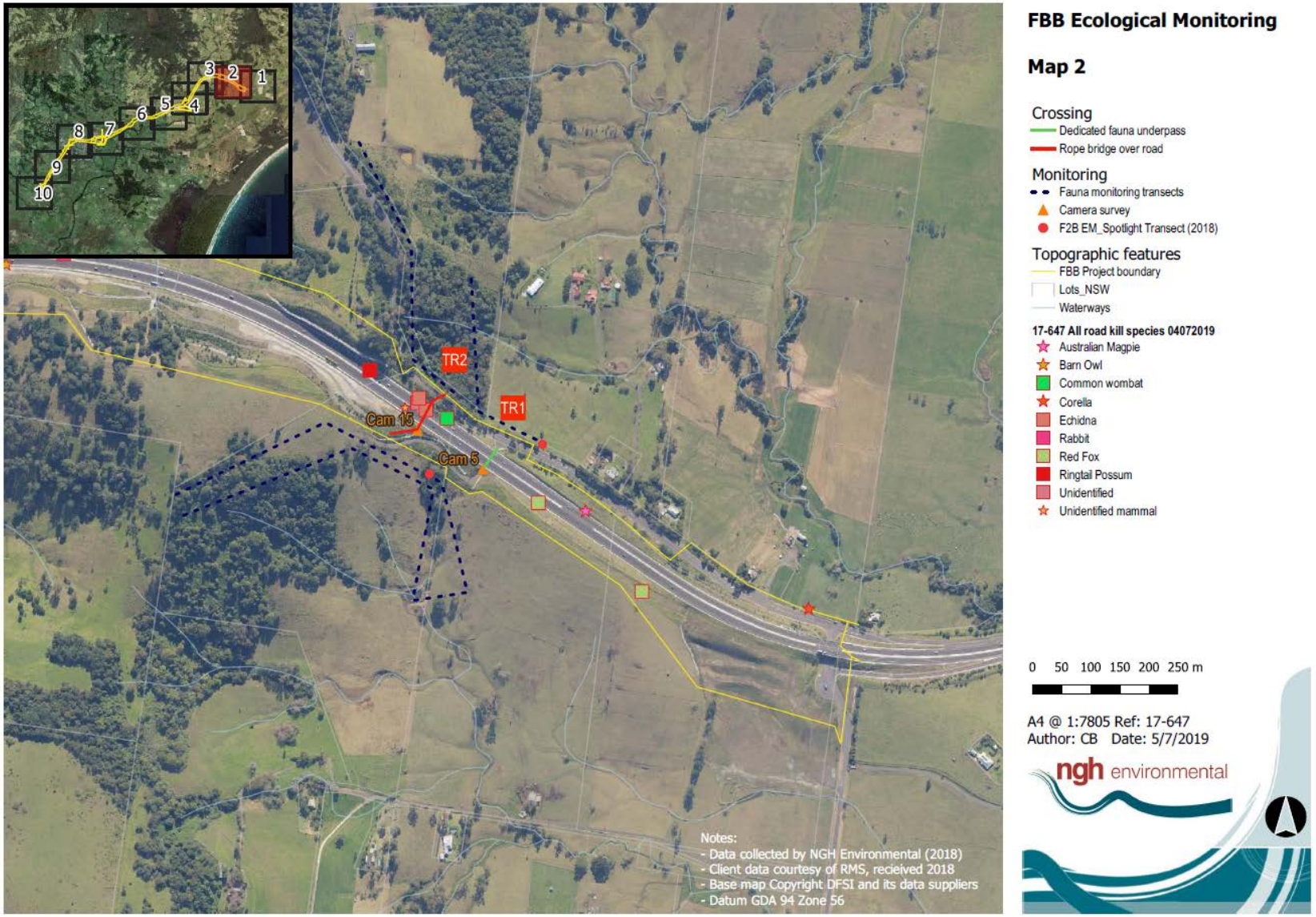

Figure 2-2 Biodiversity Monitoring Locations and Roadkill Results Map 2

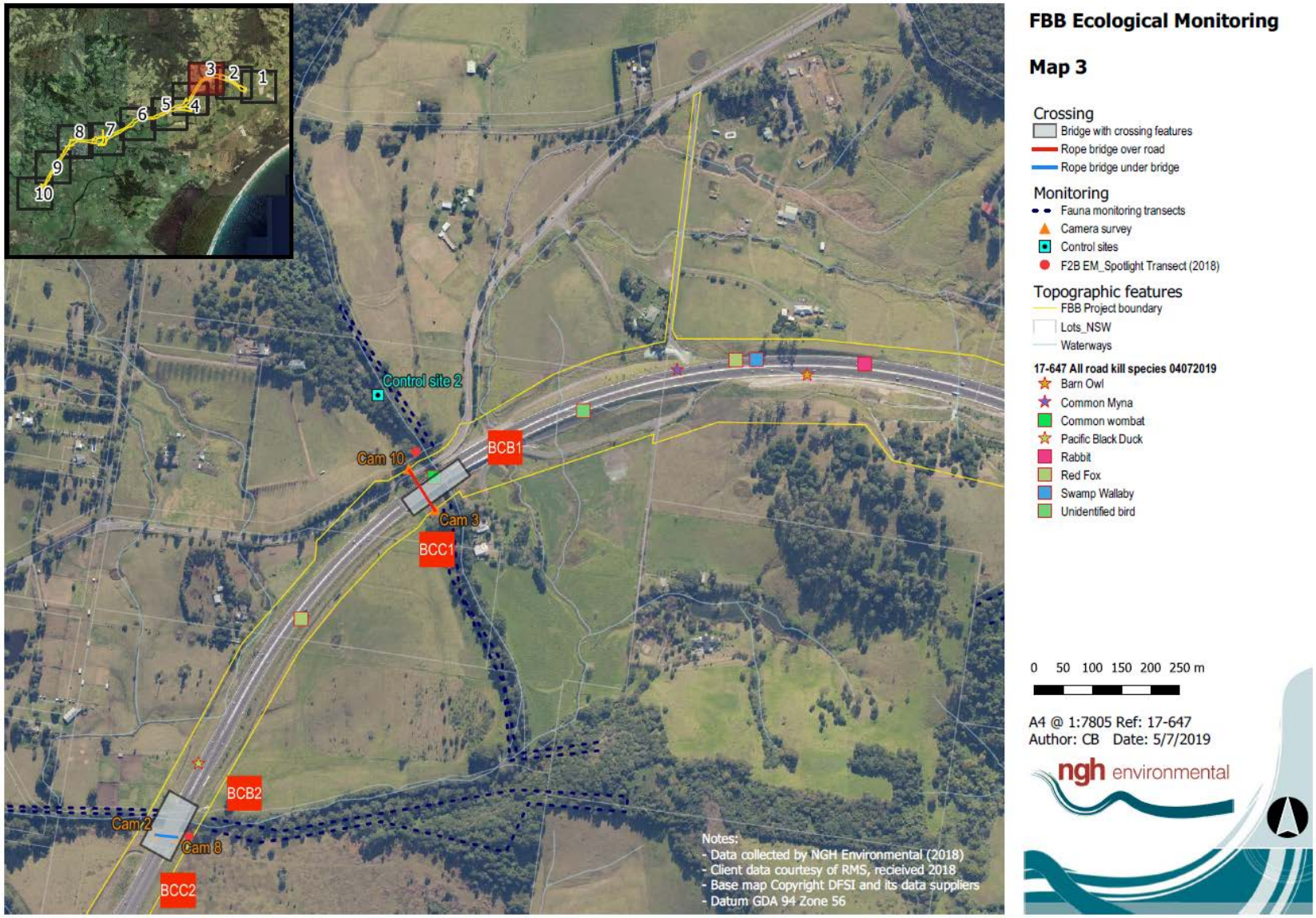

Figure 2-3 Biodiversity Monitoring Locations and Roadkill Results Map 3

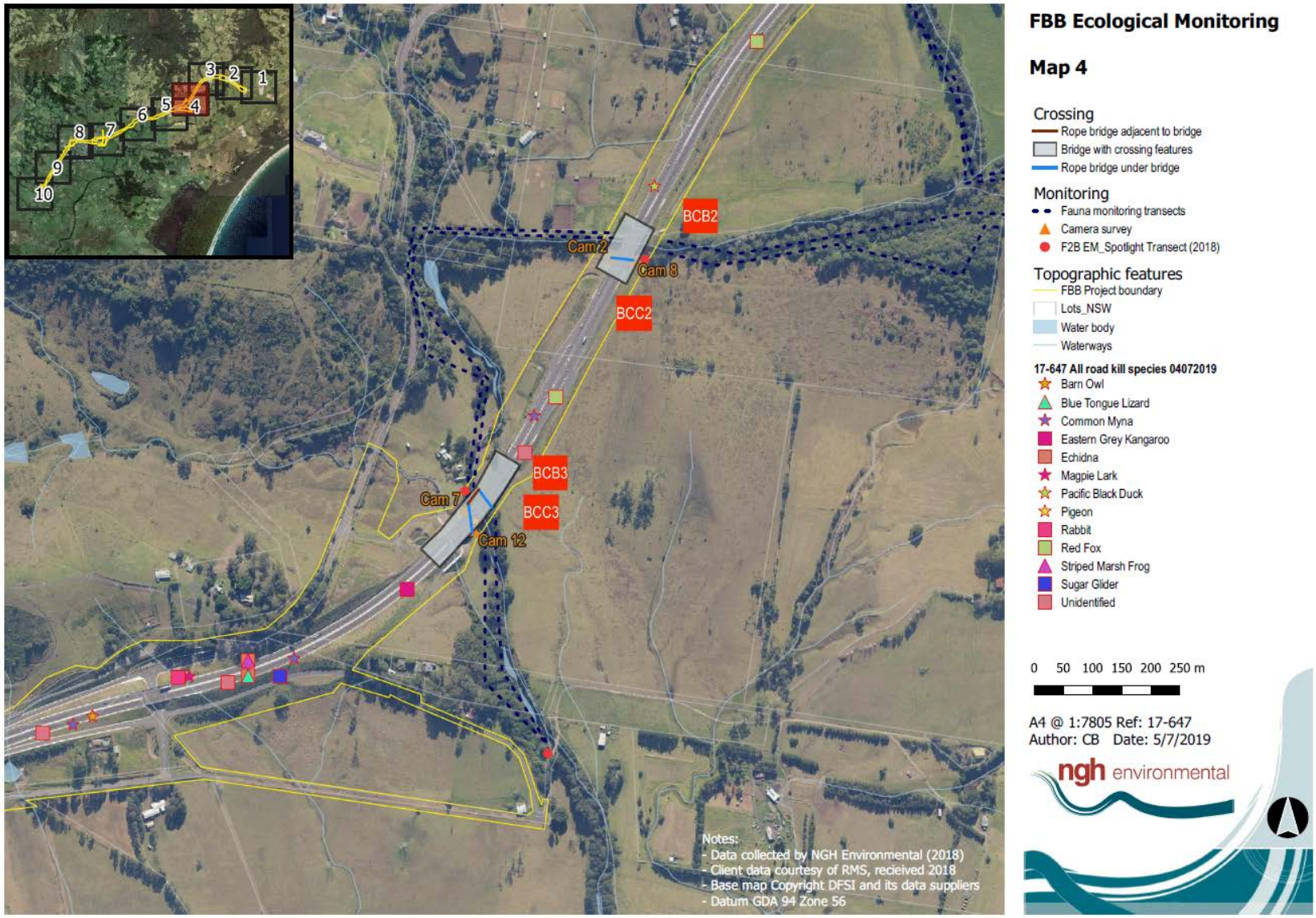

Figure 2-4 Biodiversity Monitoring Locations and Roadkill Results Map 4

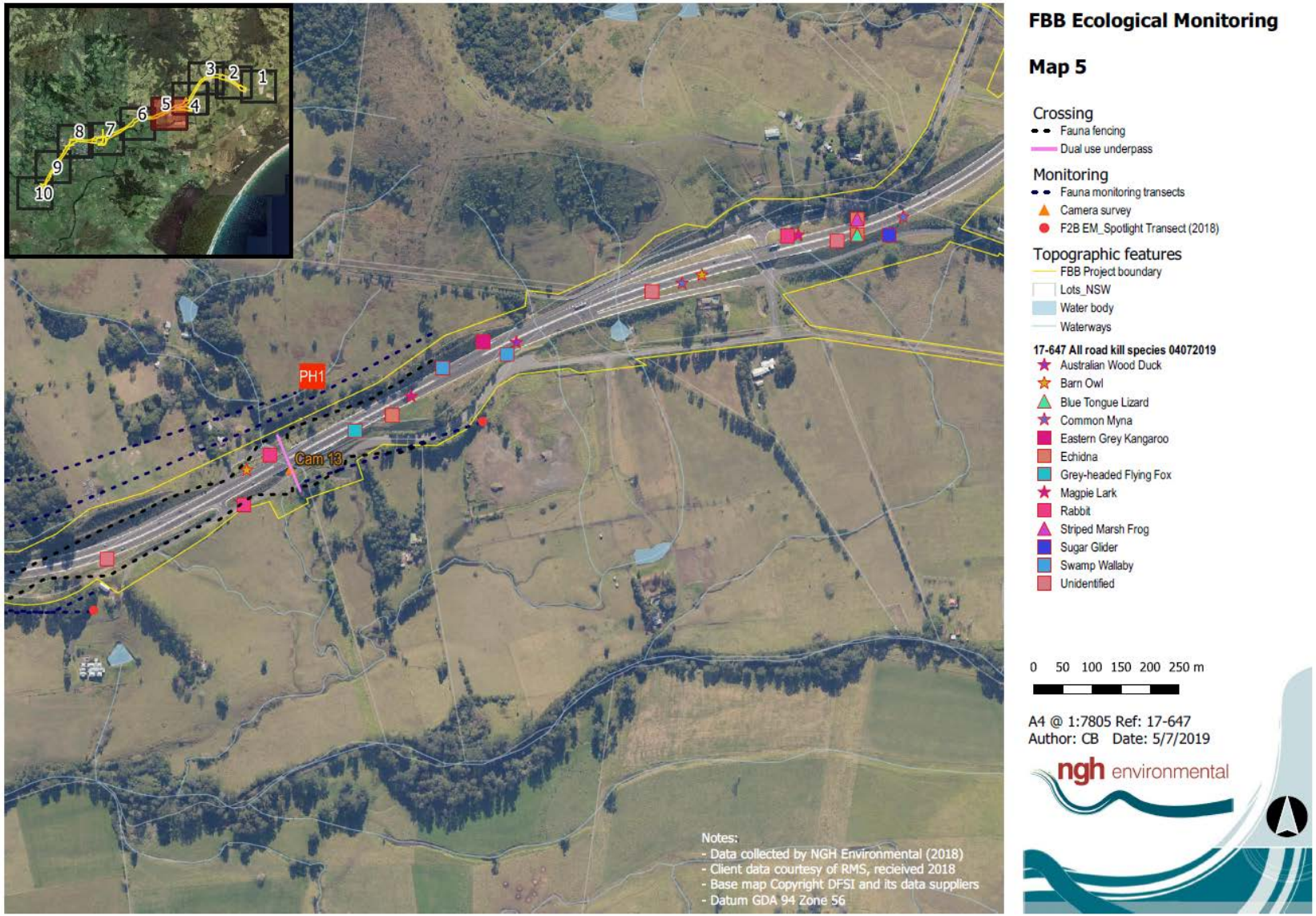

Figure 2-5 Biodiversity Monitoring Locations and Roadkill Results Map 5

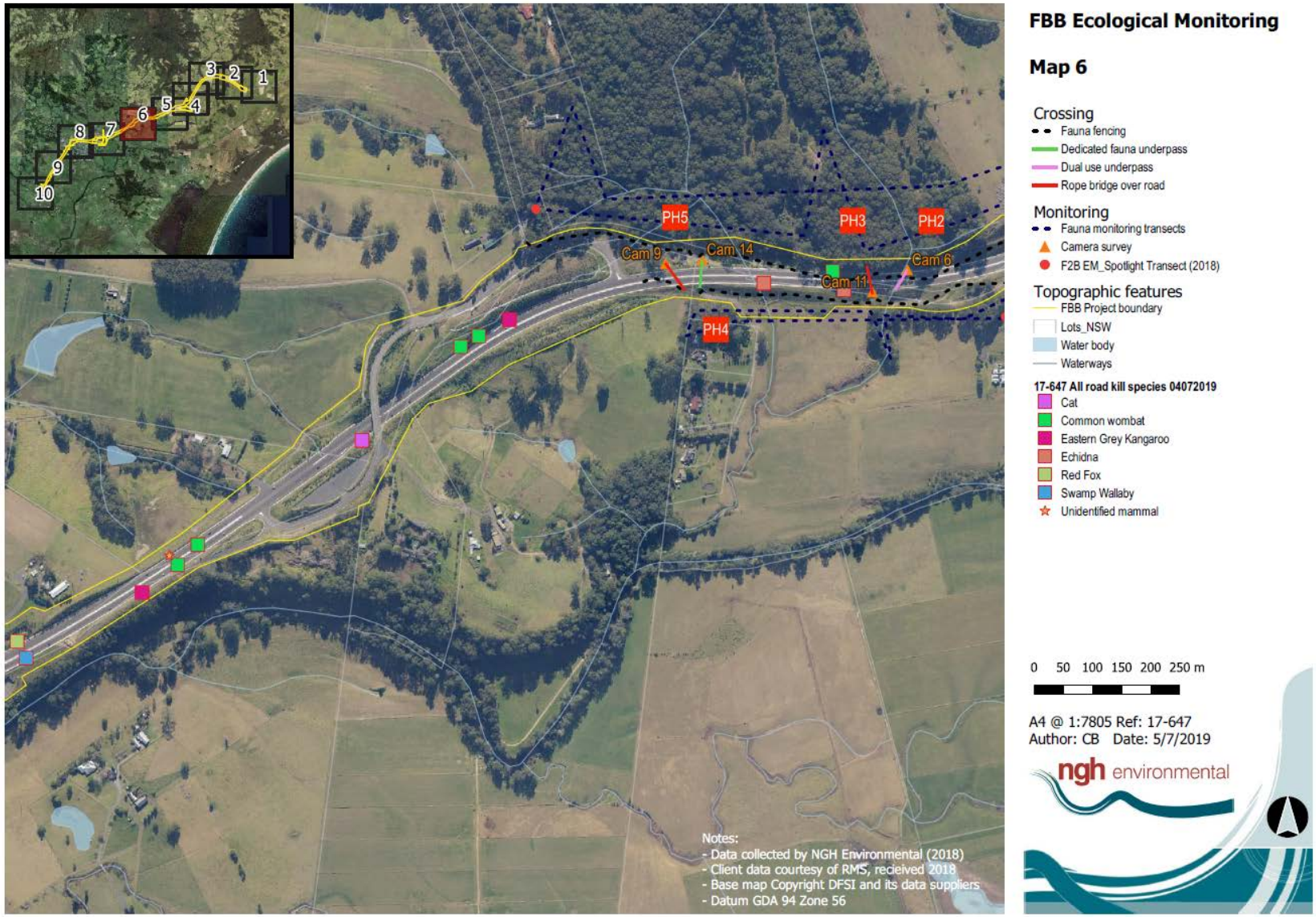

Figure 2-6 Biodiversity Monitoring Locations and Roadkill Results Map 6

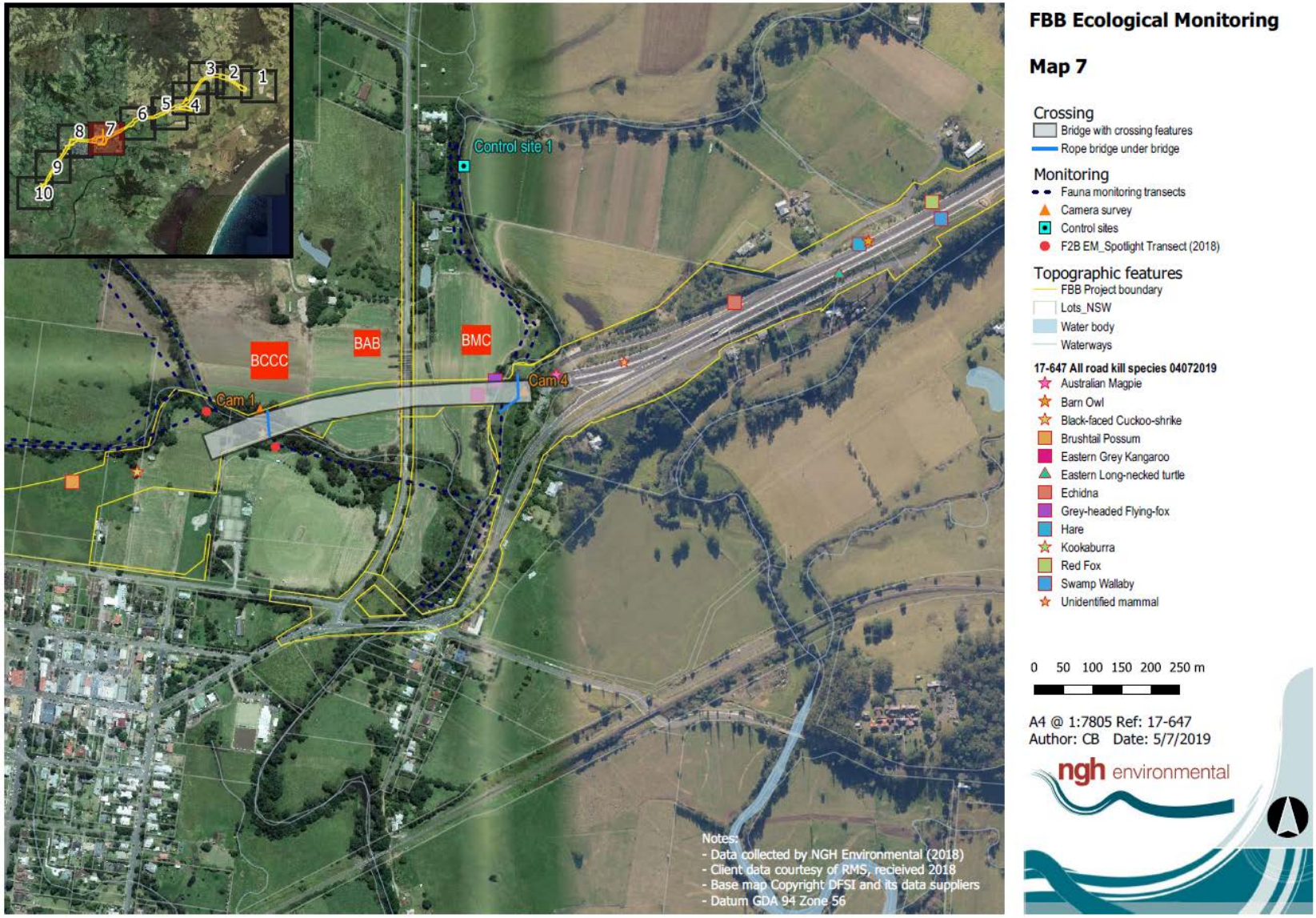

Figure 2-7 Biodiversity Monitoring Locations and Roadkill Results Map 7

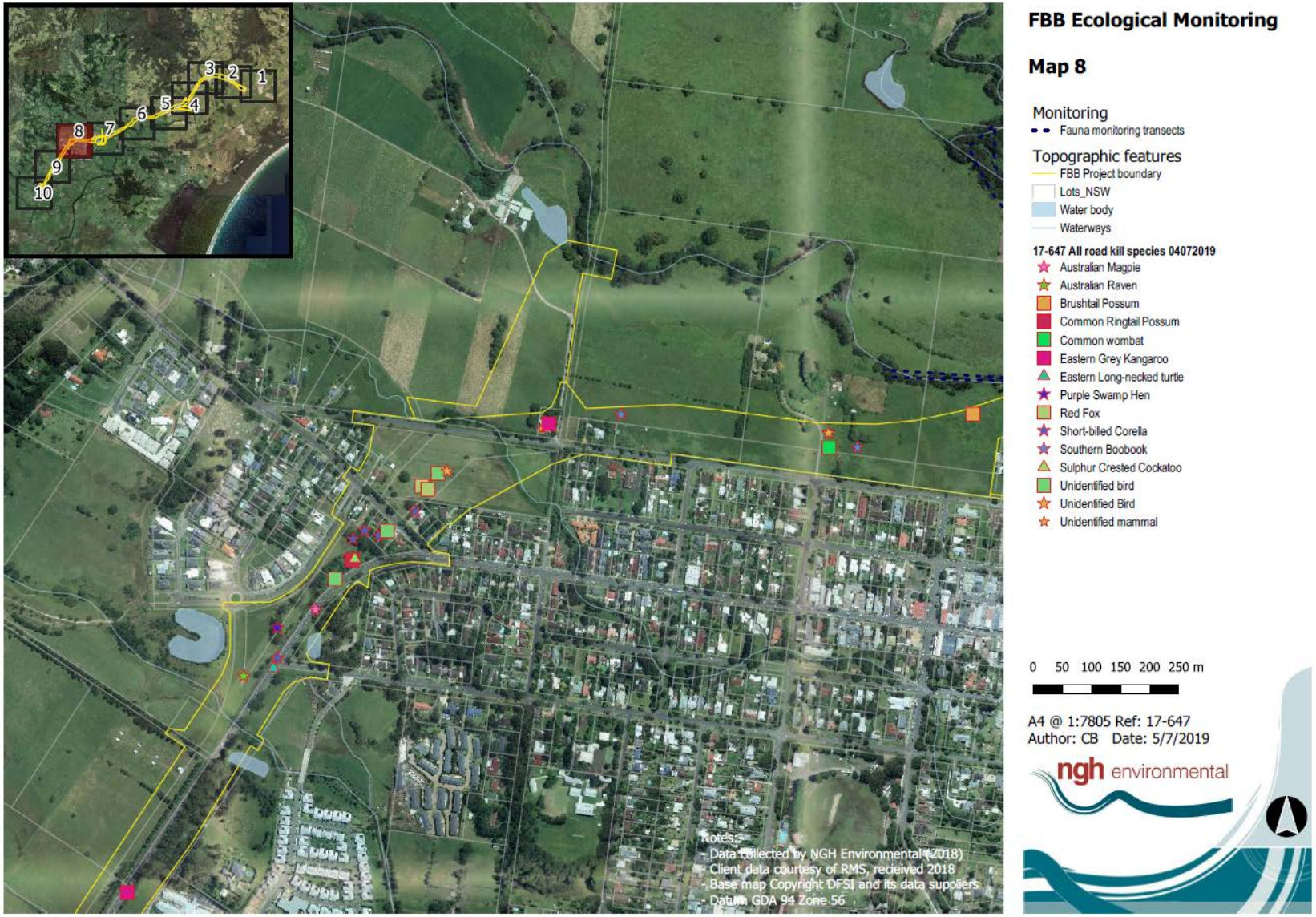

Figure 2-8 Biodiversity Monitoring Locations and Roadkill Results Map 8

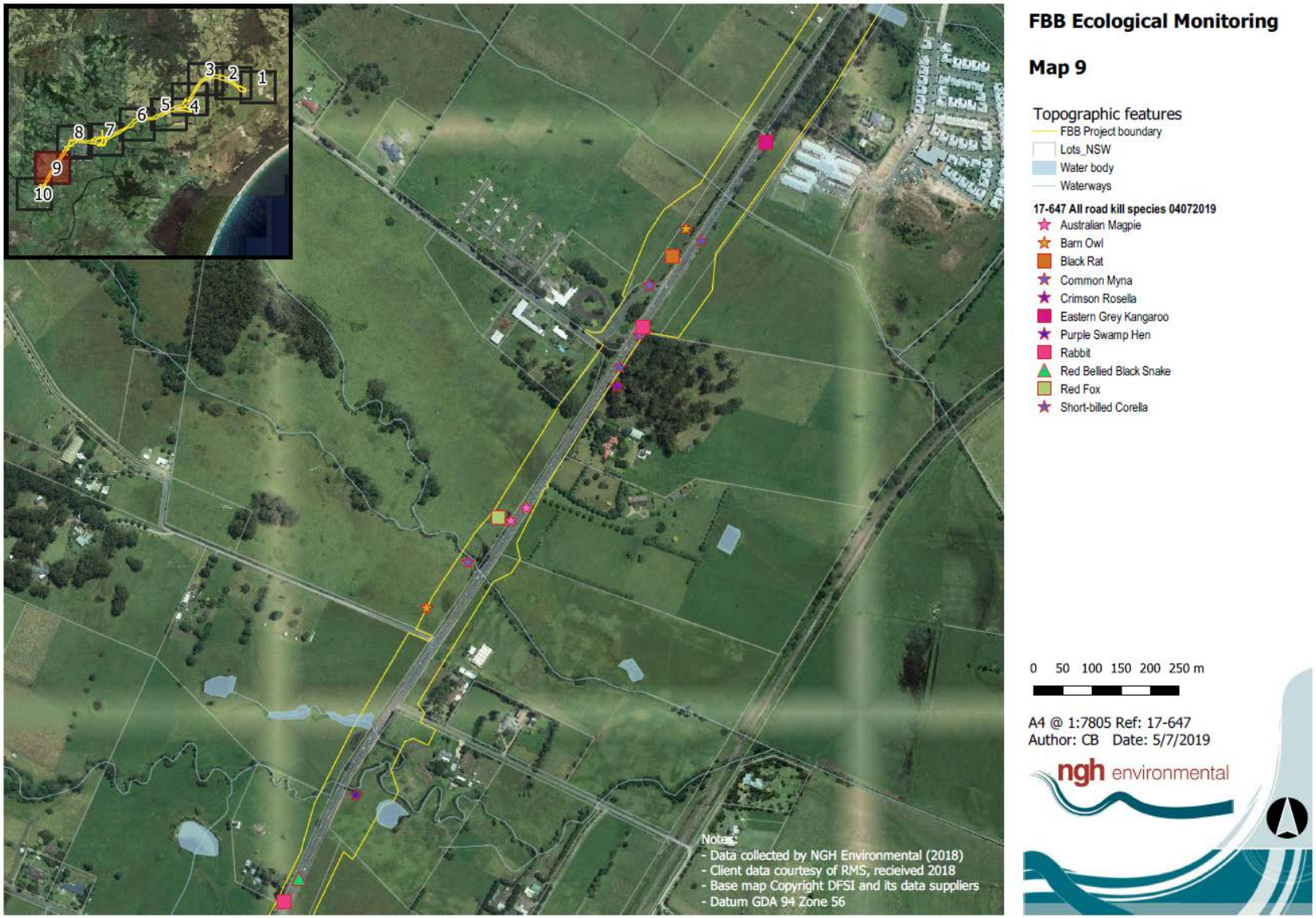

Figure 2-9 Biodiversity Monitoring Locations and Roadkill Results Map 9

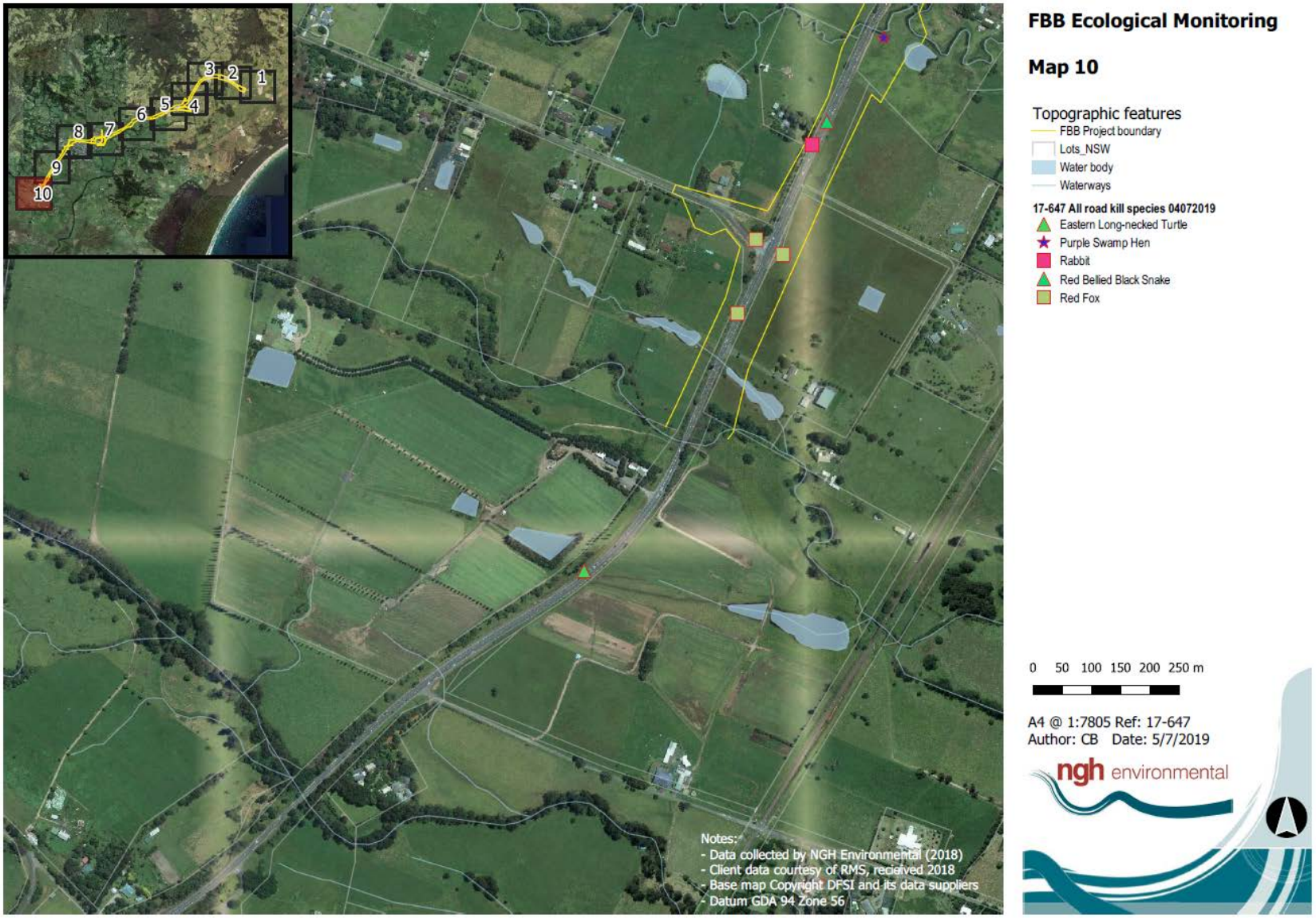

Figure 2-10 Biodiversity Monitoring Locations and Roadkill Results Map 10

2.5 TRANSECT SURVEYS

Transect surveys are all surveys carried out in February 2018 including spotlighting, herpetological surveys, tracks, scats and signs searches, and call playback. Opportunistic observations were also recorded.

The dates, weather conditions and survey effort for each transect survey session in 2018 is outlined in Table 2-4. The locations of each transect is presented in Figures 2-1 to 2-10.

Table 2-4 Transect survey dates, conditions (Berry Masonic Village Weather - 068003), and survey effort

Date	Temp max (°C)	Rainfall (mm)	Survey Type	Person hours	Notes
13/02/2018	26.3	5.2	Spotlight	360 min	Transects 13, 14
14/02/2018	37.6	0.1	Herpetological & Tracks, scats and signs	240 min	Transects 8, 10, 11
			Spotlight	360 min	Transects 8, 10, 11
			Call Playback	40 mins	Green and Golden Bell Frog
15/02/2018	25.8	0	Herpetological & Tracks, scats and signs	180 min	Transect 9
			Spotlight	240 min	Transect 9
			Call Playback	80 min	Transect 9 - all species
16/02/2018	24.6	0	Herpetological & Tracks, scats and signs	240 min	Transects 13, 14
19/02/2018	24.7	0	Herpetological & Tracks, scats and signs	180 min	Transects 1, 2
			Spotlight	240 min	Transects 1, 2
			Call Playback	120 min	Transects 1, 2 - Squirrel Glider
20/02/2018	21.5	23.2	Herpetological & Tracks, scats and signs	240 min	Transects 7, 4
			Spotlight	360 min	Transect 7, 4
			Call playback	40 min	Transect 4
21/02/2018	24.8	0.2	Herpetological & Tracks, scats and signs	240 min	Transects 5, 6
			Spotlight	360 mins	Transects 5, 6
			Call Playback	60 min	Transect 6 - Little Bittern Transect 4 - Black Bittern, Bush Stone-curlew
22/02/2018	25.5	0	Herpetological & Tracks, scats and signs	240 min	Transect 3
			Spotlight	360 min	Transect 3
			Call Playback	60 min	Transect 3 - Squirrel Glider, Yellow-bellied Glider

Date	Temp max (°C)	Rainfall (mm)	Survey Type	Person hours	Notes
23/02/2018	25.7	0	Call Playback	240 min	Transects 7, 9 - Squirrel Glider, Koala, Yellow-bellied Glider Transect 3 - Barking Owl, Masked Owl Transect 14 - Black Bittern, Barking Owl

2.5.1 Spotlighting

Spotlighting was completed after dusk along each transect (Table 2-4, Figure 2-1 to 2-10) at a slow walking pace using Led Lenser H14R.2 headtorches. The fauna observed, which included arboreal, flying and ground-dwelling mammals as well as nocturnal amphibians, reptiles and birds were identified by their distinctive calls or by sight and recorded. Spotlighting was concentrated in areas which contained suitable habitat features for nocturnal species including trees, shrubbery, rock outcrops, water bodies/wet areas and the ground surface.

2.5.2 Herpetological surveys

Active diurnal searches for frogs and reptiles were conducted along each transect (Figure 2-1 to Figure 2-10). The survey involved searches for:

- active or basking reptiles in sunlit areas
- sheltering frogs and reptiles: underneath logs and/or rocks, under decorticating bark on trees, or amongst leaf litter.

Specimens were identified visually, by call recognition (frogs only), or collected by hand for identification.

Frogs and reptiles were also surveyed for during spotlighting and call playback events and opportunistically across the study area.

2.5.3 Tracks, Scats, and Signs search

Diurnal searches were conducted for signs of animal activity along each transect (Figure 2-1 to Figure 2-10) and included searches of:

- tree trunks for scratches (e.g. Koala) and feeding wounds (e.g. Yellow-bellied Glider)
- the base of trees for scats of arboreal mammals
- the ground layer for scats of kangaroos, wallabies, Common Wombats, and exotic mammals
- the soil surface for characteristic diggings of terrestrial mammals (e.g. Short-beaked Echidna, Long-nosed Potoroo)
- sandy and muddy areas for animal tracks

2.5.4 Opportunistic

Opportunistic sightings were recorded while conducting herpetological surveys and tracks, scats and signs. This included, but was not limited to, birds of prey flying overhead, frog calls, fox sightings, etc.

2.5.5 Call playback

Call playback surveys were conducted in accordance with Table 3.3 of the EcMP. Species selected for call playback included, but was not limited to, those target species identified in the EcMP, and were tailored for the habitat of the transect and the likelihood of presence. The list included; Bush-stone Curlew, Squirrel glider, Yellow Bellied Glider, Barking Owl, Masked Owl, Sooty Owl, Powerful Owl, and Koala. Species' calls were played in order from smaller/least territorial to larger/most territorial. This was essential especially for owls, for if a Powerful Owl call was played first, this may scare off gliders and smaller owls impacting our results.

All call playback surveys occurred after dusk at a location along each transect for a minimum of 10 minutes as per the EcMP. An initial listening period of 5-10 minutes was allowed, followed by a spotlight search of the area for 10 minutes to detect any animals in the area that had not vocalised their presence. Calls for target species were then broadcasted via megaphone. The calls of the targeted species were played intermittently for 5 minutes followed by a 10-minute listening period. After the calls were played, another 10 minutes of spotlighting was completed in the vicinity to check for animals attracted by the call playback but might not be vocalising.

2.5.6 Limitations

The weather during fieldwork may have impacted fauna survey results. The rain experienced during the week of survey may have caused terrestrial and arboreal mammals to shelter in the night. In contrast, the weather would have provided enhanced activity in frog species. Weather conditions during the survey period are detailed in Table 2-4.

Transect 12 was deemed inaccessible as the surveyors did not have permitted access by the land owner. Therefore, diurnal surveys, as well as spotlight and call play back surveys, were not conducted at this location.

Species lists collected for Transects 1 and 2, and Transects 5 and 6 were combined due to the surveys being undertaken contiguously (i.e. one transect followed on from another), thus the data from these transects has been combined. Additionally, the transects surveyed during the 2018 monitoring period aligned with those detailed within the EcMP (PB, 2014), however it is understood that the exact locations of transects are not identical to those identified within the FBB Baseline Ecological Monitoring Report (PB, 2015). Future surveys will seek to replicate the updated transects (as per PB, 2015) to allow for more direct comparison of data.

3 RESULTS

3.1 ROADKILL MONITORING

After 52 weeks of monitoring between 20th February 2018 to 25th February 2019 a total of 114 individuals were recorded as roadkill on the project alignment. A summary of the data and the raw dataset is presented in Appendix D. The data presented in Appendix D includes that collected by Fulton Hogan from commencement of the operational monitoring period on the 1st of November,2017.

Of the 114 individuals, 17 could not be identified to species level due to the level of decay and/or position on the alignment but were categorised as either unidentified mammals or unidentified birds (See Appendix D.2). There were nine unidentified mammals and eight unidentified birds. There were nine weeks where no roadkill occurred/was recorded. The roadkill data found an almost even split between northbound and southbound recordings, with 58 individuals (51 per cent) and 56 individuals (49 per cent) recorded respectively.

The species and the number of individuals are presented above in Figures 2-1 to 2-10. The Red Fox, *Vulpes vulpes,* was the most frequently recorded species with 13 individuals, followed by the Short-beaked Echidna, *Tachyglossus aculeatus,* with nine individuals.

One threatened species, the Grey-headed Flying-fox, was observed during roadkill monitoring. The species was recorded twice, once in proximity to crossing feature PH1, and once in proximity to a known camp of the species, south of fauna crossing feature BMC. This species is listed as Vulnerable under both the BC Act and EPBC Act. The locations of these records are shown on Figure 2-5 and 2-7 above.

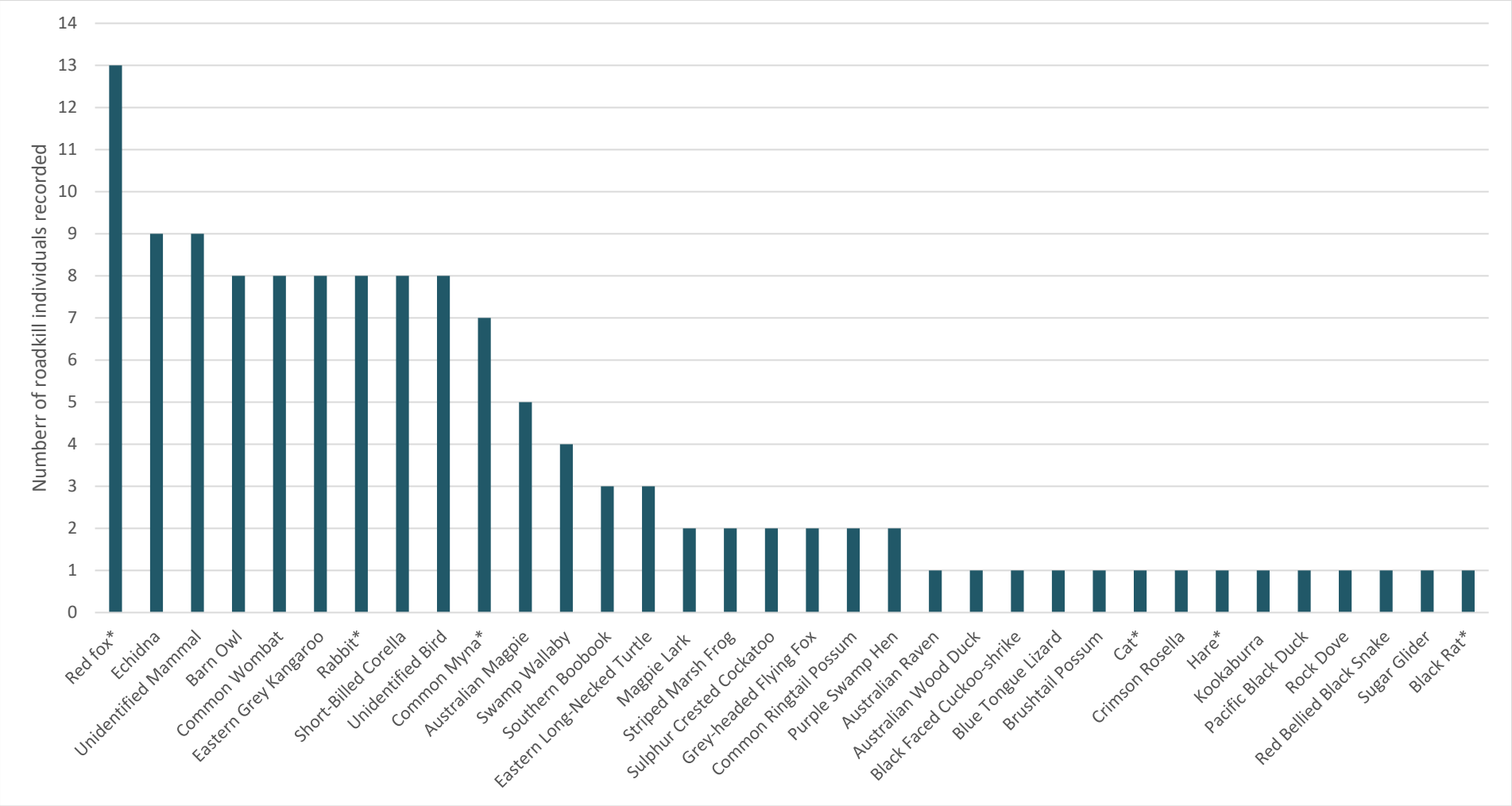

Figure 3-1 Number of roadkill individuals recorded for each species

3.1.1 Kernel density analysis (Heatmap)

Heatmaps of the roadkill data were generated to emphasise the problematic hotspots in the alignment. Species were given a quantitative weight (1- Introduced species, 1.5- unidentified, 2- Native species, 3- threatened species). Species were further split between flying species and terrestrial species. This enabled two separate heatmaps to be created to assess the problematic areas for each species type. The heat maps for terrestrial species and flying species can be seen below in Figure 3-2 to Figure 3-11 and Figure 3-12 to 3-21 respectively.

The terrestrial species heatmap (Figure 3-2 to 3-11) shows three main hotspots/areas of concern. The northernmost hotspot is found between the rock cut embankments to the north of the project, and is shown on Figure 3-3, Map 2. It is situated in proximity to the TR1 and TR2 crossing structures. The habitat is predominantly landscape maintenance/ grassland with wet sclerophyll forests downslope near Donovan Road and an open woodland upslope. It is considered likely that fauna become trapped within the rock cuttings.

Another series of hotspots exists between BCC3 (shown on Figure 3-5, Map 4) and BMC (shown on Figure 3-8, Map 7). The vegetation surrounding these hotspots is typically forest patches or vegetation corridors. These hotspots are also associated with sections of cut embankment. Fauna fencing exists for a portion of this area, however roadkill of terrestrial fauna still occur. It is considered likely that species become trapped on the road side of the fauna fence and cannot re-enter the fenced area. This area included the location of the one threatened species recorded during the surveys, an individual Grey-headed Flying-fox, in proximity to crossing feature PH1 (shown on Figure 2-5, Map 5 above).

Another instance of an impacted Grey-headed Flying-fox occurred immediately north of a known colony of the species, in proximity to fauna crossing feature BMC. This record is shown on Figure 2-7, Map 7 above, and corresponds to the hotspot in Figure 3-18, map 7 below.

The southernmost hotsposts are primarily comprised of grassland on one side of the bypass and small patches of open woodland on the other side, and tended to have a higher incidence of non-native fauna.

Flying species hotspots occur along the project alignment, and are shown in Figures 3-12 to 3-21. The major hotspot for flying species is approximately 50 m North of the Queen Street, Kangaroo Valley Road Bridge near the Berry Township. It is important to note that the majority of species detected in this area were Short-billed Corellas which assemble in groups. It is therefore very likely that multiple birds could have been hit in one event which confounds the results slightly. However, the bridge is still a concern for flying species due to the number of individuals killed in the area. It is suggested that trucks/cars may not be able to see birds flocking on the other side of the bridge or the Corellas fly more unpredictably when the bridge is seen.

Hotspots in other areas of the alignment show no distinct association with adjacent habitat types.

3.1.2 Threatened species

One threatened species was identified during roadkill surveys, the Grey-headed Flying-fox which is listed as Vulnerable under both the BC Act and EPBC Act. At the time of the survey there was a known Grey-headed Flying-fox camp at Broughton Mill Creek directly adjacent to the highway, however the record of the species was not recorded in this location, and was recorded in proximity to crossing feature PH1, shown on Figure 2-5 above.

The roadkill surveys found eight (8) Barn Owls which were deemed not to be the threatened Masked Owls, from identification features observed in photographs taken. Additionally, a large Sugar Glider detected during the roadkill survey was deemed not to be a threatened Squirrel Glider based on identification characteristics observed in photographs taken on site.

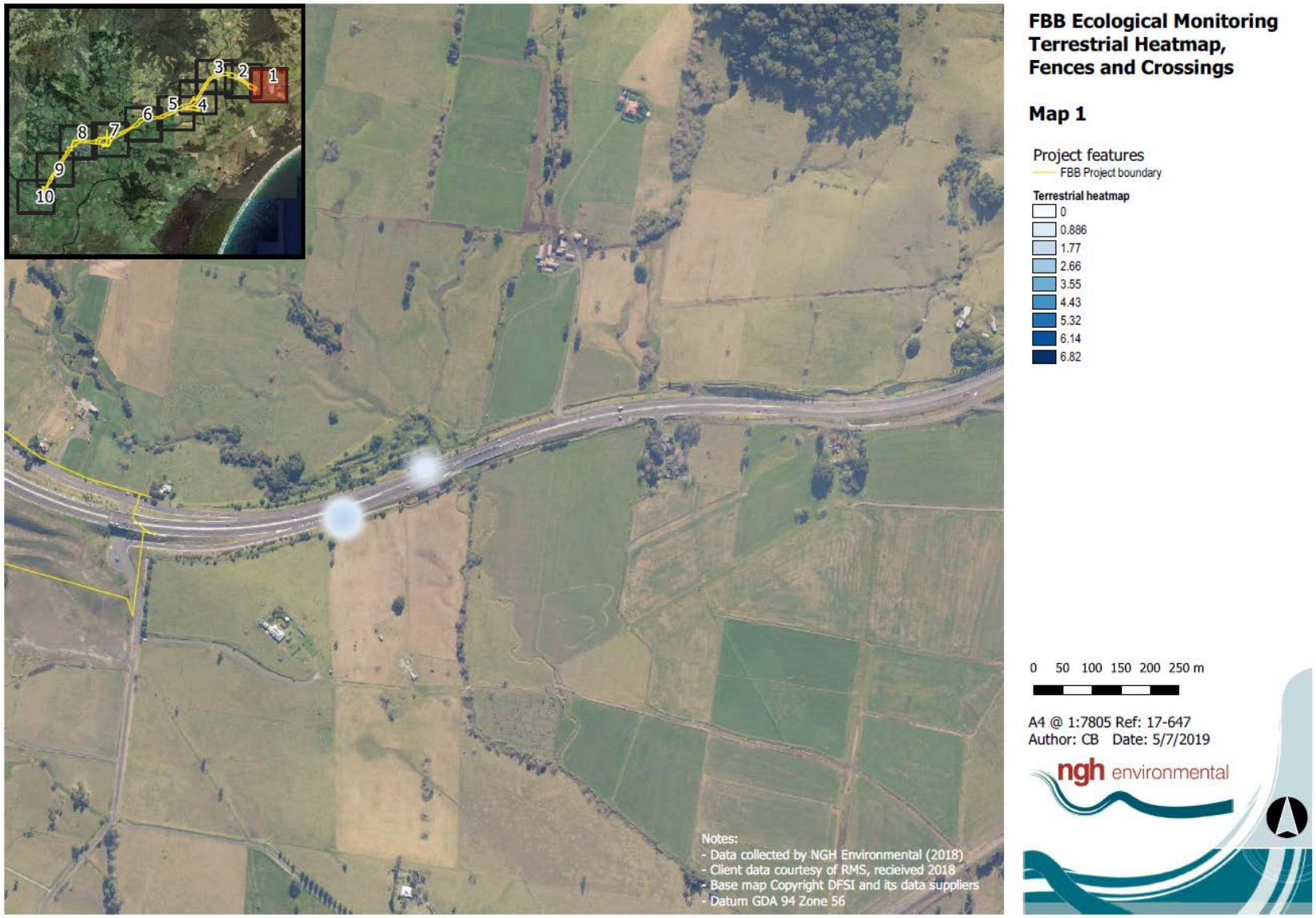

Figure 3-2 Terrestrial Heatmap – Map 1

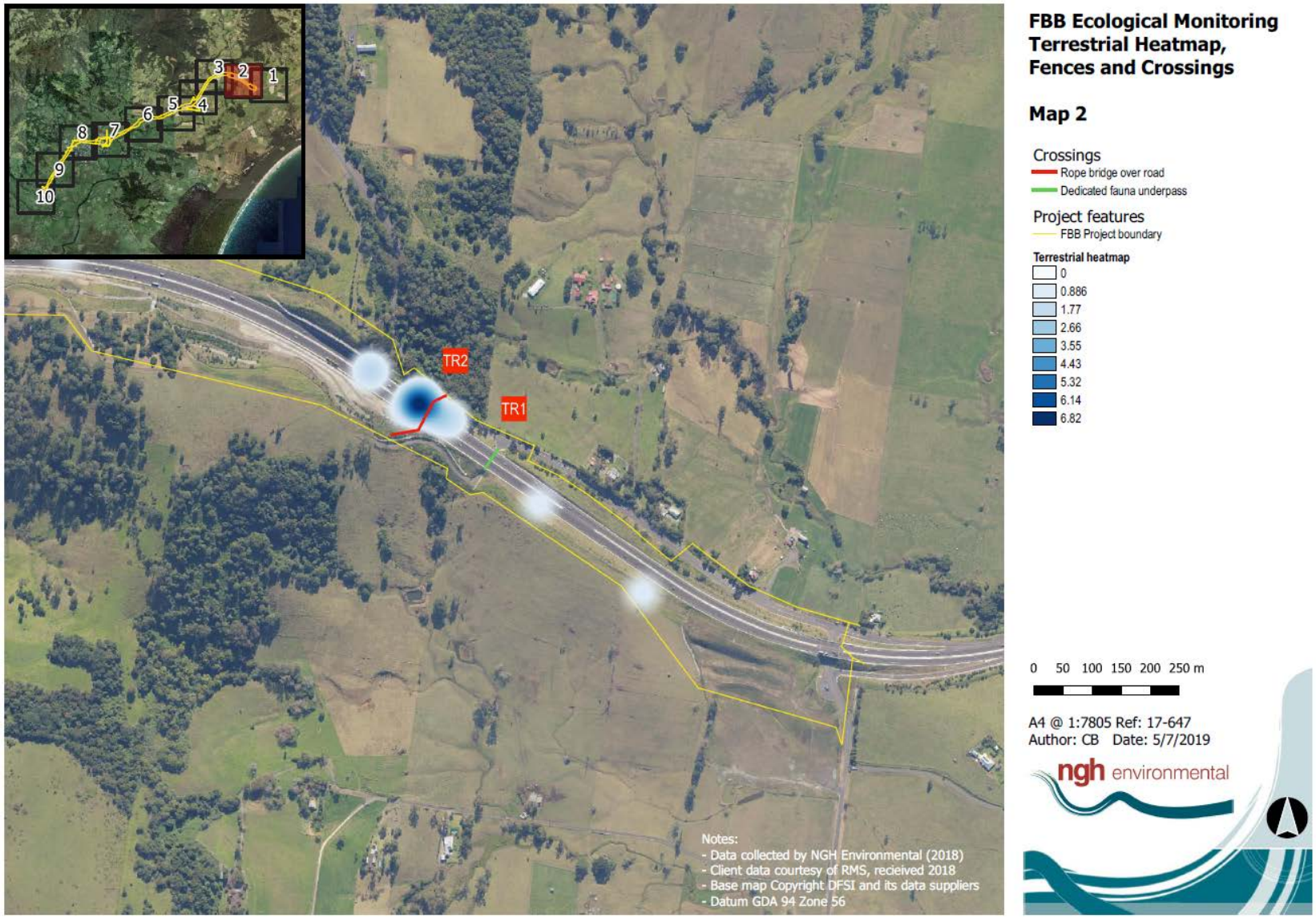

Figure 3-3 Terrestrial Heatmap – Map 2

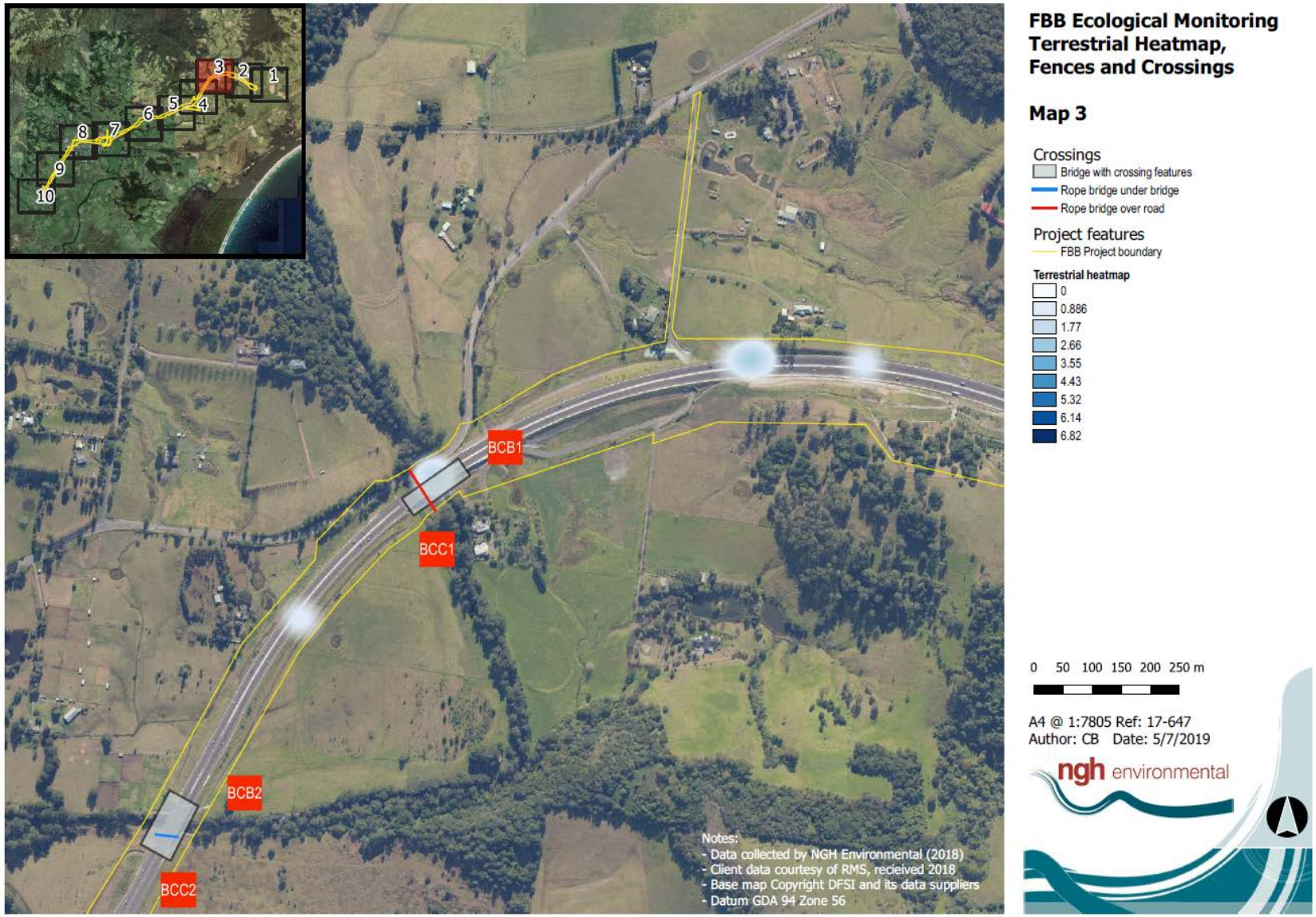

Figure 3-4 Terrestrial Heatmap – Map 3

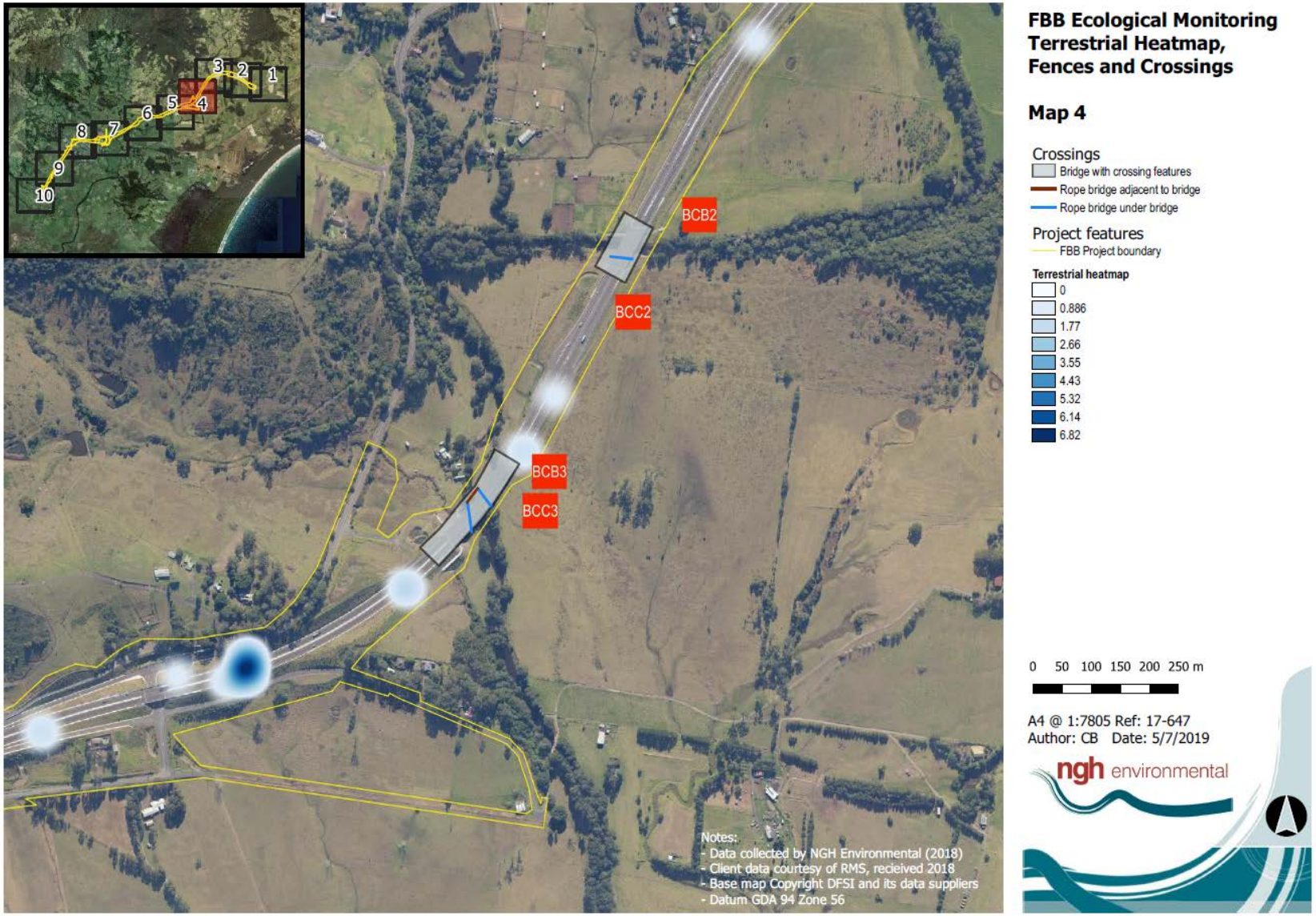

Figure 3-5 Terrestrial Heatmap – Map 4

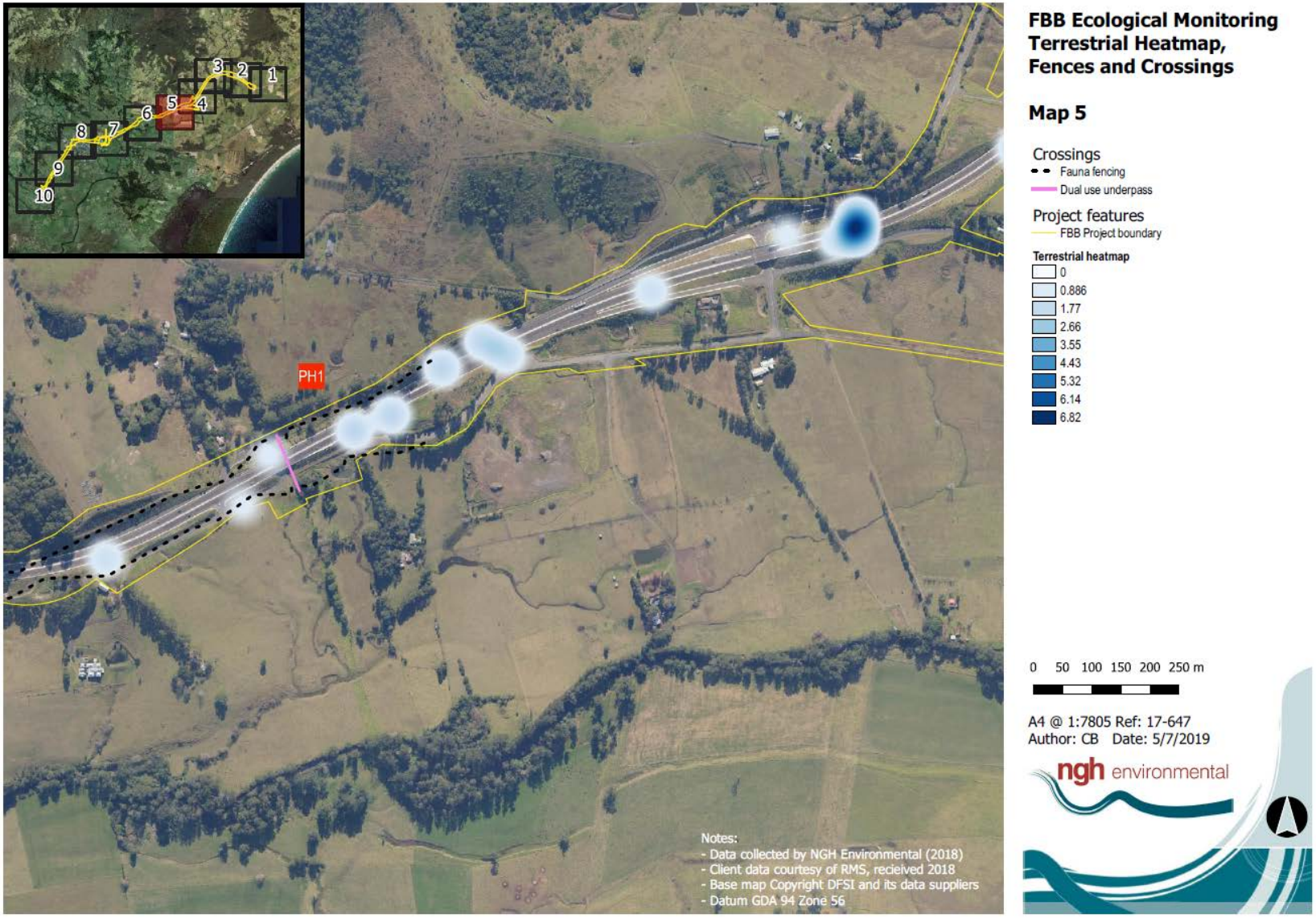

Figure 3-6 Terrestrial Heatmap – Map 5

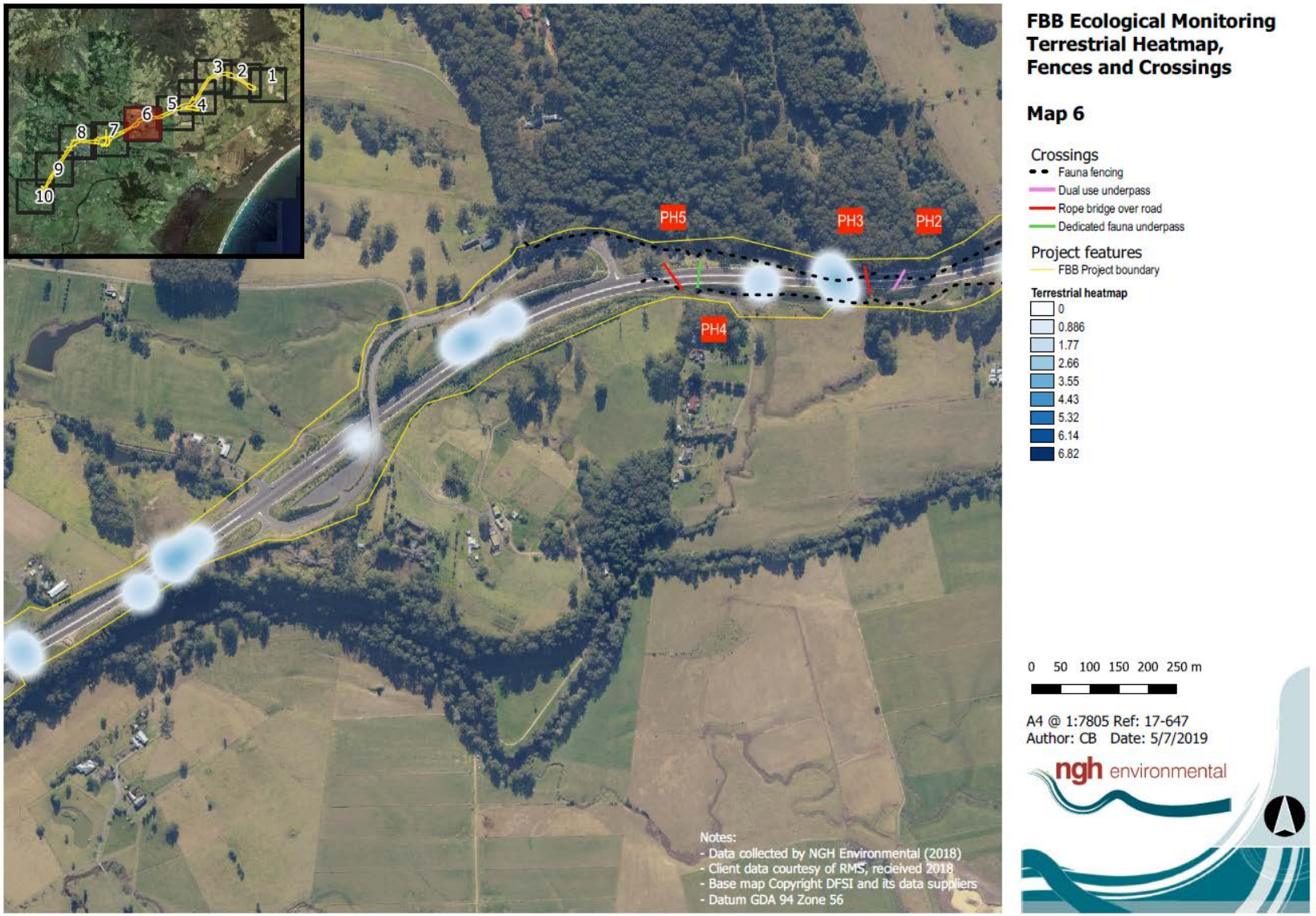

Figure 3-7 Terrestrial Heatmap – Map 6

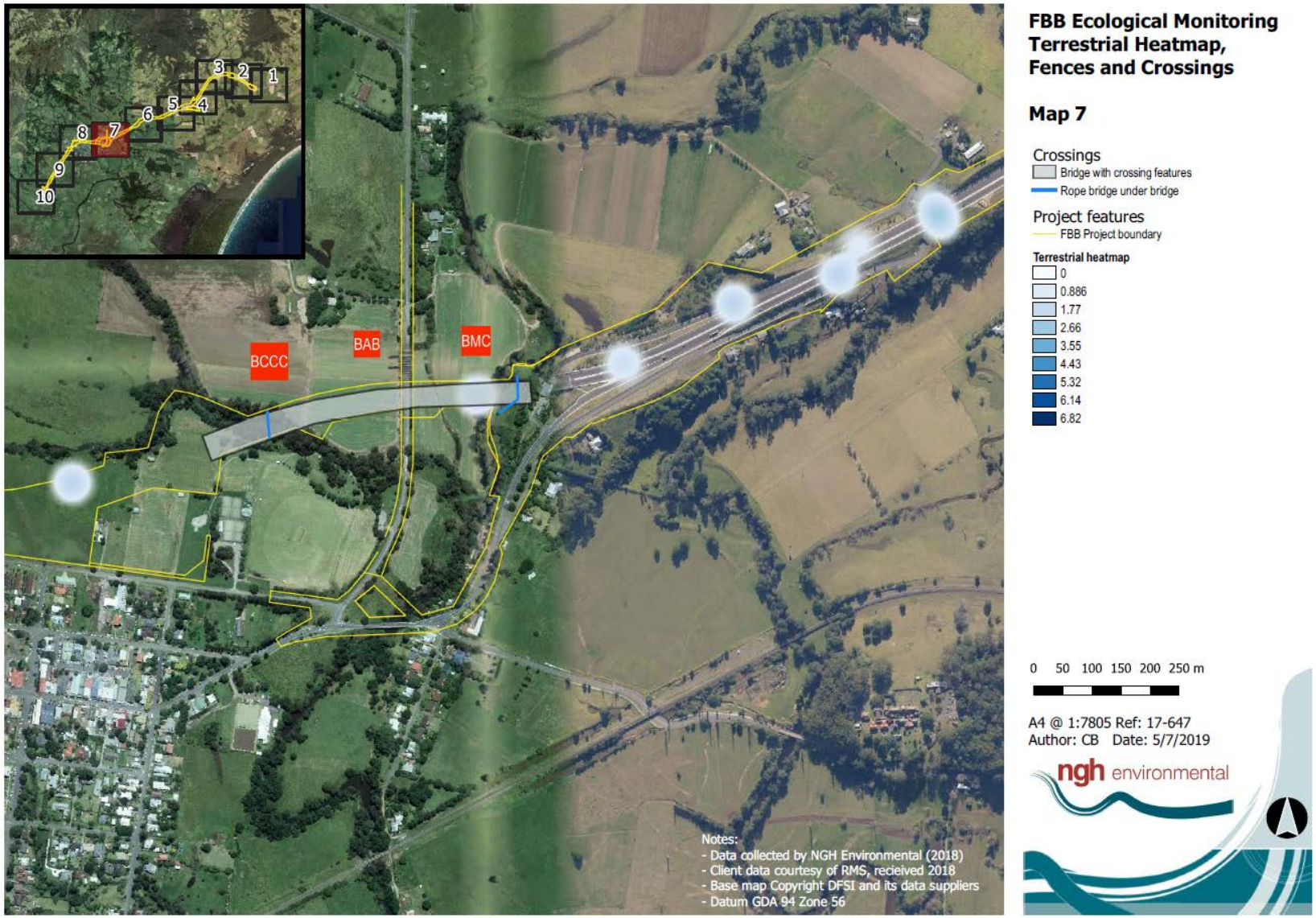

Figure 3-8 Terrestrial Heatmap – Map 7

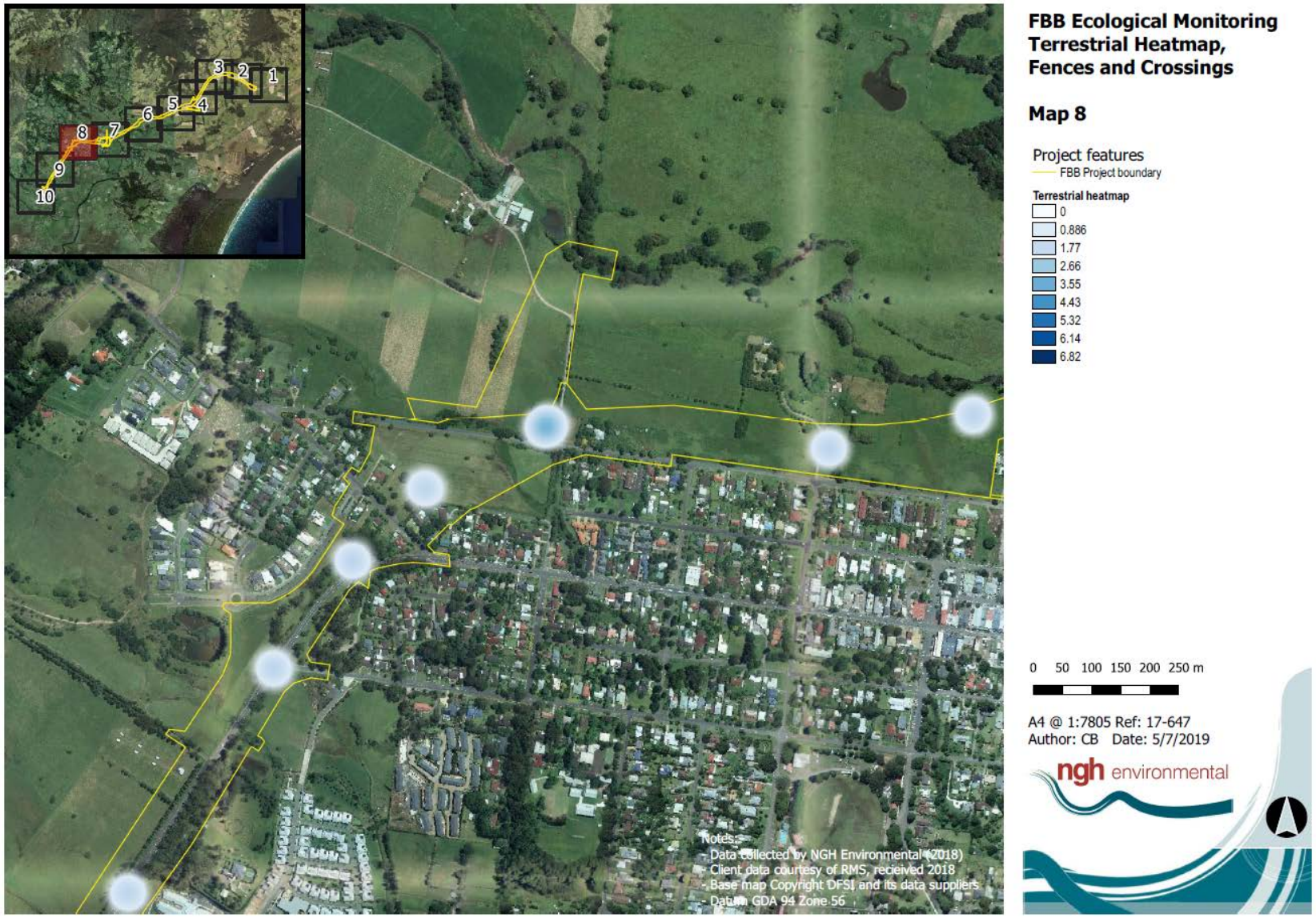

Figure 3-9 Terrestrial Heatmap – Map 8

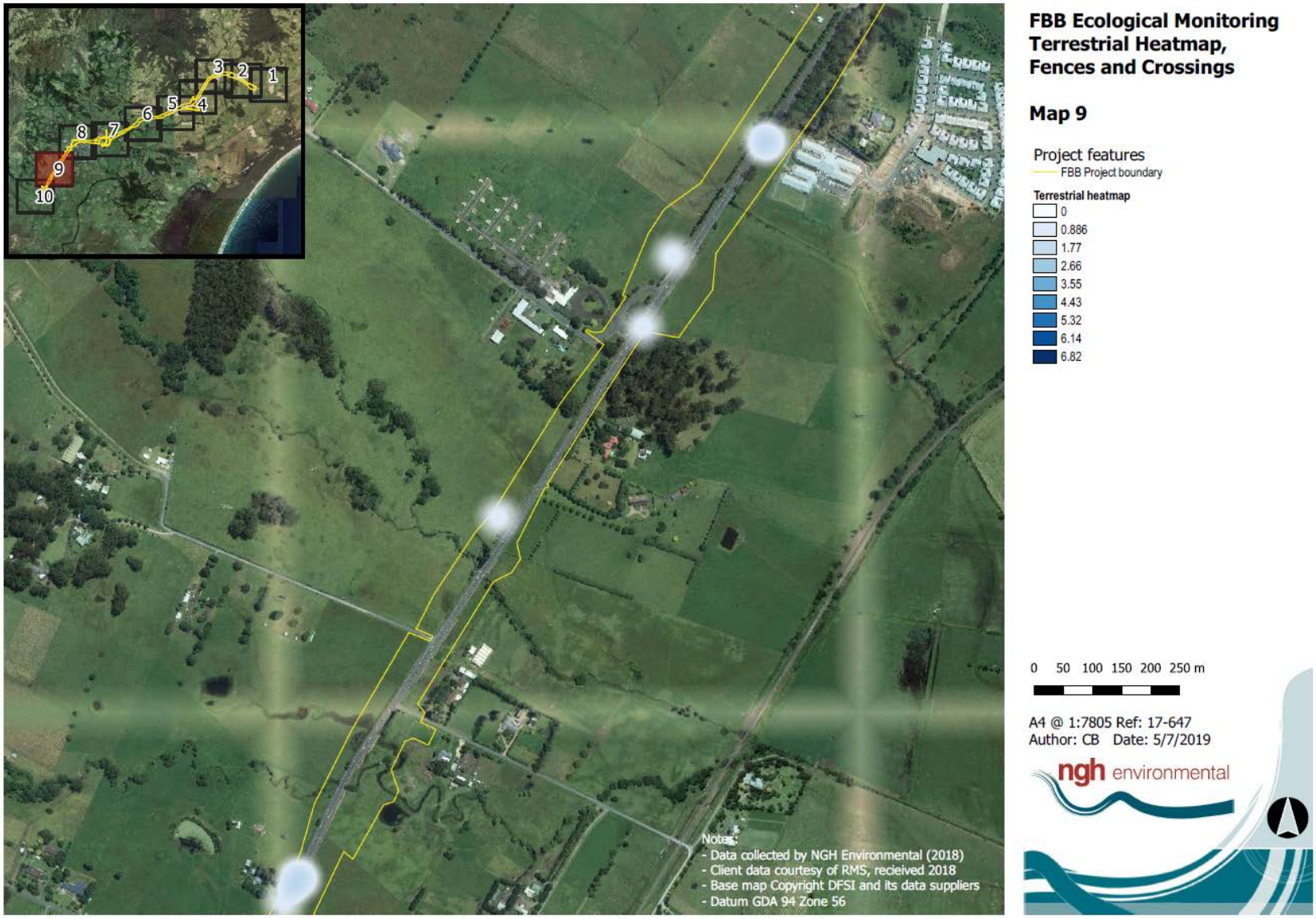

Figure 3-10 Terrestrial Heatmap – Map 9

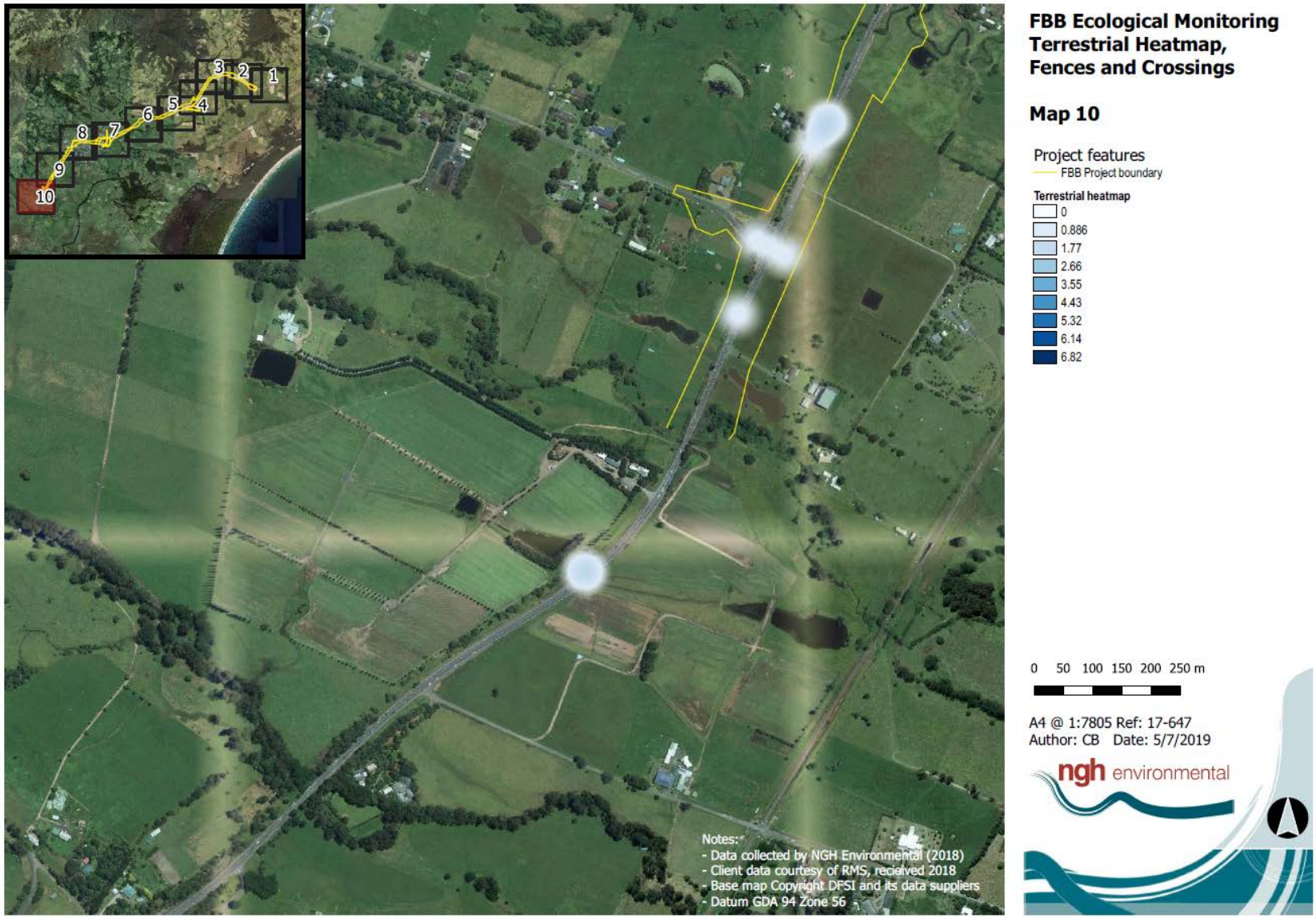

Figure 3-11 Terrestrial Heatmap – Map 10

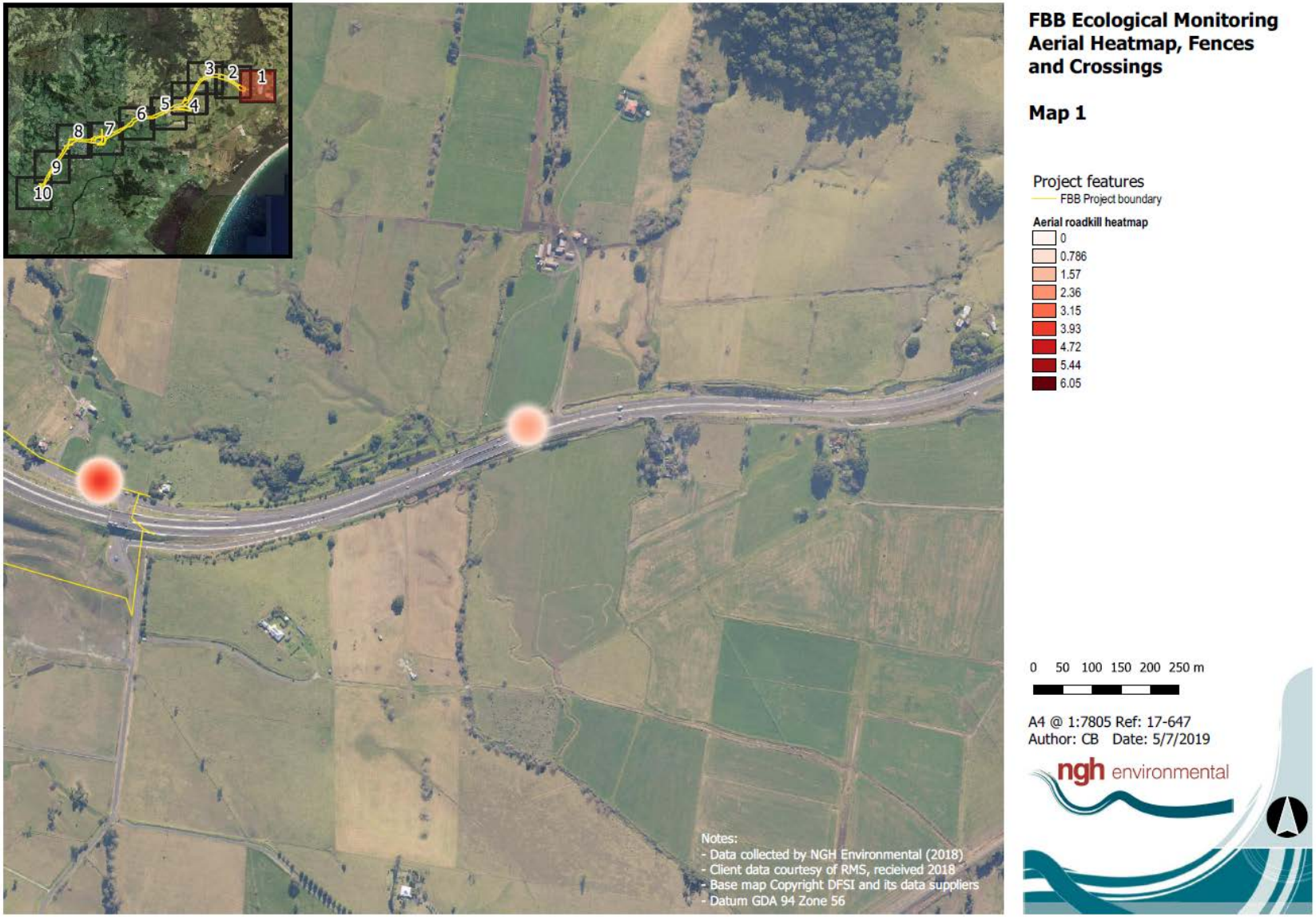

Figure 3-12 Aerial Heatmap – Map 1

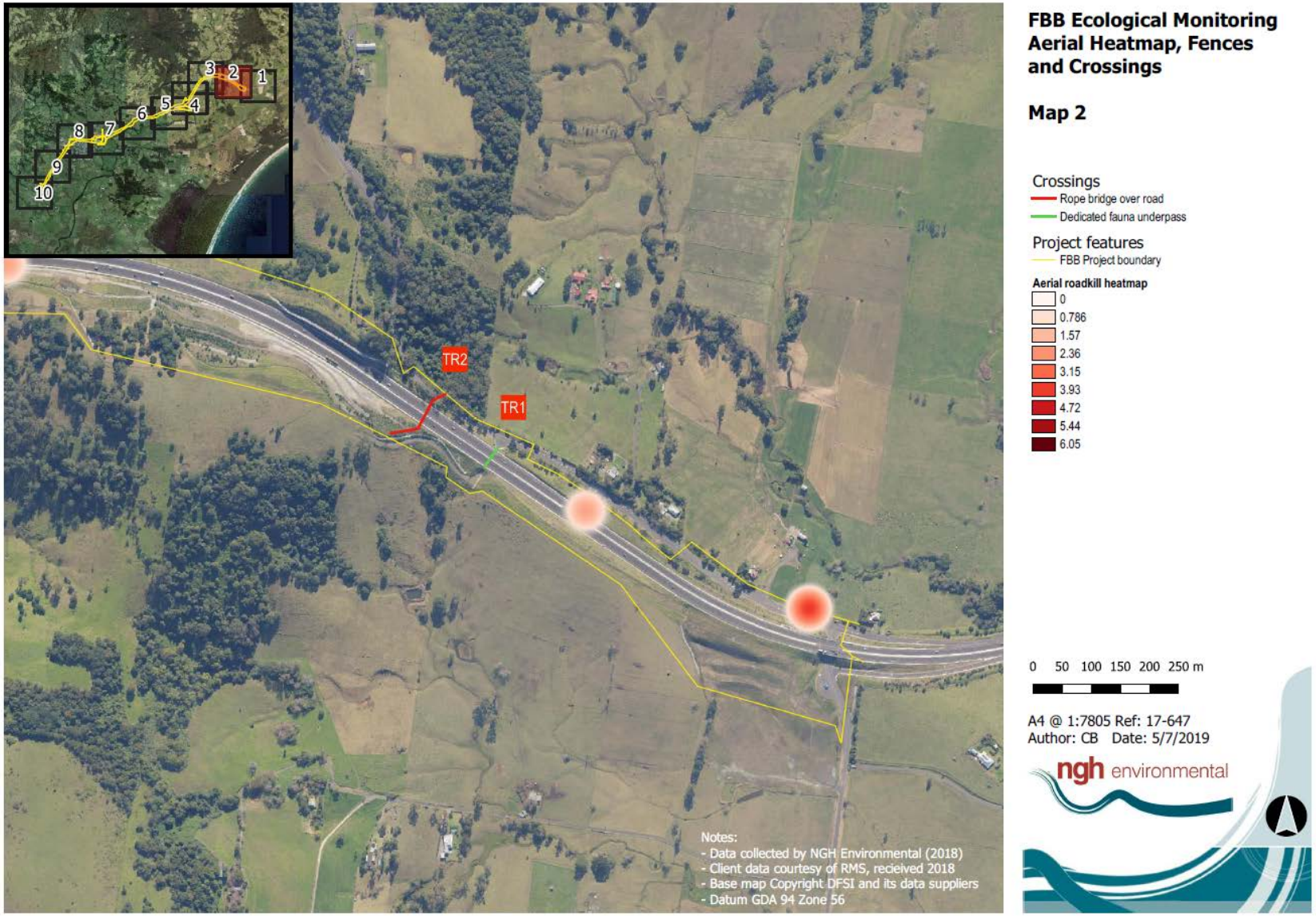

Figure 3-13 Aerial Heatmap – Map 2

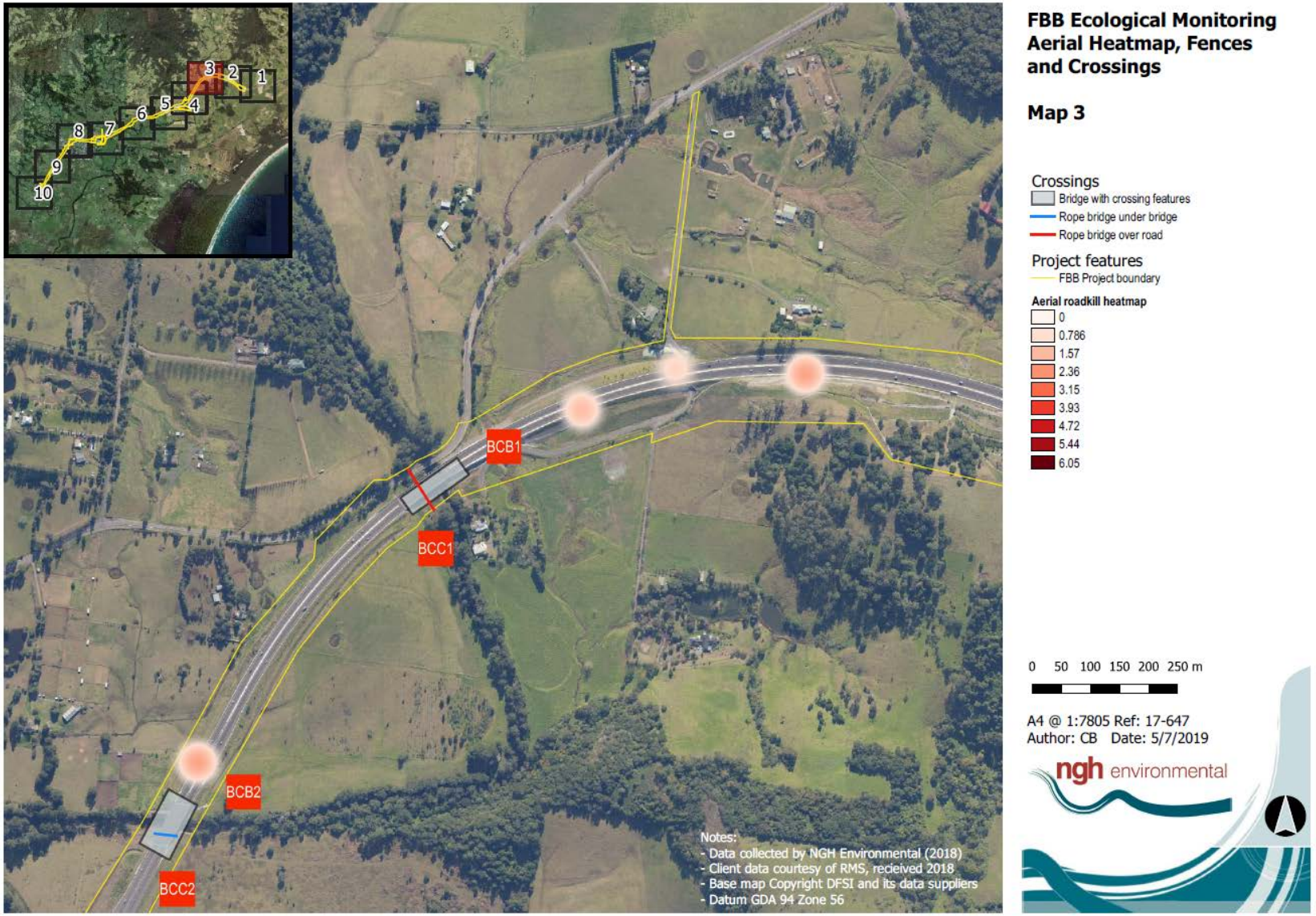

Figure 3-14 Aerial Heatmap – Map 3

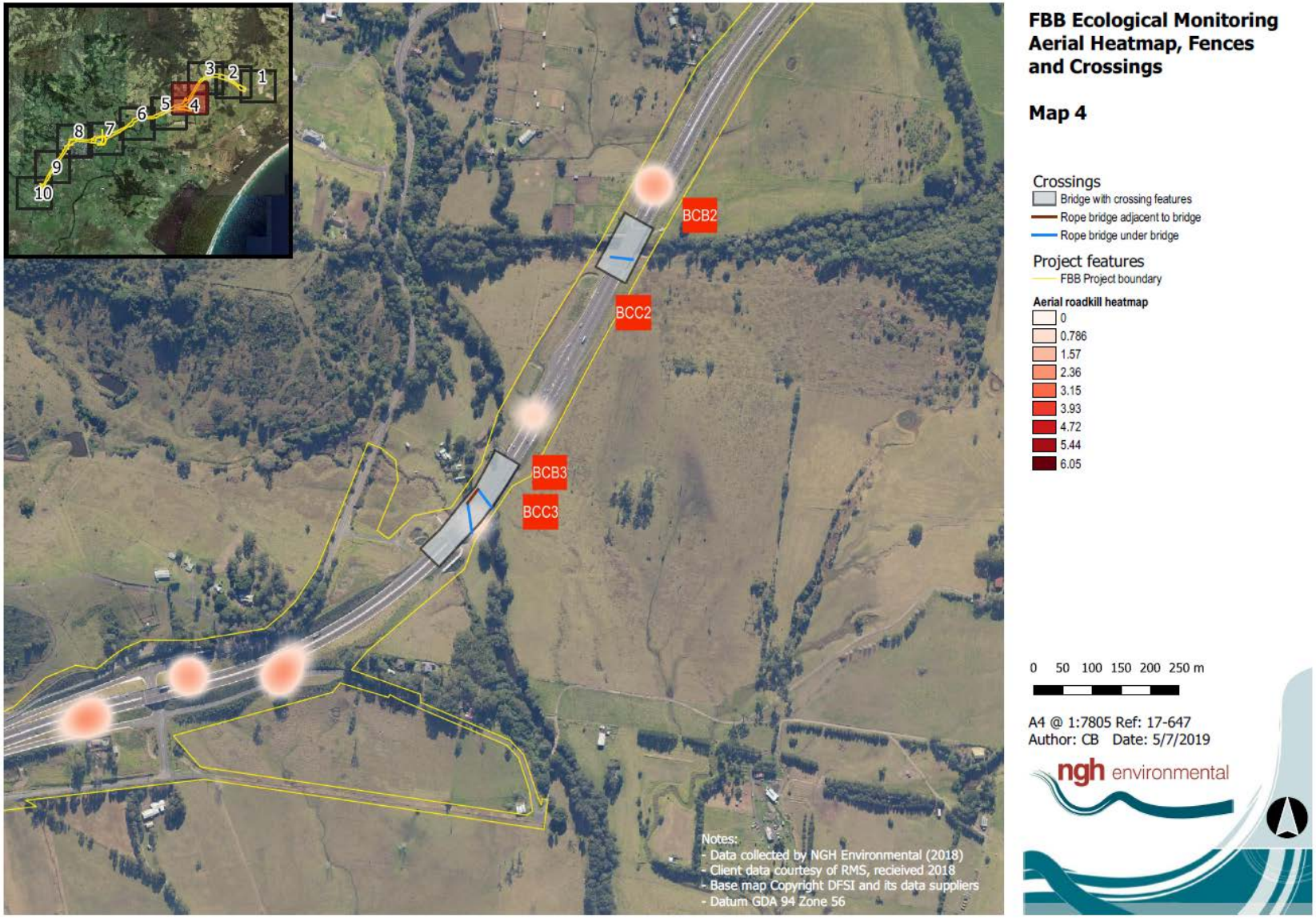

Figure 3-15 Aerial Heatmap – Map 4

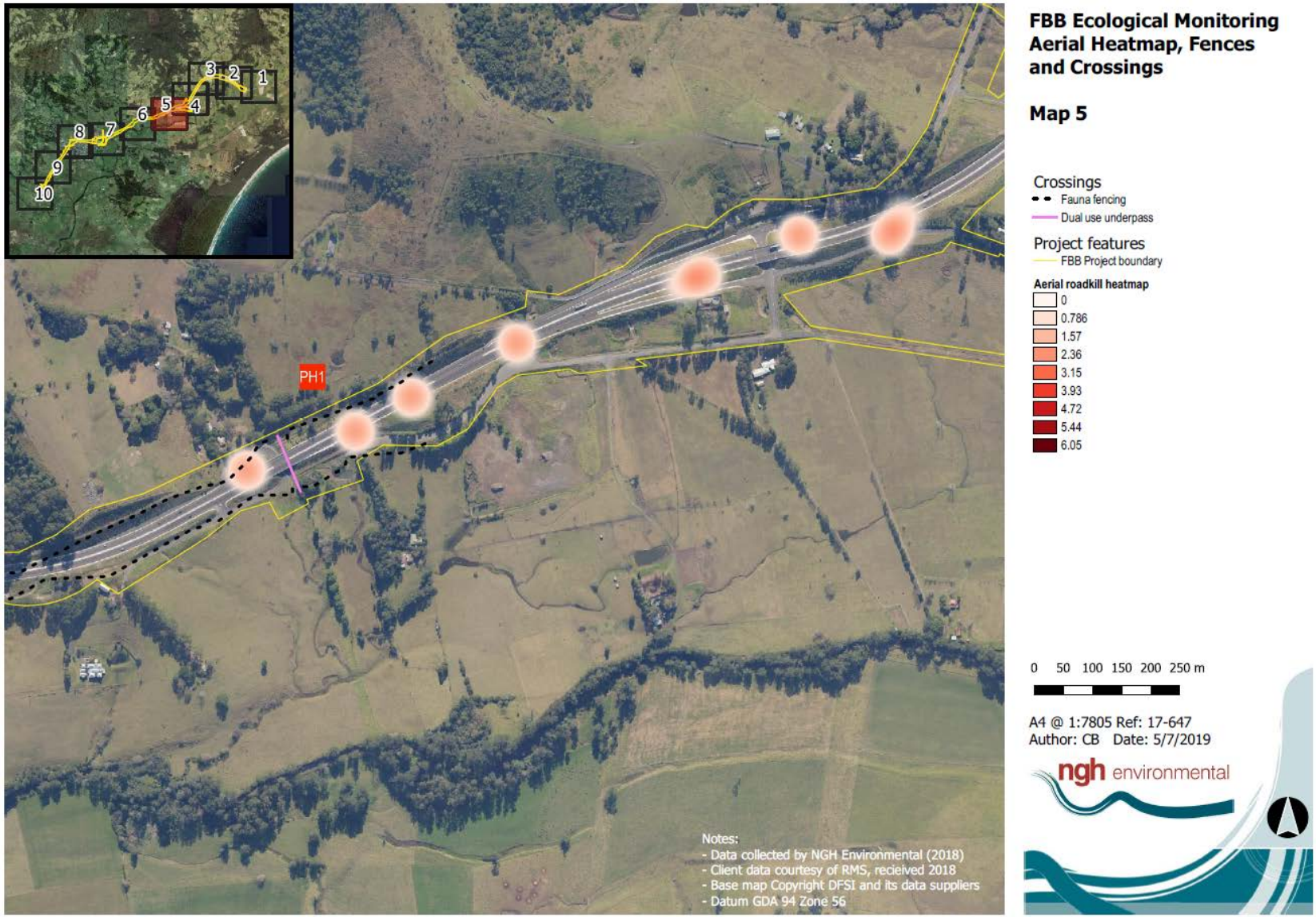

Figure 3-16 Aerial Heatmap – Map 5

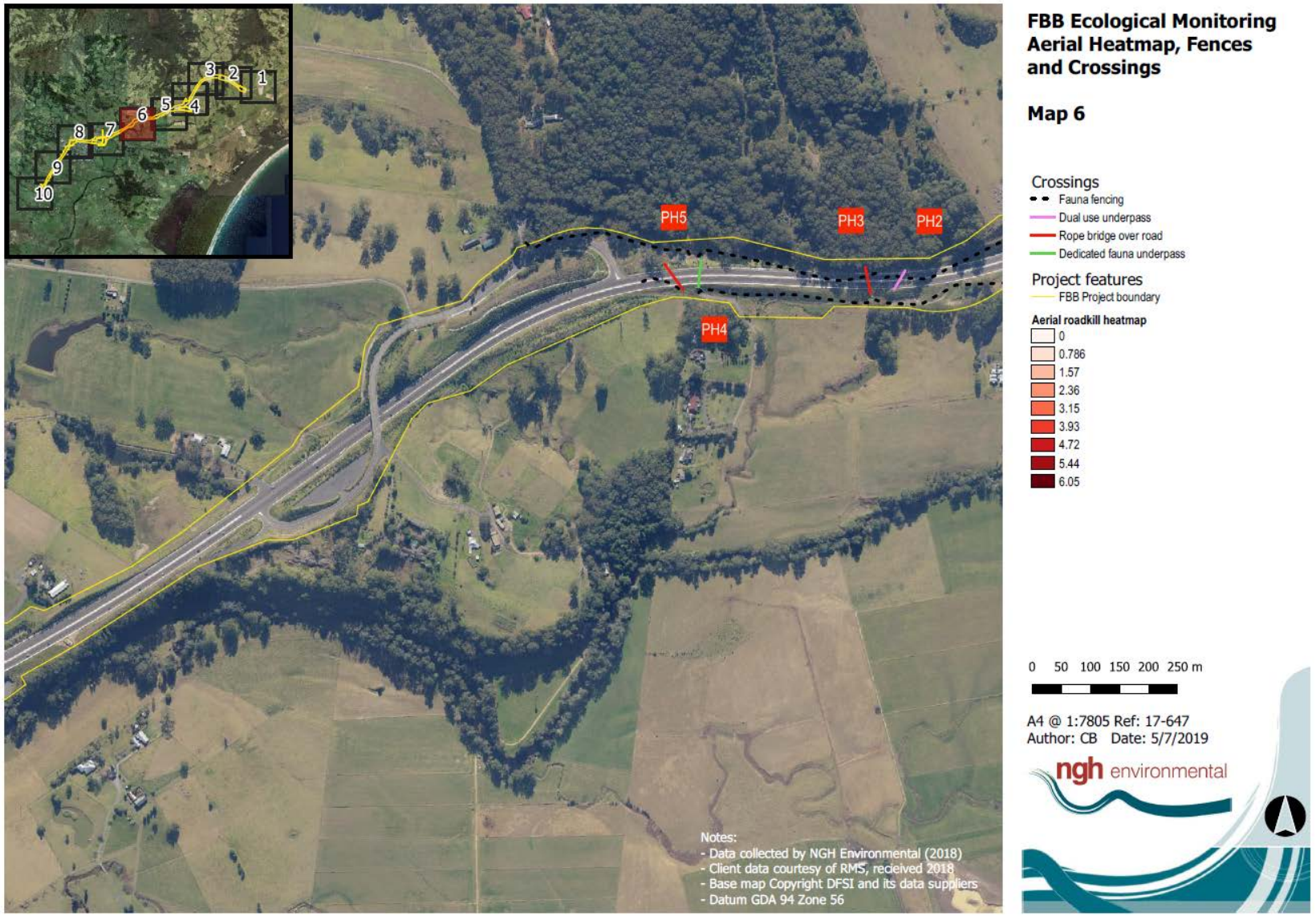

Figure 3-17 Aerial Heatmap – Map 6

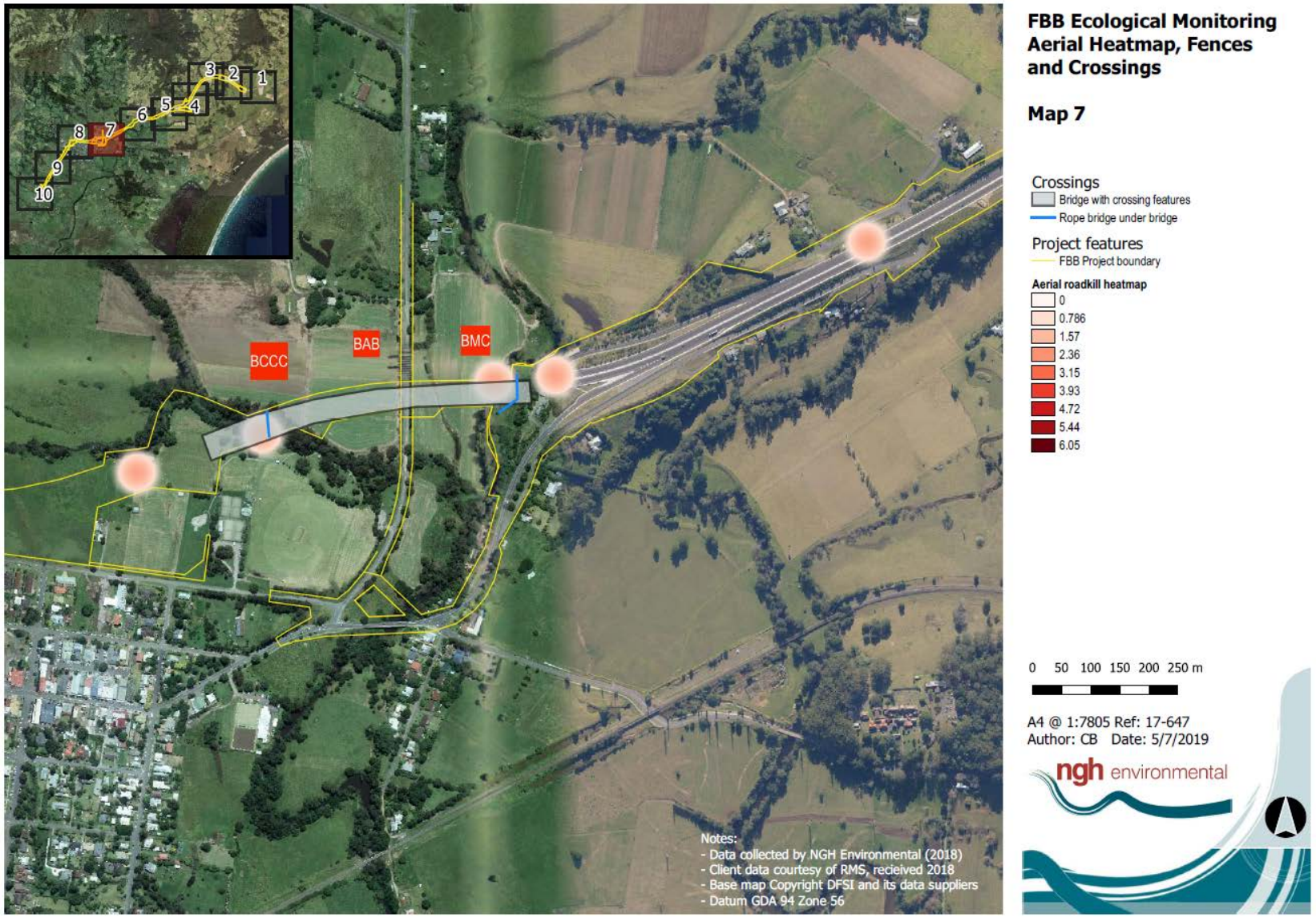

Figure 3-18 Aerial Heatmap – Map 7

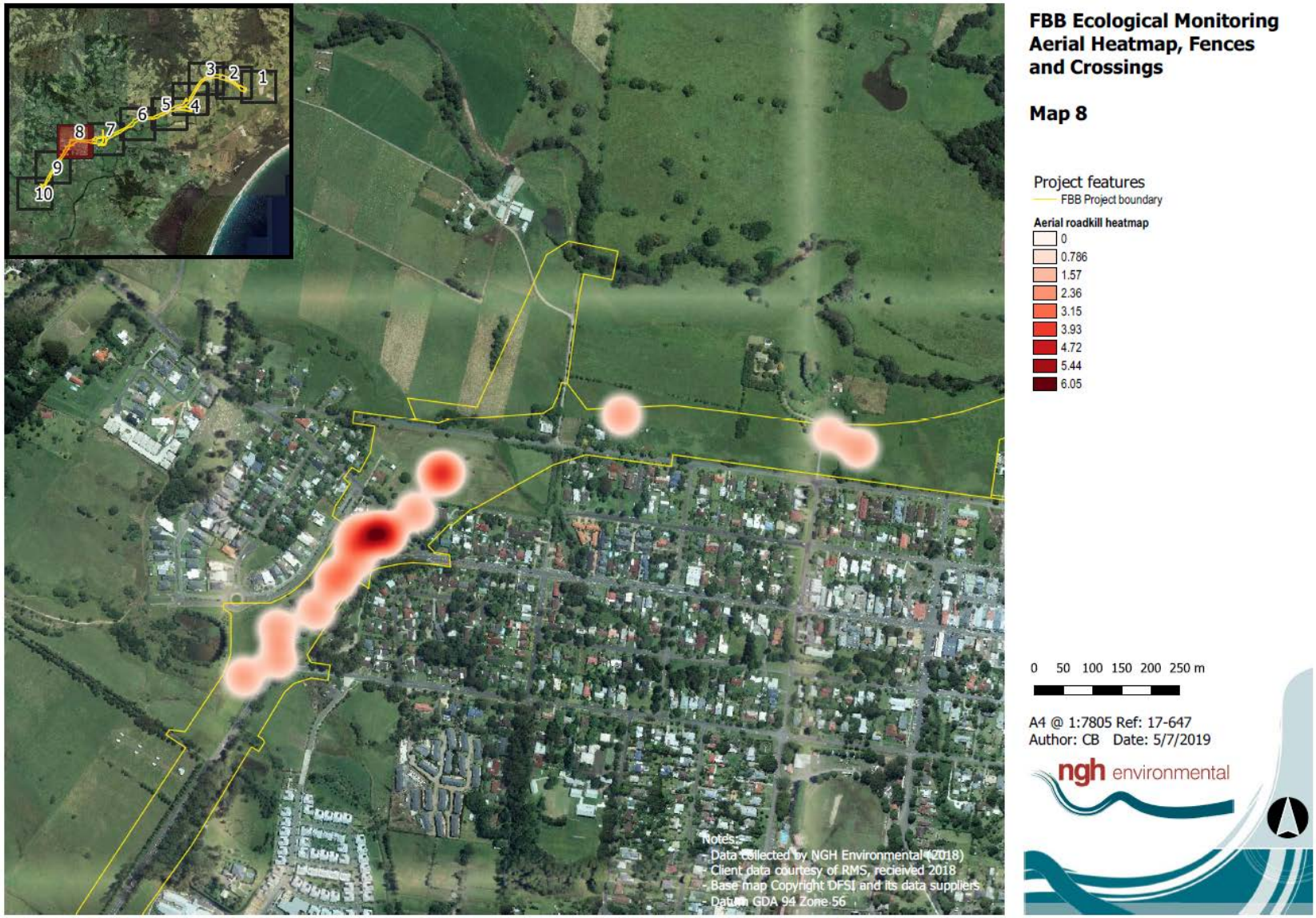

Figure 3-19 Aerial Heatmap – Map 8

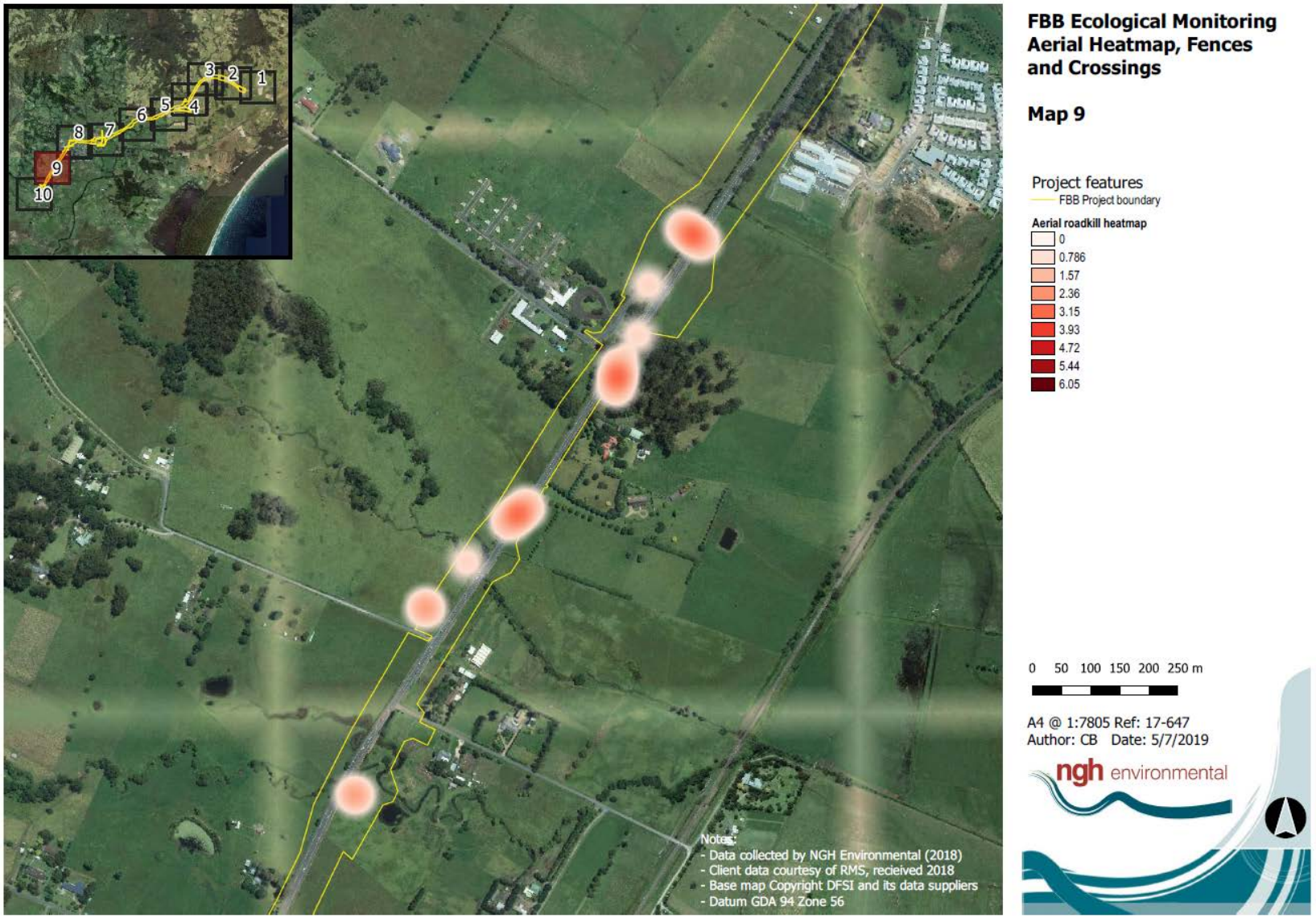

Figure 3-20 Aerial Heatmap – Map 9

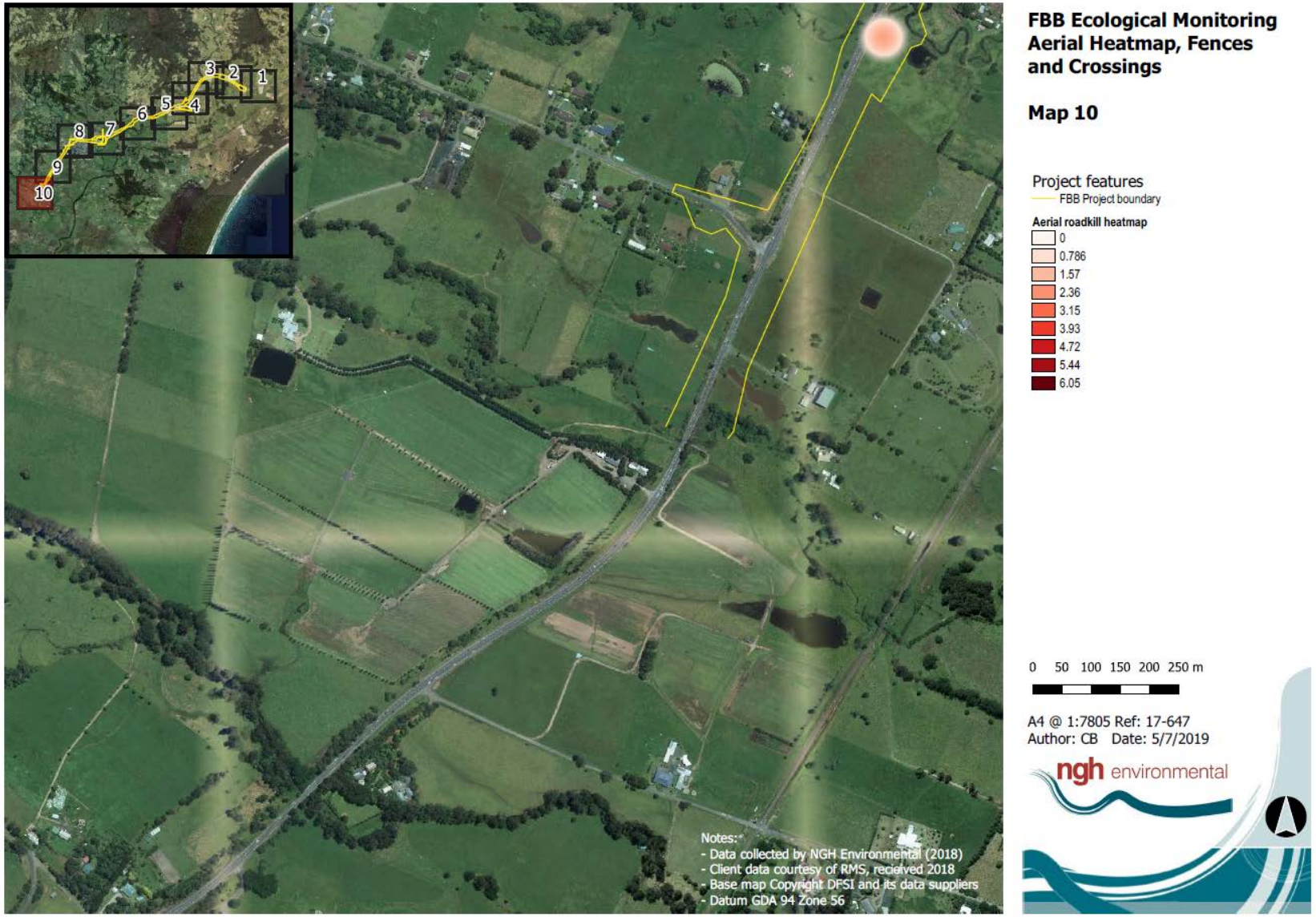

Figure 3-21 Aerial Heatmap – Map 10

3.2 CAMERA AUTOMATED DETECTION

A total of 449 sightings were recorded by the 15 deployed cameras over the 11-day survey period. This includes a category of unidentified birds and potential possum sightings. The camera with the most sightings recorded was camera 7 with 93 sightings, followed by cameras 12 and 11 with 86 and 78 sighting respectively (Table 3-1).

A total of 15 confirmed species were detected by the 15 deployed cameras over the 11-day survey period. Each camera varied in species richness detected from one to five species. The cameras which detected the greatest diversity (five species) were cameras 2, 12, and 15. The number of species detected by each camera is detailed in Table 3-1. Locations of cameras are shown in Figures 2-1 to 2-10 above.

Table 3-1 Number of sightings and species richness per camera

Camera	Number of sightings recorded	Number of species detected	Species type detected	Crossing structure type
1	11	2	Bird	Rope bridge
2	58	6	Bird, arboreal mammal	Rope bridge
3	49	5	Bird	Rope bridge
4	4	2	Bird	Rope bridge
5	1	1	Terrestrial mammal	Fauna underpass and fencing
6	7	1	Bird	Fauna underpass and fencing
7	93	4	Bird, arboreal mammal	Rope bridge
8	15	4	Bird, arboreal mammal	Rope bridge
9	8	3	Bird, arboreal mammal	Bridge
10	5	3	Bird	Rope bridge
11	78	2	Bird	Rope bridge
12	86	5	Bird, arboreal mammal	Rope bridge
13	23	3	Bird, Terrestrial mammal	Fauna underpass and fencing
14	1	1	Bird	Fauna underpass and fencing
15	10	5	Bird	Rope bridge

The most common species detected across the project by camera monitoring was the Willy Wagtail *Rhipidura leucophrys,* which was recorded by six different cameras. This was followed by Superb Fairy-wren *Malurus cyaneus*, Grey Shrike-thrush *Colluricincla harmonica*, and Australian Raven *Corvus coronoides,* which were detected by five cameras each. The Common Ringtail Possum was detected in four cameras (2, 7, 8, and 12). Camera 12 and Camera 7 had 55 detected sightings and 37 respectively. These results confirm that the common ringtail possums are using the rope bridges in these areas. No Common or Mountain Brushtail Possums were detected by the 15 cameras deployed. We suggest that perhaps brushtails may prefer to not use the rope bridges. However, in some areas, rope bridges are not connected to trees of the bushland which limits the ability for them to be used by species other than flying or gliding species. See Table 3-2 below for detailed results.

Table 3-2 Species and individuals detected during camera surveys

Common Name	Scientific Name	Individuals recorded by each camera															
		C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	Total
Mammal																	
Common Ringtail Possum	*Pseudocheirus peregrinus*		2					37	1				55				**95**
Black Rat*	*Rattus rattus*													14			**14**
Potential Possum	*Trichosurus/ Pseudocheirus sp.*									1							**1**
Common Wombat	*Vombatus ursinus*					1											**1**
Red Fox*	*Vulpes vulpes*													8			**8**
Bird																	
Unknown Bird	-		1	1	1						2						**5**
Yellow Thornbill	*Acanthiza nana*												2				**2**
Common Myna*	*Acridotheres tristis*								2							5	**7**
Grey Shrikethrush	*Colluricincla harmonica*		5	4						5	2	1					**17**
Australian Raven	*Corvus coronoides*						7			2		77			1	2	**89**
Australian Magpie	*Cracticus tibicen*							26								1	**27**
Magpie Lark	*Grallina cyanoleuca*	1						3								1	**5**
Superb Fairywren	*Malurus cyaneus.*	10	18	38					8				2				**76**
Lewin's Honeyeater	*Meliphaga lewinii*		2	2	3								3				**10**
Australasian Swamphen	*Porphyrio melanotus*													1			**1**
Willy Wagtail	*Rhipidura leucophrys*		30	4				27	4		1		24				**90**
Common Starling*	*Sturnus vulgaris*															1	**1**
Total		**11**	**58**	**49**	**4**	**1**	**7**	**93**	**15**	**8**	**5**	**78**	**86**	**23**	**1**	**10**	**449**

*= exotic

3.3 TRANSECT SURVEYS

3.3.1 Spotlighting

A total of 24 species were detected during spotlight surveys across all transects in the project alignment. Locations of transects are shown in Figure 2-1 to Figure 2-10. Spotlighting data plays a vital component in the dataset as it accounts for the detection of nocturnal fauna, in particular arboreal nocturnal fauna like the Common Brushtail Possum, the Common Ringtail Possum, and the Sugar Glider. Data on Grey-headed Flying-foxes is also important as there is a known colony which populates Bundewallah Creek near Berry town centre.

Grey-headed Flying-fox, *Pteropus poliocephalus,* Eastern Dwarf Tree Frog, *Litoria fallax*, and microbats were the most frequently observed fauna during spotlighting surveys, being detected at 10 different transects. Table 3-3 below summarises the species detected in each transect.

Sugar Gliders were observed at eight different transects. Sugar Gliders and Common Ringtail Possums were found in the same transect on two occasions (transects 8 and 9). Sugar Gliders and Brushtail Possums were detected in two transects (transect 13 and 14), with all three species found together in Transect 9. This is expected as not only do sites 13 and 14 have excellent habitat for nocturnal arboreal fauna in their dense riparian trees and shrubs, the sites are also in close proximity to Berry township which would entice Brushtail possums. In contrast, transect 9 is one of the least disturbed sites, with a large good condition remnant sclerophyll woodland and gullies of dense shrubs throughout. The diverse habitat of tall trees, wet gullies with dense shrubs, a vast number of naturally occurring hollows in old remnant trees provides excellent habitat for nocturnal arboreal fauna.

Table 3-3 Species and individuals detected during spotlight surveys in all transects

Common Name	Scientific Name	Individuals recorded in each transect										
		T1&2	T 3	T 4	T5& 6	T 7	T 8	T9	T1 0	T1 1	T1 3	T1 4
Mammal												
Black Rat*	*Rattus rattus*									1		3
Common Brushtail Possum	*Trichosurus vulpecula*						1	2			1	2
Common Ringtail Possum	*Pseudocheirus peregrinus*	1	1	1	1	2	1	5				
Grey-headed Flying Fox	***Pteropus poliocephalus***	1	1	3	2	1		1000+ (flying overhead)		1	2	
Microbat (unidentified)	Microchiroptera	1		1	20		6	6		6	3	3
Red Fox*	*Vulpes vulpes*		1			1				1		
Rusa Deer*	*Rusa timorensis*		1									
Sugar Glider	*Petaurus breviceps*		3		2		1	4		1	1	2
Swamp Wallaby	*Wallabia bicolor*		5	1	1					2		
Bird												
Domestic Goose*	*Anserini sp.*					4						
Eurasian Coot	*Fulica atra*										1	
Eastern Yellow Robin	*Eopsaltria australis*											1
Grey Fantail	*Rhipidura albiscapa*											1
Pacific Black Duck	*Anas superciliosa*											1
Southern Boobook	*Ninox boobook*		1									
White-faced Heron	*Egretta novaehollandiae*											2
Common Yabby	*Cherax destructor*	4										
Aquatic												
Cox's Gudgeon	*Gobiomorphus coxii*			1								

Common Name	Scientific Name	Individuals recorded in each transect										
		T1&2	T 3	T 4	T5& 6	T 7	T 8	T9	T1 0	T1 1	T1 3	T1 4
Common Eastern Froglet	*Crinia signifera*				5			1	1			
Eastern Dwarf Tree Frog	*Litoria fallax*	1	1	1		1		1	1	1		10 +
Short-finned Eel	*Anguilla australis*						1					
Southern Leaf Green Tree Frog	*Litoria nudidigita*			1	2	2	5					
Striped Marsh Frog	*Limnodynastes peronii*		1		1			1	1	1		
Whistling Tree Frog	*Litoria verreauxii*				2					1		

*= exotic, **bold** = threatened under the BC Act and EPBC Act

3.3.2 Herpetological surveys

A total of seven species were identified across all transects during herpetological diurnal surveys. Table 3-4 summarises the species found within each transect. The Eastern Dwarf Tree Frog *Litoria fallax* was the most frequently identified species during diurnal herpetological searches, even though they are more active at night. These frogs are very common and are very vocally active. Furthermore, survey conditions were wet/humid most days which provided good surveying conditions for amphibian species regardless of surveys being diurnal. Three species of lizards were observed, and one snake species.

A healthy Diamond Python *Morelia spilota* was also observed sleeping in a Small-leaved Privet *Ligustrum sinense* in Transect 7.

Table 3-4 Herpetological survey observations within each transect

Common Name	Scientific Name	Individuals recorded in each transect										
		T1&2	T3	T4	T5&6	T7	T8	T9	T10	T11	T13	T14
Common Eastern Froglet	*Crinia signifera*		1		5+			1	1			
Diamond Python	*Morelia spilota*					1						
Eastern Water Dragon,	*Intellagama lesueurii*			2	1	3						
Eastern Water Skink	*Eulamprus quoyii*						2		1			2
Rainbow Skink	*Lampropholis delicata*				1							
Eastern Dwarf Tree Frog	*Litoria fallax*	1	1	1				1	1	1		10+
Southern Leaf Green Tree Frog	*Litoria nudidigita*			1	2		5					

3.3.3 Tracks, Scats, and Signs search

Eleven types of Tracks, Scats, and Signs were observed in the project alignment with none detected on transects 5, 6, 8, and 13. Fresh deer tracks were identified in Transect 1. These transects are surrounded by a private property and Donovan Rd both with barbed wire fencing. The area is a wet sclerophyll gully with dense *Lantana camara* throughout. Rusa Deer were also spotted during diurnal searches confirming their presence and our identification of the tracks. Transect 3, which is directly opposite Transects 1 and 2, also had a Rusa Deer detected during spotlight searches.

Additional data collected from this survey method included wombat burrows and warrens, potential previous platypus burrows that were on the banks where the water level had dropped, bird nests and Macropod and Fox scats. It is apparent that foxes occupy all areas in and around the alignment.

Underpasses were checked for Red Fox scats and macropod scats with no results.

Results of the searches are summarised in the Table 3-5 below.

Table 3-5 Tracks, Scats, and Signs observations within each transect

Common name	Scientific name	Observation type	Individuals recorded in each transect										
			T1&2	T3	T4	T5&6	T7	T8	T9	T10	T11	T13	T14
Crimson Rosella		feathers									1		
Eastern Grey Kangaroo		scat							1				
Red Fox	*Vulpes vulpes*	den		1									
Red Fox	*Vulpes vulpes*	scat	1										
Platypus	*Ornithorhynchus anatinus*	burrow											1
European Rabbit		burrows and scats								1			
Deer		tracks	1										
Sugar glider	*Petaurus breviceps*	scat		1									
Superb Fairy-wren		nest					1						
Thornbill sp		nest		1									
Common Wombat		burrow/warren		1	1		1		1				

3.3.4 Opportunistic Species Records

A total of 55 species across all transects were detected by opportunistic observation during diurnal transect surveys. These were species not originally targeted in the EcMP or FBB Baseline monitoring (PB, 2014, PB 2015). As such, these instances of species, though recorded during a transect, were considered incidental observations for the sake of comparison with previous survey data, and were not included in the species counts for survey techniques where they were not the target. These observations may be useful for comparison during later years of monitoring.

Opportunistic observations included 48 species of birds, including one bird of prey (Nankeen Kestrel, *Falco cenchroides*) and one owl species (Southern Boobook, *Ninox boobook*). The remaining species included two aquatic species; Common Yabby *Cherax destructor,* and Short-finned Eel *Anguilla australis*, three macropod species; Common Wombat *Vombatus ursinus*, Swamp Wallaby, *Wallabia bicolor* and Eastern Grey Kangaroo, *Macropus giganteus*, a Brown Antechinus, *Antechinus stuartii* and a colony of Grey-headed Flying-foxes, *Pteropus poliocephalus*.

Transect 3 had the largest diversity of the transects surveyed with 19 species detected (Table 3-6). Transects 8 and 9 had the largest bird diversity with 15 species found in each. This is expected as transect 9 is one of the least disturbed sites, with a large good condition remnant sclerophyll woodland and gullies of dense shrubs throughout. It provides diverse habitat of tall trees, wet gullies with dense shrubs which is excellent for a variety of bird species. In contrast, transect 8 is a riparian corridor predominantly comprised of riparian trees and dense weedy shrub vegetation which still provides excellent foraging and nesting habitat for small birds.

There were only two opportunistic sightings that occurred whilst not undertaking a transect survey. A Pacific Baza, *Aviceda subcristata,* was observed flying overheard on Tannery Road on the way to a diurnal search and a Black-shouldered Kite, *Elanus axillaris,* was observed roosting on a power pole on Tindall's Lane.

Table 3-6 Opportunistic species diversity

Transect	Number of species
1 & 2	19
3	20
4	14
5 & 6	17
7	15
8	17
9	17
10	10
11	11
13	15
14	14

3.3.5 Call playback

One potential threatened species was detected during call playback surveys. A potential Masked Owl *Tyto novaehollandiae* response call was heard approximately 200 m away in Transect 8, following 5 minutes of call playback. Additionally, a Sugar Glider *Petaurus breviceps,* was observed in the locality of Transect 8 following a five minute call playback of a Squirrel Glider *Petaurus norfolcensis* call.

Surveys at other call playback points resulted in no responses being detected. Call playback locations can be seen in Figure 2-1 to Figure 2-10.

4 DISCUSSION

4.1 ROADKILL MONITORING

4.1.1 Comparison with pre-construction data

Pre-construction roadkill monitoring was only carried out for a total of 34 weeks, so in order to compare the results of pre-construction and post-construction, an average roadkill count per week was calculated. There was a significant increase in the average number of road kills from pre-construction to post-construction for both mammals and birds (Figure 4-1). Pre-construction roadkill monitoring was undertaken between March and November, however frequency of road kills can be highly seasonal with more species affected during breeding or movement periods across the year.

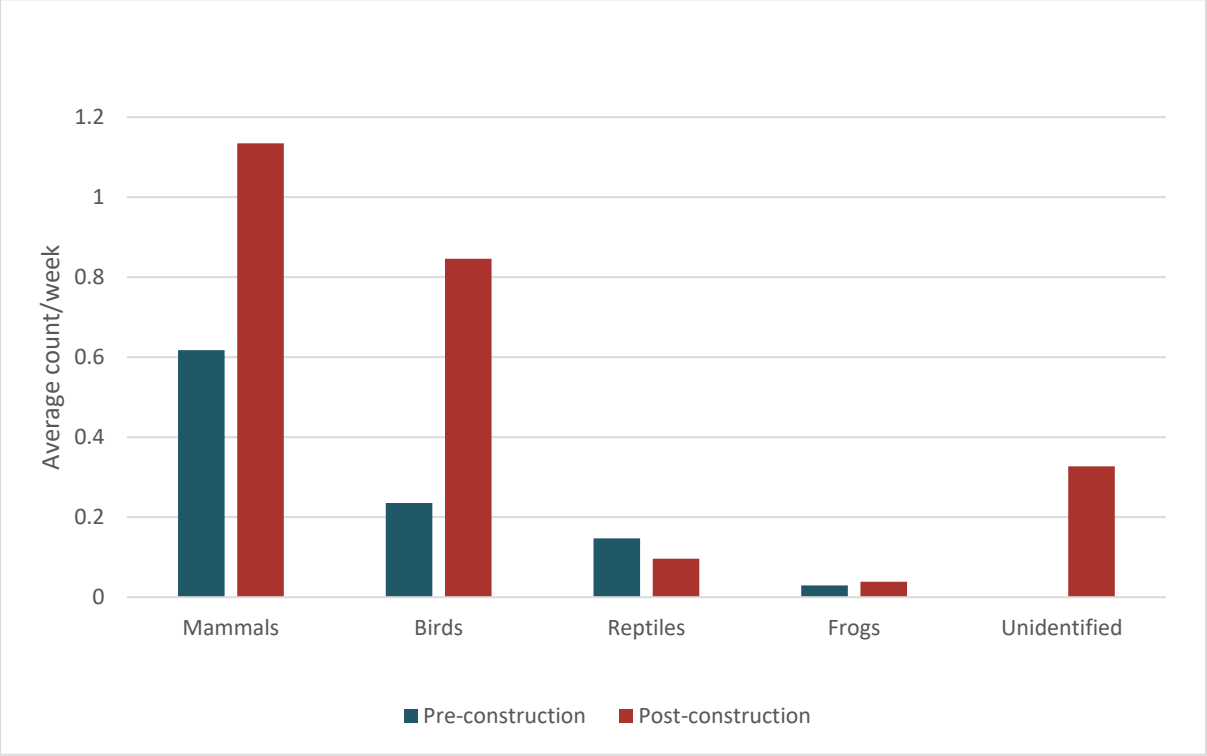

Figure 4-1 Total pre-construction vs post-construction roadkill results

When weeks of survey are directly compared (March to November 2014 vs. March to November 2018), the rate of roadkill is higher still, as shown in Figure 4-2 below.

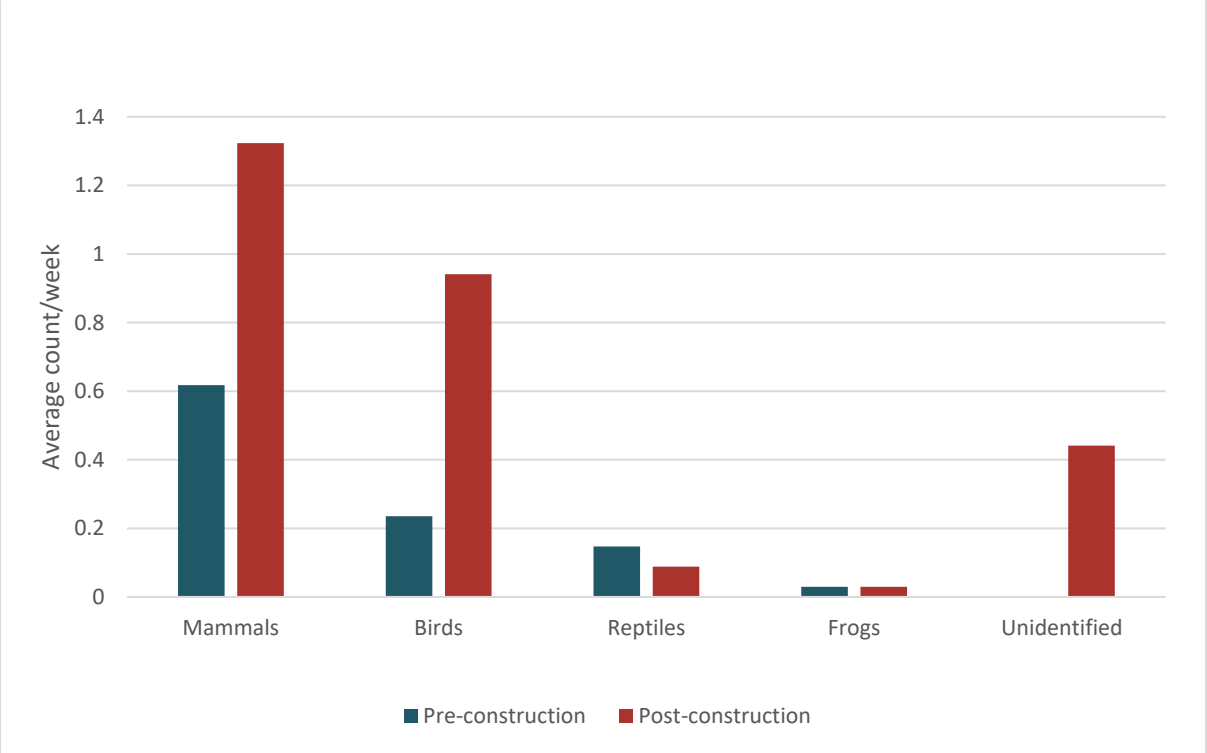

Figure 4-2 Mar-Nov 2014 vs Mar Nov 2018 roadkill rates

Flying species were most commonly recorded in proximity to Berry township. A significant driver of this is considered to be the high number of granivorous birds detected, likely feeding within recently sprayed soil stabilising seed mixture. Terrestrial species were more evenly distributed along the alignment, with hotspots being identified in the vegetation in proximity to the Alexander Berry Monument, in proximity to Austral Park Road, and within the Toolijooa Ridge cut (shown in Figures 3-2 to 3-11). These areas all contain adjacent native vegetation on at least one side, do not have dedicated terrestrial fauna crossing structures within 500 m and do not have proximate fauna fencing. These areas typically also contain a steep cutting or embankment, within which fauna are likely being trapped.

4.2 CAMERA AUTOMATED DETECTION

4.2.1 Comparison with pre-construction data

A direct comparison of the pre-construction and post-construction data (Figure 4-3) reveals that more individuals were detected during post-construction monitoring. However, the placement of cameras during the pre-construction phase was quite different, as no crossing structures were present at the time of initial monitoring. As such, some terrestrial species were recorded in initial monitoring which would not be recorded during post-construction monitoring of structures such as rope bridges. Five species were detected during the post-construction phase, whereas six species were recorded during the pre-construction period. A high number of Common Ringtail Possums were detected using rope bridges during post-construction monitoring, and there was an absence of Common or Mountain Brushtail Possums which indicates that they are not readily utilising the crossing structures yet. It may take longer for certain species to acclimatise to the crossing structures. Table 4-1 below provides a comparison of results pre and post construction at each crossing site.

A number of fauna underpasses were observed to contain fauna "furniture" in form of timber attached along the side of underpasses, however these poles are relatively isolated from adjacent vegetation, potentially reducing their efficacy for arboreal species that are less likely to move along the ground. It is recommended that any revegetation efforts target these areas to create vegetative connectivity to the crossings.

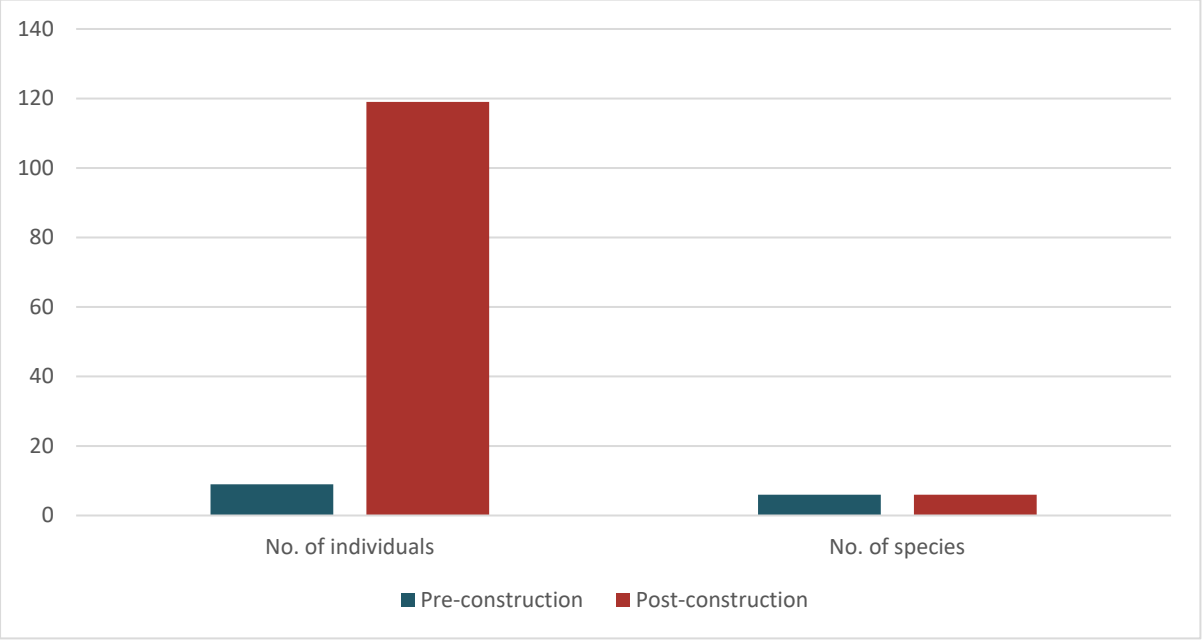

Figure 4-3 Pre-construction vs post-construction camera survey fauna results

Table 4-1 Terrestrial and arboreal fauna recorded during camera surveys during pre-construction and post-construction

Fauna mitigation structure locations	Structure code and type (PB 2015)	Camera No. (2018)	Fauna crossing main orientation	[1]Pre-construction		[1]Post-construction	
				Terrestrial and arboreal animals recorded on north or east	Terrestrial and arboreal native animals recorded on south or west	Terrestrial and arboreal animals recorded on north or east	Terrestrial and arboreal native animals recorded on south or west
Toolijooa ridge 1 CH 8450	TR1 Fauna underpass and fencing	5	North-South	Common Wombat Swamp Wallaby	-	-	Common Wombat
Toolijooa ridge 2 CH 8500	TR2 Rope bridge	15	North-South	Common Brushtail Possum	-	-	Magpie Lark, Common Myna, Common Starling, Australian Magpie, Australian Raven
Broughton Creek 1 CH 9950 - CH 9990	BCB1 Bridge	No camera		-	Short-beaked Echidna	-	-
	BCC1 Rope bridge	10 and 3		-	-	Willy Wagtail, Grey Shrike-thrush, Unknown Bird	Superb Fairywren, Willy Wagtail, Lewin's Honeyeater, Grey Shrike-thrush, Unknown Bird
Broughton Creek 2 CH 10700	BCB2 Bridge	No camera	East-West	Mountain Brushtail Possum	Eastern Water Skink	-	-
	BCC2 Rope bridge	8 and 2				Superb Fairywren, Willy Wagtail, Common Ringtail Possum, Common Myna	Superb Fairywren, Willy Wagtail, Lewin's Honeyeater, Grey Shrike-thrush, Common Ringtail

Fauna mitigation structure locations	Structure code and type (PB 2015)	Camera No. (2018)	Fauna crossing main orientation	[1]Pre-construction		[1]Post-construction	
				Terrestrial and arboreal animals recorded on north or east	Terrestrial and arboreal native animals recorded on south or west	Terrestrial and arboreal animals recorded on north or east	Terrestrial and arboreal native animals recorded on south or west
							Possum, Unknown Bird
Broughton Creek 3 CH 11200	BCB3 Bridge	No camera	North-South	-	none	-	-
	BCC3 Rope bridge	7 and 12				Magpie Lark, Willy Wagtail, Common Ringtail Possum, Australian Magpie	Superb Fairywren, Willy Wagtail, Lewin's Honeyeater, Yellow Thornbill, Common Ringtail Possum
Princes Highway CH 12770	PH1 Fauna underpass and fencing	13	North-South	-	Swamp Wallaby	-	Australasian Swamphen, Black Rat, Red Fox
Princes Highway CH 13320	PH2 Fauna underpass and fencing	6	North-South	Swamp Wallaby	-	Australian Raven	-
Princes Highway CH 13360	PH3 Rope bridge	11	North-South	-	none	-	Grey Shrike-thrush, Australian Raven
Princes Highway CH	PH4 Fauna underpass and fencing	14	North-South	-	Swamp Wallaby	Australian Raven	-

Fauna mitigation structure locations	Structure code and type (PB 2015)	Camera No. (2018)	Fauna crossing main orientation	[1]Pre-construction		[1]Post-construction	
				Terrestrial and arboreal animals recorded on north or east	Terrestrial and arboreal native animals recorded on south or west	Terrestrial and arboreal animals recorded on north or east	Terrestrial and arboreal native animals recorded on south or west
13680							
Princes Highway CH 13700	PH5 Rope bridge	9	North-South	none	-	Grey Shrikethrush, Australian Raven, Possum?	-
Broughton Mill Creek CH 15900	BMC Rope bridge	4	North-South	none	-	Lewin's Honeyeater, Unknown Bird	-
Bridge at Berry CH 16000	BAB Bridge	No camera	North-South	-	-	-	-
Bundewallah Creek (Connollys Creek) CH 16250	BCCC Rope bridge	1	North-South			Superb Fairywren, Magpie Lark	-

*1 ˜none" indicates that no species were recorded. ˜- " indicates that no camera was placed in this location due to monitoring program design

4.3 TRANSECT SURVEYS

4.3.1 Comparison with pre-construction data

From Figure 4-4 it is evident that more individuals and more species were detected during post-construction spotlighting surveys. The number of individuals detected through scats, tracks and signs searches was similar, with a slightly higher number of species detected during post-construction surveys. Herpetological surveys found a higher number of individuals and species during the pre-construction phase, which may be attributed to the conditions at the time of the survey which may have been more favourable for reptiles.

An analysis of mammal species found three new native species detected during post-construction including the Brown Antechinus, Grey-headed Flying-fox, and Platypus. Three additional exotic species were also detected including the Domestic Cat, Rusa Deer, and Hare. Native mammal species observed during pre-construction but not during post-construction include the Long-nosed Bandicoot and Mountain Brushtail Possum. Overall, 10 native mammal species were detected during the pre-construction surveys, and 11 native mammal species during the post-construction surveys.

Figure 4-4 Pre-construction vs post-construction count and species diversity transect data

4.4 OVERALL PERFORMANCE CRITERIA COMPARISON

Table 4-2 Performance criteria comparison

Mitigation measure	Performance criteria	Performance target and timeframe	Are performance criteria being met?
Targeted GGBF surveys	If any GGBFs are detected during the pre-clearing surveys further investigations and reporting would be required (such as a GGBF Management Plan). This would identify the appropriate performance criteria. Generally, this would be likely to focus on the presence of GGBF continuing at the same or higher population levels	GGBF persist in areas identified during the life of the monitoring program.	Yes. No GGBFs were detected during pre-clearing surveys, therefore no further targeted surveys were required during the post-construction period. No GGBFs were recorded during the transect surveys or call playback surveys conducted in February 2018.
Connectivity mitigation measures (fauna exclusion fencing, underpasses and arboreal rope crossing)	Low fauna mortality or injury due to road kill	Road kill rates similar or lower than rates recorded pre- construction on existing highway, during the life of the monitoring program.	No. Road kill rates were 64 per cent higher during the post-construction period, when pre and post construction monitoring periods (March to November) are directly compared.
	Evidence of use of by arboreal, cover-dependent species with low mobility, dispersing (juvenile) or different age cohorts.	Demonstrated use of structure by native targeted fauna species within 3 years of start of operation phase	Yes. Common Ringtail Possums have been confirmed using the rope bridges.
	High rates of native fauna movement and species diversity using structures.	Majority of structures show several native species using the structure within 3 years of start of operation phase	Yes. A total of 15 different species were recorded using the rope bridges and fauna underpasses. The cameras recorded 119 terrestrial and arboreal individuals using the crossing structures in 2018.
Habitat Use	Mammal species present within retained habitat is at similar levels to pre-construction	Mammal diversity of monitoring areas within 20% of pre-construction data during the life of the monitoring program.	Yes.

Mitigation measure	Performance criteria	Performance target and timeframe	Are performance criteria being met?
			Native mammal diversity is 10% higher during the first year of post-construction monitoring when compared to pre-construction monitoring data.
	Reptile species similar diversity as pre-construction	Reptile diversity of monitoring areas within 20% of pre-construction data during the life of the monitoring program.	No. Twelve reptile species were recorded during pre-construction surveys and seven reptile species were recorded during post-construction surveys. This is a 42% decrease in reptile diversity. Survey conditions and surveyor experience may be factors, and further monitoring may detect additional species.
	Amphibians species similar diversity as pre-construction	Amphibians diversity of monitoring areas within 20% of pre-construction data during the life of the monitoring program.	No. Seven species of frog were recorded during pre-construction surveys and five species of frog were identified during post-construction surveys. This is a 29% decrease in amphibian diversity. Survey conditions and surveyor experience may be factors, and further monitoring may detect additional species.

5 RECOMMENDATIONS

The CoA require the development of potential contingency measures that would be implemented if circumstances arise where there are changes in habitat usage patterns as a result of the construction or operation phase of the Project, or where performance criteria are not met.

Table 5-1 and 5-2 below provide a list of mitigation and contingency measures in response to the performance criteria results in Section 4.4 and in accordance with Section 5 of the EcMP.

Table 5-1 Mitigation measures and contingency measures

Area of concern	Recommendation/Mitigation Measure
Roadkill rates – fauna fencing	• A fauna fence assessment should be conducted along the project alignment, to assess the current level of damage to fauna fences, and determine if installation of new areas of fauna fencing is feasible. This assessment should also assess whether the installation of fauna escape features is feasible in fenced areas • Restore damaged fauna fencing • Replace severely damaged fauna fencing • Where feasible, install fauna fencing in areas where roadkill hotspots are high, and no fence is present. Installation areas should focus on the terrestrial roadkill hotspots identified in Section 4.1.1 and within figures 3-2 to 3-11

Roadkill rates - Landscape Maintenance	• Plant non-preferred clumping species or non-desirable species to reduce grazing potential for macropods near the roadside in areas with no fencing. Examples include:
	  • Spiny-head Mat-rush *Lomandra lonigfolia*
	  • Coastal Rosemary *Westringia fruticosa*
	• Mowing these areas will also reduce habitat for small rodents and reptiles, reducing the foraging habitat for birds of prey and owls.
	• Supplement the loss of foraging habitat by implementing Weed Management recommendations by creating more suitable locations for foraging further from the road.
	• Control fruit-bearing vegetation which may attract birds/Flying Foxes adjacent to the road.

Reptile species diversity	• Continue monitoring • If continued low diversity, implement additional shelter structures in proximity to crossings
Amphibian diversity	• Continue monitoring • If continued low diversity, implement additional shelter structures in proximity to crossings

Two additional recommendations not triggered by the EcMP criteria are provided below.

Table 5-2 Additional measures

Area of concern	Recommendation/Mitigation Measure
Rope Bridges	Although data suggests that some rope bridges are being used by Ringtail Possums and roosting birds, there appears to be a lack of use by other mammals. The areas surrounding crossing structures would benefit from additional vegetation. It is understood that replanting has been undertaken

Area of concern	Recommendation/Mitigation Measure
	around these, thus additional time will be required before surrounding vegetation grows to the height of crossing structures.
Underpasses/ underpass bridges Wooden structures have been installed without connecting ropes	The areas surrounding crossing structures would benefit from additional vegetation. Ensure adequate connectivity of underpass structures to surrounding vegetation to enable use by fauna. It is understood that revegetation has taken place surrounding structures, and this will take time to grow to a height useable by fauna.

6 REFERENCES

AECOM (2012) Foxground and Berry Bypass Environmental Assessment, prepared for Roads and Maritime Services, from https://www.rms.nsw.gov.au/documents/projects/south-coast/foxground-and-berry-bypass/foxground-berry-bypass-environmental-assessment-main-report.pdf

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RTA Environmental Branch (2011) Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects, Transport Roads and Traffic Authority, NSW Government, from https://www.rms.nsw.gov.au/business-industry/partners-suppliers/documents/guides-manuals/biodiversity_guidelines.pdf

APPENDIX A TRANSECT SURVEY RESULTS SUMMARY

Fauna mitigation structure code and survey area site location with respect to structure (see Table 3.1) (N=north, S=south, E=east, W=west)

Common Name	Tracks, Scats & Signs		Herpetology Searches		Spotlight		Opportunistic		Camera		Roadkill		Call Playback	TR2 N		TR2 S		BCB1 N		BCB1 S		BCB2 E		BCB2 W		BCB3 N		BCB3 S		BCC2 W		BCC3 N		BCC3 S		PH1 N		PH 1 S		PH2 N		PH 2 S		PH3 N	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Arboreal mammals																																													
Black Rat*						X			X	X	X																															X			
Brown Antechinus								X																																					
Common Brushtail Possum	X				X	X			X		X	X		X														X					X		X				X			X	
Common Ringtail Possum					X	X				X	X	X			X		X		X		X	X	X		X		X		X		X		X		X			X			X	
Terrestrial mammals																																												
Common Wombat	X	X						X	X	X	X	X		X	X		X	X	X						X		X				X		X			X			X	X			X	X
Cat*												X																																	
Eastern Grey Kangaroo		X			X			X			X	X					X											X						X		X			X	X			X	X
European Rabbit*	X				X				X		X	X			X																X			X		X				X			
Hare*												X																																	
Long-nosed Bandicoot	X										X																														X			X	
Mountain Brushtail Possum									X														X																					
Platypus (Burrow)		X																																											
Red Fox*	X	X			X	X			X	X	X	X			X		X		X		X		X		X				X		X		X							X			
Rusa Deer*		X				X		X							X		X																											
Short-beaked echidna	X						X		X		X	X			X					X								X					X		X				X					
Sugar Glider		X			X	X						X	X				X				X		X						X						X		X				X		X		X
Swamp Wallaby	X				X									X			X		X		X		X												X	X		X			X	X		

Common Name	Tracks, Scats & Signs		Herpetology Searches		Spotlight		Opportunistic		Camera		Roadkill		Call Playback	TR2 N		TR2 S		BCB1 N		BCB1 S		BCB2 E		BCB2 W		BCB3 N		BCB3 S		BCC2 W		BCC3 N		BCC3 S		PH1 N		PH 1 S		PH2 N		PH 2 S		PH3 N	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Flying mammals																																											
Grey-headed Flying Fox						X		X				X			X		X		X		X		X		X		X				X		X			X		X		X		X		X
Microbat (unidentified)						X			X						X				X		X		X						X						X		X			X		X		X
Terrestrial reptiles																																											
Cream-striped Shinning Skink			X											X																					X					X				
Diamond Python				X																					X		X			X		X											
Eastern Blue Tongue Lizard			X								X	X												X					X											X			
Eastern Long-Necked Turtle											X	X																																
Eastern Small-eyed Snake			X																		X				X						X								X			X	
Eastern Water Dragon			X	X					X									X	X	X	X	X	X		X	X	X	X			X	X	X	X									
Eastern Water Skink			X	X										X				X		X		X		X		X		X	X	X		X		X		X		X	X	X		X	X	X	
Golden-crowned Snake											X																																	
Mainland She-oak Skink			X																																X									
Dark-flecked Garden Sunskink			X	X													X				X		X	X				X		X				X				X	X			X	X	
Red Bellied Black Snake			X								X	X																									X							

Common Name	Tracks, Scats & Signs		Herpetology Searches		Spotlight		Opportunistic		Camera		Roadkill		Call Playback	TR2 N		TR2 S		BCB1 N		BCB1 S		BCB2 E		BCB2 W		BCB3 N		BCB3 S		BCC2 W		BCC3 N		BCC3 S		PH1 N		PH 1 S		PH2 N		PH 2 S		PH3 N	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Pale-flecked Garden Sunskink			X																	X																				X			
Weasel Skink			X																	X																							
Amphibians																																											
Bibron's Toadlet			X		X																	X				X				X													
Bleating Tree Frog			X																																								
Common Eastern Froglet			X	X	X	X											X				X		X														X		X		X		X	
Eastern Dwarf Tree Frog			X	X		X									X		X		X						X		X				X		X			X		X		X		X	
Green Stream Frog				X	X	X												X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X									
Peron's Tree Frog			X																																									
Whistling Tree Frog				X		X															X		X																					
Striped Marsh Frog				X	X	X					X	X					X				X		X									X				X		X		X		X	
Birds																																											
Australasian Bittern								X																				X						X									
Australasian Figbird								X																																			
Australasian Swamphen										X																																	
Australian Magpie								X		X		X			X										X		X		X		X		X		X				X				X	
Australian Raven								X		X	X	X			X						X		X		X		X				X		X						X				
Australian Wood Duck								X				X							X																				X				
Barn Owl												X			X		X																		X		X						
Black Bittern								X													X		X																				

Common Name	Tracks, Scats & Signs		Herpetology Searches		Spotlight		Opportunistic		Camera		Roadkill		Call Playback	TR2 N		TR2 S		BCB1 N		BCB1 S		BCB2 E		BCB2 W		BCB3 N		BCB3 S		BCC2 W		BCC3 N		BCC3 S		PH1 N		PH 1 S		PH2 N		PH 2 S		PH3 N	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Black-faced Cuckoo-shrike								X				X					X																										
Black Shouldered Kite								X																												X				X				X
Brown Cuckoo-Dove								X																				X						X		X				X				X
Brown Falcon								X									X				X		X																				
Brown Thornbill		X						X							X		X																			X				X				X
Brush Cuckoo								X																				X						X									
Catbird								X													X		X																				
Common Myna*										X		X															X						X		X								
Common Starling*										X																																		
Crimson Rosella		X						X				X			X											X		X		X		X		X		X				X				X
Domestic Goose*						X																				X		X				X		X								
Eastern Rosella								X																					X						X								
Eastern Spinebill								X																		X		X				X		X								
Eastern Whipbird								X						X												X		X				X		X								
Eastern Yellow Robin						X		X	X					X					X							X		X		X		X		X		X					X		
Eurasian Coot						X																														X				X				X
Golden Whistler								X						X																						X				X				X
Great Cormorant								X																		X		X				X		X								
Grey Butcherbird								X			X					X				X		X																				
Grey Fantail						X		X						X				X		X		X		X		X		X		X		X		X		X		X		X		X

Common Name	Tracks, Scats & Signs		Herpetology Searches		Spotlight		Opportunistic		Camera		Roadkill		Call Playback	TR2 N		TR2 S		BCB1 N		BCB1 S		BCB2 E		BCB2 W		BCB3 N		BCB3 S		BCC2 W		BCC3 N		BCC3 S		PH1 N		PH 1 S		PH2 N		PH 2 S		PH3 N	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Grey Shrike-Thrush								X		X							X												X					X									
Grey Teal								X																																				
Laughing Kookaburra								X				X					X		X																	X				X				X
Lewin's Honeyeater								X		X					X		X				X		X		X		X				X		X			X		X		X		X		X
Little Eagle											X																																	
Little Pied Cormorant								X																															X					
Magpie Lark								X		X		X			X														X				X		X			X				X	
Masked Owl (possible)													X																															
Nankeen Kestrel								X													X		X																					
New Holland Honeyeater								X																					X					X									
Pacific Black Duck						X		X				X							X						X		X		X		X		X		X								
Purple Swamphen								X			X	X																										X						
Quail								X																													X				X			X
Rainbow Lorikeet											X																																	
Red-browed Finch								X							X		X		X		X		X																		X			
Red-whiskered Bulbul*								X				X							X																									
Rock Dove*												X																	X					X									
Rufous Fantail								X																													X				X			X
Sacred Kingfisher								X											X																									
Satin Bowerbird								X	X		X																																	
Shining Bronze-Cuckoo								X													X		X																					

Common Name	Tracks, Scats & Signs		Herpetology Searches		Spotlight		Opportunistic		Camera		Roadkill		Call Playback	TR2 N		TR2 S		BCB1 N		BCB1 S		BCB2 E		BCB2 W		BCB3 N		BCB3 S		BCC2 W		BCC3 N		BCC3 S		PH1 N		PH 1 S		PH2 N		PH 2 S		PH3 N	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Short-Billed Corella												X																																
Silvereye								X									X				X		X																				
Southern Boobook						X		X			X	X					X																											
Sulphur Crested Cockatoo												X																																
Superb Fairy-wren		X						X		X					X		X		X		X		X		X		X		X		X		X		X		X		X		X		X
Welcome Swallow								X																	X		X				X		X										
White-Faced Heron									X																																			
Willy Wagtail								X		X							X		X										X						X									
Yellow-tail Black Cockatoo								X							X																											X		
Yellow Thornbill								X		X							X		X		X		X		X		X				X		X				X				X		X
Yellow-throated Scrubwren								X									X																				X				X		X
Yellow-rumped Thornbill								X																													X				X		X
Aquatic																																												
Common Yabby						X		X							X																												
Cox's Gudgeon						X													X																								
Short-fin Eel						X		X																				X						X									
Unidentified																																												
Unidentified												X			X													X						X									
Unidentified Mammal												X			X																												
Unidentified Bird												X								X																								

Common Name	Tracks, Scats & Signs		Herpetology Searches		Spotlight		Opportunistic		Camera		Roadkill		Call Playback	PH 3 S		PH4 N		PH 4 S		PH5 N		PH 5 S		BM C N		BM C S		BAB N		BAB S		BCCC N		BCCC S	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Arboreal mammals																																			
Black Rat*						X			X	X	X				X				X				X						X				X		
Brown Antechinus								X																											
Common Brushtail Possum	X				X	X			X		X	X					X				X						X	X	X		X		X		X
Common Ringtail Possum					X	X				X	X	X					X				X				X						X			X	
Terrestrial mammals																																			
Common Wombat	X	X						X	X	X	X	X				X	X			X	X		X												X
Cat*												X											X												
Eastern Grey Kangaroo		X			X			X			X	X				X	X			X	X		X				X						X		X
European Rabbit*	X				X				X		X	X			X				X				X										X		X
Hare*												X									X														
Long-nosed Bandicoot	X										X					X				X															
Mountain Brushtail Possum									X																										
Platypus (Burrow)		X																											X				X		
Red Fox*	X	X			X	X			X	X	X	X			X				X		X		X										X		X
Rusa Deer*		X				X		X																											
Short-beaked echidna	X						X		X		X	X			X				X					X			X				X				
Sugar Glider		X			X	X						X	X		X		X		X		X					X		X	X	X		X	X	X	X
Swamp Wallaby	X				X										X	X		X	X	X			X												
Flying mammals																																			
Grey-headed Flying Fox						X		X				X			X		X		X		X		X				X				X				X
Microbat (unidentified)						X			X						X		X		X		X		X				X		X		X		X		X
Terrestrial reptiles																																			

Common Name	Tracks, Scats & Signs		Herpetology Searches		Spotlight		Opportunistic		Camera		Roadkill		Call Playback	PH 3 S		PH4 N		PH 4 S		PH5 N		PH 5 S		BM C N		BM C S		BAB N		BAB S		BCCC N		BCCC S	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Cream-striped Shinning Skink			X											X				X				X													
Diamond Python				X																														
Eastern Blue Tongue Lizard			X								X	X				X				X														
Eastern Long-Necked Turtle											X	X											X											X
Eastern Small-eyed Snake			X													X				X														
Eastern Water Dragon			X	X					X															X		X	X	X			X	X			X
Eastern Water Skink			X	X										X	X	X		X	X	X		X	X	X		X		X	X	X		X	X	X	
Golden-crowned Snake											X																								
Mainland She-oak Skink			X																																
Dark-flecked Garden Sunskink			X	X											X	X			X	X			X					X				X			
Red Bellied Black Snake			X								X	X																	X				X	X	
Pale-flecked Garden Sunskink			X											X				X				X		X		X		X				X			
Weasel Skink			X																																
Amphibians																																			
Bibron's Toadlet			X		X																														
Bleating Tree Frog			X																																
Common Eastern Froglet			X	X	X	X									X		X		X		X		X					X				X			
Eastern Dwarf Tree Frog			X	X		X									X		X		X		X		X					X	X			X	X		
Green Stream Frog				X	X	X																		X		X				X					X	

Common Name	Tracks, Scats & Signs		Herpetology Searches		Spotlight		Opportunistic		Camera		Roadkill		Call Playback	PH 3 S		PH4 N		PH 4 S		PH5 N		PH 5 S		BM C N		BM C S		BAB N		BAB S		BCCC N		BCCC S	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Peron's Tree Frog			X																															
Whistling Tree Frog				X		X																												
Striped Marsh Frog				X	X	X					X	X			X		X		X		X		X											
Birds																																		
Australasian Bittern								X																										
Australasian Figbird								X																		X				X				X
Australasian Swamphen										X																								
Australian Magpie								X		X		X					X				X					X		X		X		X		X
Australian Raven								X		X	X	X														X		X		X		X		X
Australian Wood Duck								X				X																						
Barn Owl												X										X										X		
Black Bittern								X																										
Black-faced Cuckoo-shrike								X				X																X				X		X
Black Shouldered Kite								X									X				X												
Brown Cuckoo-Dove								X									X				X												
Brown Falcon								X																										
Brown Thornbill		X						X									X				X					X		X		X		X		X
Brush Cuckoo								X																										
Catbird								X																										
Common Myna*										X		X																				X		X
Common Starling*										X																								
Crimson Rosella		X						X				X					X				X													X
Domestic Goose*						X																												
Eastern Rosella								X																										
Eastern Spinebill								X																										

Common Name	Tracks, Scats & Signs		Herpetology Searches		Spotlight		Opportunistic		Camera		Roadkill		Call Playback	PH 3 S		PH4 N		PH 4 S		PH5 N		PH 5 S		BM C N		BM C S		BAB N		BAB S		BCCC N		BCCC S	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Eastern Whipbird								X																			X				X				X
Eastern Yellow Robin						X		X	X						X				X				X						X				X		
Eurasian Coot						X											X				X						X				X				X
Golden Whistler								X									X				X														
Great Cormorant								X																											
Grey Butcherbird								X			X																								
Grey Fantail						X		X							X		X		X		X		X						X				X		
Grey Shrike-Thrush								X		X															X		X				X				X
Grey Teal								X																			X		X		X		X		X
Laughing Kookaburra								X				X					X				X								X				X		X
Lewin's Honeyeater								X		X					X		X		X		X		X		X		X				X				X
Little Eagle											X																								
Little Pied Cormorant								X																											
Magpie Lark								X		X		X			X				X				X				X		X		X		X		X
Masked Owl (possible)													X																						
Nankeen Kestrel								X																											
New Holland Honeyeater								X																											
Pacific Black Duck						X		X				X															X		X		X		X		X
Purple Swamphen								X			X																X				X				X
Quail								X									X				X														
Rainbow Lorikeet											X																								
Red-browed Finch								X							X				X				X												
Red-whiskered Bulbul*								X				X																							
Rock Dove*												X																							
Rufous Fantail								X									X				X														

Common Name	Tracks, Scats & Signs		Herpetology Searches		Spotlight		Opportunistic		Camera		Roadkill		Call Playback	PH 3 S		PH4 N		PH 4 S		PH5 N		PH 5 S		BM C N		BM C S		BAB N		BAB S		BCCC N		BCCC S	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Sacred Kingfisher								X																										
Satin Bowerbird								X	X		X																							
Shining Bronze-Cuckoo								X																										
Short-Billed Corella												X																				X		X
Silvereye								X																										
Southern Boobook						X		X			X	X																				X		X
Sulphur Crested Cockatoo												X																						X
Superb Fairy-wren		X						X		X					X		X		X		X		X		X		X		X		X		X
Welcome Swallow								X																										
White-Faced Heron									X																				X			X		
Willy Wagtail								X		X														X				X				X		
Yellow-tail Black Cockatoo								X							X				X				X											
Yellow Thornbill								X		X							X				X						X				X			X
Yellow-throated Scrubwren								X									X				X													
Yellow-rumped Thornbill								X									X				X													
Aquatic																																		
Common Yabby						X		X																										
Cox's Gudgeon						X																												
Short-fin Eel						X		X																										
Unidentified																																		
Unidentified												X																						
Unidentified Mammal												X								X				X								X		
Unidentified Bird												X																				X		X

TSS = Track, Scats, Signs, HS = Herpetological surveys, SP = Spotlighting, CP = Call playback, OP = Opportunistic, CS = Camera survey, RK = Roadkill surveys, * = exotic, **bold =** listed as threatened under the BC Act and/or EPBC Act

APPENDIX B SPOTLIGHT SURVEY RAW DATA

X	Y	Name	Description	Time
150.7523792	-34.75930759	Spotlight Transect 8	Spotlight T8 List End time 1030 Microbat - 6 Eel *Litoria nudidigata* - 5 Sugar glider Common Ringtail Possum Common Brushtail Possum Masked Owl - return call after playback	14 Feb 2018 at 8:30 pm
150.7397028	-34.76076766	Spotlight Transect 10	Spotlight Transect 10 List End time 1110 *Crinia signifera* *Litoria fallax* *Lymnodynastes peronii*	14 Feb 2018 at 10:35 pm
150.7323346	-34.76355146	Spotlight Transect 11	Spotlight Transect 11 List end time 1215am *Litoria fallax* *Litoria verreauxii* Swamp wallaby – 2 Microbat – 6 Fox – 1 Sugar glider - 1 GHFF Black rat *Lymnodynastes peronii*	14 Feb 2018 at 11:12 pm
150.7235787	-34.76172055	Spotlight Transect 9	Spotlight Transect 9 List End time 2330 Sugar Glider - 4 calls GHFF colony flying overhead BTP – adult 1 subadult 1 RTP - adult 5 Microbat - 6 *Litoria fallax* *Lymnodynastes peronii* *Crinia signifera*	15 Feb 2018 at 8:11 pm
150.7000025	-34.77120046	Spotlight Transect 14	Spotlight Transect List End time 2145 *Litoria fallax* - 10+ White-faced Heron - 2 Black rat - 3 Grey Fantail Microbat sp 3 Eastern Yellow Robin Common Brushtail Possum adult 2 Sugar Glider 2 Pacific Black Duck	13 Feb 2018 at 8:30 pm
150.7012776	-34.77177218	Spotlight Transect 13	Spotlight Transect 13 List End time 1145 Sugar Glider 1 Microbat 3	13 Feb 2018 at 10:00 pm

X	Y	Name	Description	Time
			Grey-headed Flying-fox heard 2 Black Rat 1 Eurasian Coot 1 Common Brushtail Possum 1	
150.7761485	-34.74774649	Spotlight Transect 1 and 2	Spotlight Transect 1 and 2 End time 2230 *Litoria fallax* Freshwater yabbie x4 Brown snail 10+ Common Ringtail Possum 1 Grey-headed Flying-fox 1 call Microbat 1	19 Feb 2018 at 8:22 pm
150.758811	-34.74584045	Spotlight Transect 4	Spotlight Transect 4 List End time 2200 *Litoria fallax* in culvert Grey-headed Flying-fox 3 Microbat Gudgon in creek Common Ringtail Possum *Litoria nudidigita* Swamp wallaby	20 Feb 2018 at 8:45 pm
150.7509382	-34.75522306	Spotlight Transect 7	Spotlight Transect 7 List End time 12 *Litoria fallax* Geese 4 Red Fox 1 Common Ringtail Possum 2 Grey-headed Flying-fox 1 *Litoria nudidigita* heard 2	20 Feb 2018 at 10:29 pm
150.7544068	-34.75170205	Spotlight Transect 5 and 6	Spotlight transect 6 List End time 11 *Crinia signifera* calling 5+ *Litoria verreauxii* calling 2 Swamp wallaby 1 Grey-headed Flying-fox 2 *Lymnodynastes peronii* *Litoria nudidigata* Microbat 20 many foraging just over water level - possible *Myotis macropus* Common Ringtail Possum 1 Sugar Glider 1	21 Feb 2018 at 8:35 pm
150.7740185	-34.74816468	Spotlight Transect 3	Spotlight Transect 3 List End time Fox Swam Wallaby 5 *Litoria fallax* *Lymnodynastes peronii* Grey-headed Flying-fox 1 Common Ringtail Possum 1 Southern Boobook Sugar glider 1 Rusa deer	22 Feb 2018 at 8:50 pm

APPENDIX C CAMERA AUTOMATED DETECTION SURVEY

Common Name	Scientific name	Camera Number															
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	TOTAL
Superb Fairy-wren	*Malurus cyaneus*	10	18	38					8				2				76
Australian Magpie Lark	*Grallina cyanoleuca*	1						3								1	5
Willy Wagtail	*Rhipidura leucophrys*		30	4				27	4		1		24				90
Lewin's Honeyeater	*Meliphaga lewinii*		2	2	3								3				10
Grey Shrike-thrush	*Colluricincla harmonica*		5	4						5	2	1					17
Yellow Thornbill	*Acanthiza nana*												2				2
Common Ringtail Possum	*Pseudocheirus peregrinus*		2					37	1				55				95
Common Wombat	*Vombatus ursinus*					1											1
Common Myna	*Acridotheres tristis*								2							5	7
Common Starling	*Sturnus vulgaris*															1	1
Australian Magpie	*Cracticus tibicen*							26								1	27
Australian Raven	*Corvus coronoides*						7			2		77			1	1	88
Australasian Swamphen	*Porphyrio melanotus*													1			1
Black rat	*Rattus rattus*													14			14
Red fox	*Vulpes vulpes*													8			8
Unknown bird			1	1	1						2						5
TOTAL		11	58	49	4	1	7	93	15	8	5	78	86	23	1	9	448

APPENDIX D ROADKILL MONITORING RESULTS

D.1 ROADKILL SPECIES LIST

Common Name	Scientific name	Number of individuals detected
Red fox*	*Vulpes vulpes*	13
Echidna	*Tachyglossidae aculeatus*	9
Barn Owl	*Tyto alba*	8
Common Wombat	*Vombatus ursinus*	8
Eastern Grey Kangaroo	*Macropus giganteus*	8
Rabbit*	*Oryctolagus cuniculus*	8
Short-Billed Corella	*Cacatua sanguinea*	8
Common Myna*	*Acridotheres tristis*	7
Australian Magpie	*Cracticus tibicen*	5
Southern Boobook	*Ninox boobook*	3
Swamp Wallaby	*Wallabia bicolor*	4
Eastern Long-Necked Turtle	*Chelodina longicollis*	3
Magpie Lark	*Grallina cyanoleuca*	2
Striped Marsh Frog	*Limnodynastes peronii*	2
Sulphur Crested Cockatoo	*Cacatua galerita*	2
Australian Raven	*Corvus coronoides*	1
Australian Wood Duck	*Chenonetta jubata*	1
Black Faced Cuckoo-shrike	*Coracina novaehollandiae*	1
Blue Tongue Lizard	*Tiliqua scincoides scincoides*	1
Common Brushtail Possum	*Trichosurus vulpecula*	1
Cat*	*Felis catus*	1
Crimson Rosella	*Platycercus elegans*	1
Grey-headed Flying Fox	*Pteropus poliocephalus*	2
Hare*	*Lepus sp.*	1
Kookaburra	*Dacelo novaeguineae*	1
Pacific Black Duck	*Anas superciliosa*	1
Rock Dove	*Columba livia domestica*	1
Red Bellied Black Snake	*Pseudechis porphyriacus*	1
Common Ringtail Possum	*Pseudocheirus peregrinus*	2
Sugar Glider	*Petaurus breviceps*	1
Purple Swamp Hen	*Porphyrio porphyrio*	2
Black Rat*	*Rattus rattus*	1

D.2 ROADKILL RAW DATA

Date	Time	Northbound or southbound?	Latitude	Longitude	Common name	Closest habitat	Sex or Age	Distance from edge of road (m)	Pouch young?	Comment
20 Feb 2018	6:38 am	South	150.7293196	-34.76307527	Echidna	Open grassland. Open forest 50m away.		2	None.	One large adult echidna (30cm) found 2m from road edge. South bound.
20 Feb 2018	6:46 am	South	150.7278196	-34.76294504	Echidna	Open grassland. 50m from open forest.	Juvenile	2	None	Young echidna found 2m from road edge.
20 Feb 2018	6:30 am	South	150.7735926	-34.74713424	Unidentified mammal	Grassland, landscape. Open forest 100m away.		2		Unidentifiable. Looks like the remains of an echidna
20 Feb 2018	6:46 am	South	150.6869625	-34.77354431	Short-billed Corella	Landscape revegetation strip between off ramp and bypass. Closest tall trees 100m away.		1		Remains of what seems to be a Corella. Hard to identify due to time spent on the road. Could not access due to traffic and being between lanes.
20 Feb 2018	6:51 am	South	150.6863504	-34.77387392	Bird Remains	Landscape revegetation strip. Under overpass Kangaroo Valley Rd.		0		Rosella remains
20 Feb 2018	6:55 am	South	150.6862699	-34.77391067	Bird Remains	Landscape revegetation strip. Closest trees >100m away. Was found under the Kangaroo Valley Rd overpass.		0		Remains of an unidentifiable bird species. Found 1m from median. Far right lane. Difficulty in identification due to traffic and being in the far right lane.
20 Feb 2018	7:14 am	North	150.6857854	-34.77395285	Bird Remains	Landscape revegetation strip.		2		Difficult to identify due to decay from time on road. Possibly a Corella due to colours in feathers. Found between off ramp and bypass. Close proximity to Kangaroo Valley Rd over pass where other bird remains were found (approximately 50m).

Date	Time	Northbound or southbound?	Latitude	Longitude	Common name	Closest habitat	Sex or Age	Distance from edge of road (m)	Pouch young?	Comment
20 Feb 2018	7:18 am	North	150.6860119	-34.77382257	Corella	Landscape revegetation area. Closest trees 100m away.		3		Remains of a Corella found between off ramp and bypass. Close proximity to Kangaroo Valley Rd over pass where other bird remains were found (approximately 30m).
20 Feb 2018	7:37 am	North	150.7729414	-34.74654184	Ringtail Possum	30m from landscape revegetation area. Close proximity to a landscape revegetation strip. Grassland East across the bypass. Closest trees approximately 50m away over a rock wall, or 150m further north down the bypass (possum rope bridge to tree line). Dens		2		Remains of a ringtail possum. 2m from edge. Habitat is scarce from area. Found between rock walls either side of bypass.
20 Feb 2018	7:50 am	North	150.7738255	-34.7470627	Unidentified	Grassland/landscape revegetation area to the East. Wet sclerophyll to the West. Closest trees 50m away. Approximately 30m from Possum rope bridge.		1		Unidentified due to decay and time on road. Approximately 1m from median. Possible brush tail possum.
20 Feb 2018	7:55 am	North	150.7739794	-34.74717229	Echidna	Dense wet sclerophyll 50m to the West. Grassland 50m to the East.		1		Echidna remains. ~25-30cm. Found on median strip between the lanes.
20 Feb 2018	8:00 am	North	150.7743718	-34.74731138	Wombat	50m from dense wet sclerophyll forest/ littoral rainforest		4		Wombat remains. 4m from road edge, on edge of landscape strip.
2-Mar-18	7:14 AM	South	150.6785769	-34.78276208	Short-billed Corella	Open forest 20m.		2		Short-billed Corella
2-Mar-18	7:18 AM	South	150.6734428	34.78927263	Purple Swamp Hen	2m to bridge edge. Under bridge is swamp/creek. Another waterbody (larger pond) 50m south, 20m off		5		Blue Swamp Hen

Date	Time	Northbound or southbound?	Latitude	Longitude	Common name	Closest habitat	Sex or Age	Distance from edge of road (m)	Pouch young?	Comment
						road. Both waterbodys surrounded by grassland.				
2-Mar-18	6:52 AM	South	150.7326078	-34.76276248	Unidentified	Landscape reverberation slopes to open grassland. 50m to nearest tall tree.		2		Unidentifiable road kill.
2-Mar-18	7:10 AM	South	150.6801593	-34.78083262	Short-billed Corella	Open grassland 50m. 150m to nearest tree/open forest.		1		Short-billed corella
2-Mar-18	7:44 AM	North	150.706568	-34.7707618	Australian Magpie	Riparian trees below bridge. Grassland 50m away. Closest tree 30m away		3		Magpie
8-Mar-18	6:51 AM	South	150.6857656	-34.77427747	Common Ringtail Possum	Landscape revegetation/urban		1		Ringtail possum found near landscape revegetation/urban. 75m to nearest tree. 1m from road edge.
2-Mar-18	7:30 AM	North	150.6843258	-34.7752969	Purple Swamp Hen	Landscape revegetation slopes. Open forest opposite side of road 50m.		3		Blue Swamp Hen. Landscape revegetation slopes. 100m to open forest. No immediate waterbodys around.
2-Mar-18	7:41 AM	North	150.7054204	-34.77082737	Grey-headed Flying-fox	Close proximity (50m) to local population identified during diurnal survey		1		Grey headed flying fox. Close proximity to local population identified during diurnal survey.
8-Mar-18	7:15 AM	North	150.6796099	-34.78106489	Black Rat	Grassland		2		Underpass. Grassland
8-Mar-18	7:36 AM	North	150.7637412	-34.74466177	Common Myna	Landscape revegetation slope		2		Adult Common Myna found near landscape revegetation slope.
8-Mar-18	6:56 AM	South	150.6850533	-34.7750271	Australian Magpie	Landscape/urban		5		Adult Magpie found near landscape revegetation area on other side of metal rope.

Date	Time	Northbound or southbound?	Latitude	Longitude	Common name	Closest habitat	Sex or Age	Distance from edge of road (m)	Pouch young?	Comment
8-Mar-18	7:09 AM	North	150.6675991	-34.7974032	Eastern Long-necked Turtle	Swamp/ grassland		2		Adult turtle. Unsure if long or short neck due to state. Near swamp/grassland. Suspect it was hit by mowers recently (recently mowed edge within 1m)
12-Mar-18	7:36 AM	South	150.7401896	-34.7597388	Swamp Wallaby	Landscape revegetation/ grassland		7		Possible swamp wallaby previously missed or potentially recorded by prior surveyor. Only skeleton and some fur remaining for ID
12-Mar-18	7:22 AM	South	150.7476688	-34.75775454	Common Myna	Grassland/landscape revegetation to East. Wet sclerophyll to West across bypass. Closest tree 75m.		5		Adult common myna
12-Mar-18	7:28 AM	South	150.7429289	-34.75881945	Unidentified	Grassland/open forest to East. Grassland/dry rainforest to West.		8		Unidentified bird. Found between bypass and on ramp south bound. Possibly a Tawny frog mouth.
2-Mar-18	7:14 AM	South	150.6785769	-34.78276208	Short-billed Corella	Open forest 20m.		2		Short-billed Corella
2-Mar-18	7:18 AM	South	150.6734428	34.78927263	Purple Swamp Hen	2m to bridge edge. Under bridge is swamp/creek. Another waterbody (larger pond) 50m south, 20m off road. Both waterbodys surrounded by grassland.		5		Blue Swamp Hen
2-Mar-18	6:52 AM	South	150.7326078	-34.76276248	Unidentified	Landscape reverberation slopes to open grassland. 50m to nearest tall tree.		2		Unidentifiable road kill.
2-Mar-18	7:10 AM	South	150.6801593	-34.78083262	Short-billed Corella	Open grassland 50m. 150m to nearest tree/open forest.		1		Short-billed corella

Date	Time	Northbound or southbound?	Latitude	Longitude	Common name	Closest habitat	Sex or Age	Distance from edge of road (m)	Pouch young?	Comment
19 Mar 2018	7:25 am	South	150.6785158	-34.7830518	Crimson Rosella	Landscape reveg slope 20 m to open forest HBT 25 m away (big hollow) habitat tree	Adult	5		
19 Mar 2018	7:40 am	North	150.6884354	-34.7971742	Rabbit	Grassland/swampland 10 m grassland across bypass	Adult	1		
26 Mar 2018	7:20 am	South	150.6854376	-34.7745606	Unidentified bird	See photos: rest area casurina/euc/melaleuca open forest or landscape - right next to road	Adult	10		Little Corella or Sulphur Crested Cockatoo size: more likely corella. middle of road
26 Mar 2018	7:20 am	South	150.6854376	-34.7745606	Unidentified bird	See photos: rest area casurina/euc/melaleuca open forest or landscape - right next to road	Adult	5		2nd Bird white Corella feathers (+black: dirty)
26 Mar 2018	7:57 am	North	150.687406	-34.772967	Unidentified bird	Slope (weeds) + landscape (feihlise)		10		Bird - whitish side of road lost his colours
26 Mar 2018	7:57 am	North	150.687406	-34.772967	Unidentified bird	Slope (weeds) + landscape (feihlise)		10		Bird - Indian middle road can't ID or spray
26 Mar 2018	8:05 am	North	150.6893748	-34.7723101	Unidentified mammal			7		?fox/dog mammal
26 Mar 2018	8:23 am	North	150.7742823	-34.758266	Southern Boobook			16		middle of road
26 Mar 2018	8:36 am	North	150.7456975	-34.7579944	Magpie Lark			3		small
26 Mar 2018	8:44 am	North	150.746806	-34.7577699	Echidna			10		

Date	Time	Northbound or southbound?	Latitude	Longitude	Common name	Closest habitat	Sex or Age	Distance from edge of road (m)	Pouch young?	Comment
26 Mar 2018	8:44 am	North	150.746806	-34.7577699	Unidentified amphibian			2		Frog
26 Mar 2018	8:57 am	North	150.7738566	-34.7469899	Unidentified mammal			16		Fox?. Middle of road.
26 Mar 2018	9:01 am	North	150.7738566	-34.7469899	Echidna			10		
3 April 2018	7:33 am	South	150.6864361	-34.7738394	Unidentified bird	Under overpass / near rest area (previously 2 corellas) 26/03		3		Bird: Beak Parrot
9 April 2018	7:09 am	South	150.6767637	-34.7848981	Australian Magpie	50 m from open forest grassland		4		
9 April 2018	7:26 am	North	150.676238	-34.7850361	Fox	50 m from open forest grassland		1		
9 April 2018	7:49 am	North	150.69086	-34.7721228	Southern Boobook	landscape reveg	Adult	0.1		
16 April 2018	7:05 am	south	150.7434984	-34.7587001	Common myna	landscape revetation area on ramp median. Open forest 50 m away	Adult	3		
16 April 2018	7:15 am	South	150.6858141	-34.7742588	Sulphur Crested Cockatoo	Landscape revetation. Bridge urban area.	Adult	1		Median
23 April 2018	6:54 AM	South	150.7619667	-34.7452621	Unidentified bird	Grassland	Adult	10		Median

Date	Time	Northbound or southbound?	Latitude	Longitude	Common name	Closest habitat	Sex or Age	Distance from edge of road (m)	Pouch young?	Comment
23 April 2018	7:00 AM	South	150..7546742	-34.7509704	Echidna	Grassland/open forest		10		Median
23 April 2018	7:07	South	150.7511172	-34.7556933	Pigeon	Grassland/ Waterbody		2		
23 April 2018	7:17	South	150.7467999	-34.7580068	Echidna	Grassland/ Open forest		10		Median
23 April 2018	7:17	South	150.7467999	-34.7580068	Blue tongue lizard	Grassland/ Open forest		10		Median
23 April 2018	7:56	South	150.6789480	-34.7822714	Common Myna	Tall open forest/ shrubby understory		10		Median
23 April 2018	08:02:00	South	150.6764700	-34.7850953	Australian Magpie	Grassland		2		
23 April 2018	08:15:00	North	150.6756462	-34.7857170	Common Mynah	Grassland/ Waterbody		5		Median
23 April 2018	08:30:00	North	150.687578	-34.7729328	Unidentified Bird	Revegetation landscape		10		Median
23 April 2018	08:37:00	North	150.6947422	-34.7724814	Unidentified Bird	Revegetation landscape		5		
23 April 2018	08:43:00	North	150.7171028	-34.7667902	Wombat	Revegetation landscape/open forest		4		

Date	Time	Northbound or southbound?	Latitude	Longitude	Common name	Closest habitat	Sex or Age	Distance from edge of road (m)	Pouch young?	Comment
23 April 2018	08:52:00	North	150.7221138	-34.7638211	Wombat	Revegetation landscape		0		
23 April 2018	09:01:00	North	150.7522675	-34.7540879	Common Mynah	Grassland		5		
23 April 2018	09:11:00	North	150.7871467	-34.7502938	Rabbit	Grassland		1		
30 April 2018	07:35:00	South	150.7202269	-34.7652377	Unidentified Mammal, Possibly Cat	Landscape revegetation area		10		
30 April 2018	08:10:00	North	150.7122983	-34.7688465	Hare	Grassland		10		
7 May 2018	07:20:00	South	150.7565926	-34.7483800	Fox	Grassland		0.5		
7 May 2018	07:24:00	South	150.7498133	-34.7567249	Eastern Grey Kangaroo	Grassland/landscape revegetation		10		
14 May 2018	07:18:00	South	150.7760493	-34.7486495	Fox	Grassland/landscape revegetation		3		
14 May 2018	07:27:00	South	150.7520764	-347546509	Unidentified	Grassland		3		Middle of lane
14 May 2018	07:44:00	South	150.7167202	-34.7670940	Wombat	Open forest		4		

Date	Time	Northbound or southbound?	Latitude	Longitude	Common name	Closest habitat	Sex or Age	Distance from edge of road (m)	Pouch young?	Comment
14 May 2018	07:56:00	South	150.6709617	-34.7923394	Fox	Grassland		5		
21 May 2018	07:50:00	South			Fox	Grassland		1		Could not stop in traffic
21 May 2018	08:07:00	North	150.7769298	-347487941	Australian Magpie	Lanscape revegtation		10		
28 May 2018	07:35:00	South	150.6952760	-34.7727157	Southern Boobook	Landscape revegetation		3		
28 May 2018	07:50:00	North	150.6720557	-34.7908972	Rabbit	Grassland		5		
28 May 2018	08:15:00	North	150.7352600	-34.7614370	Barn Owl	Landscape / Open forest		5		
28 May 2018	08:30:00	North	150.7397473	-34.7595347	Eastern Grey Kangaroo	lansdscape		3		
11 June 2018	07:11:00	South	150.6986777	-34.7721110	Black faced cuckoo	Landscape		7		
11 June 2018	07:47:00	North	150.7648427	-34.7445306	Fox	Grassland		10		
11 June 2018	08:05:00	North	150.7890993	-34.7496869	Barn Owl	Grassland		10		

Date	Time	Northbound or southbound?	Latitude	Longitude	Common name	Closest habitat	Sex or Age	Distance from edge of road (m)	Pouch young?	Comment
19 June 2018	No Roadkill Observed									
26 June 2018	No Roadkill Observed									
2 July 2018	07:20:00	North	150.6871053	-34.7731575	Fox	Landscape/ grassland		0.5		
10 July 2018	08:15:00	North	150.6798767	-34.7806478	Barn Owl	Grassland		10		
10 July 2018	08:38:00	North	150.7672554	-34.7446348	Rabbit	Grassland		10		
16 July 2018		South	150.7351940	-34.761974	Rabbit			0		
16 July 2018		North	150.7136800	-34.768220	Fox	Open forest		0		
16 July 2018		North	150.6895100	-34.772240	Eastern Grey Kangaroo	Landscape		0		Potentially previously recorded
24 July 2018	07:03:00	South	150.7855920	-34.7510329	Eastern Grey Kangaroo	Grassland		3		
24 July 2018	08:45:00	North	150.7230398	-34.7634209	Eastern Grey Kangaroo	Landscape		5		

Date	Time	Northbound or southbound?	Latitude	Longitude	Common name	Closest habitat	Sex or Age	Distance from edge of road (m)	Pouch young?	Comment
24 July 2018	08:55:00	North	150.7591464	-34.7462390	Wombat	Waterbody/ Grassland		5		
7 August 2018	07:00:00	South	150.7779520	-34.750054	fox	grassland		10		
7 August 2018	07:07:00	South	150.7661730	-34.744785	barn owl?	sandstone/grassland		2		
7 August 2018	07:31:00	South	150.6714620	-34.792584	fox	grassland		1		
7 August 2018	07:46:00	North	150.7357020	-34.761214	rabbit	Grassland/open forest		0		
7 August 2018	07:55:00	North	150.7810700	-34.750381	barn owl?	grassland		1		
14 August 2018	07:48:00	North	150.7291140	-34.7627858	common wombat	Tall open forest	male	3		
21 August 2018	08:02:00	North	150.6705835	-34.7934788	Fox	grassland		1		near Croziers road
21 August 2018	08:26:00	North	150.6974596	-34.7722412	Brushtail possum	reveg lanscape/grassland/patch of forest	Couldn't see pouch or testis	1		
28 August 2018	No Roadkill Observed									

Date	Time	Northbound or southbound?	Latitude	Longitude	Common name	Closest habitat	Sex or Age	Distance from edge of road (m)	Pouch young?	Comment
4 September 2018	07:55:00	South	150.684241	-34.7759159	turtle	Landscape revegetation		1		
13 September 2018	08:38:00	North	150.7078438	-34.7705882	Fox ?	Landscape revegetation				
13-Sep-18		South	150.7124679	-34.7688047	owl barn?	Grassland		3		could take a good photo. Middle of road
13-Sep-18		South	150.7165663	-34.7669489	? really furry	Open forest		7		
18 September 2018	No Roadkill Observed									
25 September 2018	7:17	South	150.74387	-34.75858	Barn Owl	Grassland either side. closest tree 100m		0		
25 September 2018	7:27	South	150.71604	-34.76751	Eastern grey kangaroo			4		
2 October 2018	06:25:00	South	150.705086	-34.771036	Eastern Grey Kangaroo	riparian on median strip on bridge	n/a	6		too dangerous to spray
2 October 2018	06:45:00	North	150.709939	-34.769704	Echidna	Landscape revegetation between onramp and hwy		1		removed from road
9 October 2018	06:55:00	South	150.7380116	-34.760639	Echidna	Landscape revegetation on side of road		0		removed from road

Date	Time	Northbound or southbound?	Latitude	Longitude	Common name	Closest habitat	Sex or Age	Distance from edge of road (m)	Pouch young?	Comment
16 October 2018	07:25:00	North	150.68721	-34.77321	Fox	Landscape revegetation on road verge		0		
22 October 2018	06:55:00	South	150.75268	-34.753803	Fox	veg on sthbound side on road		2		removed from road
30 October 2018	No Roadkill Observed									
6 November 2018	06:50:00	South	150.74037	-34.759556	Australian Wood Duck	Grassland on road where exit ramp joins fwy		2		removed from road
6 November 2018	06:50:00	South	150.71384	-34.768482	Swamp Wallaby	Woodland veg on southbound side on road verge		0		sprayed pink
13 November 2018	7:35	South	150.738375	-34.7603578	Magpie Lark	Landscape revegetation on median strip		5		
13 November 2018	7:48	South	150.6814086	-34.7793375	Eastern Grey Kangaroo			1		very smelly (oldish?)
20 November 2018	No Roadkill Observed									
27 November 2018	7:31	South	150.78107	-34.750381	Corella or Sulphur crested cockatoo	grassland		7		damaged. Hard to id
27 November 2018	8:04	North	150.7454909	-34.7580054	Rabbit		7			

Date	Time	Northbound or southbound?	Latitude	Longitude	Common name	Closest habitat	Sex or Age	Distance from edge of road (m)	Pouch young?	Comment
4 December 2018	7:47	South	150.6843205	-34.7757641	Corella			1		
4 December 2018	8:00	North	150.7224548	-34.7636633	Common wombat		female	2		
11 December 2018	8:30	N	150.6836801	-34.7760282	Raven			5		
18 December 2018	No Roadkill Observed									
24 December 2018	8:26	S	150.6790261	-34.7821485	rabbit	Tall open forest		0		
31 Decemeber 2018	No Roadkill Observed									
8 January 2019	7:44	S	150.7010464	-34.7715632	Kookaburra	casuarina		5		
8 January 2019	8:07	N	150.6791646	-34.7814998	Indian Mynah Bird			1		
18 January 2019	8:15	S	150.747398	-34.7580253	Squirrel glider	Tall open forest		1		
18 January 2019	8:26	S	150.7373089	-34.7608679	stripped Marsh Frog	Tall open forest		1		

Date	Time	Northbound or southbound?	Latitude	Longitude	Common name	Closest habitat	Sex or Age	Distance from edge of road (m)	Pouch young?	Comment
18 January 2019	8:26	S	150.7373089	-34.7608679	Flying fox	Tall open forest		0		
18 January 2019	8:39	N	150.6723431	-34.7905478	Snake	grassland		0		
21 January 2019					Pacific black duck					
21 January 2019					Eastern longneck turtle					
30 January 2019 (48)					Unidentified					
6 February 2019	No Roadkill Observed									
13 February 2019	No Roadkill Observed									
19 February 2019	No Roadkill Observed									
27 February 2019	No Roadkill Observed									

Date (Week Commencing)	Observations	Locations GPS incl.	Species	Number	Native Total	Exotic Total
9-Jan-15	Nil			0	0	0
16-Jan-15	Nil			0	0	0
23-Jan-15	Nil			0	0	0
30-Jan-15	Nil			0	0	0
6-Feb-15	Nil			0	0	0
13-Feb-15	Nil			0	0	0
20-Feb-15	3 x animals injured on the road	Echindna at approximate ch 8000 on existing P HWay, Wombat at ch 8500 of existing P Hway, Echinda at approximate ch 14500 on existing P Hway	2 X Echinada, 1 Wombat	3	3	0
27-Feb-15	Perished Glider	South of Berry on the South bound carriageway approximate chainage 18100	1 x Glider perished	1	1	0
6-Mar-15	Animal observed South of Berry	Sth of Berry	1 x Rabbit	1	2	1
13-Mar-15	Gembrook	Wombat at Gembrook Property possiblt hit by truck.	1 x Wombat	1	3	1
20-Mar-15		South of Hithcocks Lane (rabbits), Fox on Broughton Mill Bridge. 4 x Wooduck between Thomson to Tomlins Rd, Possum at Entry to Berry	2 x Rabbit, 1 x Fox , 4 x Wooduck, 1 x Possum	8	9	4
27-Mar-15	Animal observed in Berry Township	Berry	1 x Possum	1	10	4
3-Apr-15	Nil			0	10	4
10-Apr-15	Brushtail possum	Tannery Rd	1 x Possum	1	11	4
17-Apr-15	Nil			0	11	4
24-Apr-15	Two perished animals observed	no.1 rabbit - North of BC1 on existing Princes HW approx CH9800. no.2 rabbit - south of tindalls lane interchange on P HW ch14300	2 x rabbit	2	12	6
1-May-15	Nil			0	12	6
8-May-15	One perished animal	Between Tomlins and Thompsons Roads	1 x Possum	1	13	6
15-May-15	Two perished animals	Crow on the bend between Tomlins and Thompsons rd. rabbit 100m north of Berry Lookout (gate 18)	1 x crow 1 x rabbit	2	15	7
22-May-15	Nil			0	15	7
29-May-15	Nil			0	15	7
5-Jun-15	Nil			0	15	7
12-Jun-15	Nil			0	15	7
19-Jun-15	Nil			0	15	7
26-Jun-15	Nil			0	15	7
3-Jul-15	Nil			0	15	7
10-Jul-15	Nil			0	15	7
17-Jul-15	Nil			0	15	7
24-Jul-15	Nil			0	15	7
31-Jul-15	Nil			0	15	7
7-Aug-15	Wallaby - perished	Tindalls Lane	wallaby	1	16	7
14-Aug-15	Nil			0	16	7
21-Aug-15	Nil			0	16	7
28-Aug-15	Nil			0	16	7
4-Sep-15	Nil			0	16	7
11-Sep-15	Deceased Echinda's observed	Austral Park, Jemena and SB opposite Wiley's	2 x Echidna	2	18	7
18-Sep-15	Deceased Echinda observed, Deceased wood ducks	Tindalls Lane, Bragg and Ridge area	1 X Echidna, 2 x Wood duck	3	21	7
25-Sep-15	Nil			0	21	7
2-Oct-15	Perished Kangaroo, Perished Echidna	North of Gate 11, Tollijooa Ridge	1 x Kangaroo, 2 x Echidna	3	24	7
9-Oct-15	Wombat - Perished	Princes Highway, between Austral Park and Tindalls	Wombat	1	25	7

16-Oct-15	Nil			0	25	7
23-Oct-15	Nil			0	25	7
30-Oct-15	Nil			0	25	7
6-Nov-15	Wombat - Perished	Princes Highway, 100m north of gate 17. Opposite Wiley Resident	Wombat	1	26	7
13-Nov-15	Nil			0	26	7
20-Nov-15	Nil			0	26	7
27-Nov-15	Nil			0	26	7
4-Dec-15	Nil			0	26	7
11-Dec-15	Nil			0	26	7
18-Dec-15	Nil			0	26	7
25-Dec-15	Snake - Perished	Woodhill Mountain Rd	1 x Red Belly Black snake	1	27	7
1-Jan-16	Nil			0	27	7
8-Jan-16	Perished Wallaby	New Tindalls Bridge Area	1 x Wallaby perished	1	28	7
15-Jan-16	Perished Wallaby	South of Schofields, New Tindalls Bridge Area	1 x Wallaby perished	1	29	7
22-Jan-16	Perished Glider	Tannery Rd at the Broughton Creek Bridge	1 x Glider perished	1	30	7
29-Jan-16	Perished Rabbit	Princes Highway approximetly 1 km Sotuh of BC1	1 x Rabbit	1	31	8
5-Feb-16	Wallaby - perished	Top of Foxground bends across from 455 Princes Highway	wallaby	1	32	8
12-Feb-16	Nil			0	32	8
19-Feb-16	Nil			0	32	8
26-Feb-16	Female King Parrot	100m south of Toolijooa Rd -34° 45' S 150° 46' E	King Parrot	1	33	8
4-Mar-16	Nil			0	33	8
11-Mar-16	Swamp Wallaby	Oppostie SC01	wallaby	1	34	8
18-Mar-16	Nil			0	34	8
25-Mar-16	Nil			0	34	8
19-Apr-16	Brushtail possum	60m sth of Mananga Homestead	possum	1	35	
19-Apr-16	Rabbit perished	BC3	rabbit	1	35	9
14-Apr-16	Fox - perished	Foxground	Fox	1	35	10
22-Apr-16	Water hen - perished	Foxground	waterhen	1	36	
9-May-16	Fox - perished	BC1	Fox	1	36	11
10-May-16	Fox - perished	50m North of Toolijooa road on PHWY	Fox	1	36	12
16-May-16	Fox - perished	350m south of BC#1 in the southbound lane	Fox	1	36	13
31-May-16	Fox - perished	Cut 6 - 100m north of Tindells Rd/Gate 11A turn off	Fox	1	36	14
7-Jun-16					36	
14-Jun-16					36	
21-Jun-16	Purple - Swamphen	100m north of Thomson Road - Nth bound carriageway	Waterhen	1	37	
28-Jun-16					37	
5-Jul-16					37	
12-Jul-16					37	
19-Jul-16					37	
26-Jul-16	Kangaroo	Ch 12900, South bound carriageway existing Princes Highway	Kangaroo	1	38	14
2-Aug-16	Wood Duck Chick - perished	Ch13550, Northbound carriageway existing Princes Highway	1 x Wood Duck	1	39	14
9-Aug-16	Fox - perished	Ch15000, Northbound carriageway Princes Highway	Fox	1	39	15
16-Aug-16					39	
23-Aug-16	Purple - Swamphen	CH19720 (SB12), Southbound carriageway Princes Highway	Purple - Swamphen	1	40	15
30-Aug-16					40	

6-Sep-16					40	
12-Sep-16	Raven - Perished, Wallaby - perished	Ch 12700 (Gate 8), Northbound carriageway Ch 12100 Southbound carriageway	Raven - Perished, Wallaby - perished	2	42	15
19-Sep-16					42	15
26-Sep-16					42	15
3-Oct-16					42	15
12-Dec-16	Crimson Rosella - Perished	Toolijooa Rd Bridge area, main highway Northbound carriageway	Crimson Rosella	1	43	15
16-Jan-17	Wood Duck - Perished Echinda - Perished	Highway Southbound, Mark Radium Park area Highway Northbound near Gate 15	Wood Duck Echinda	2	45	15
23-Jan-17	Brushtail possum - Perished Kangaroo - Perished	Highway southbound @ 455 Property, Tindalls Rd entry off Highway & under Berry Bridge Highway Northbound @ Gate 15	3 x Brushtail possum & Kangaroo	4	49	15
30-Jan-17	Magpie - Perished Fox - Perished Possum - Perished	Highway southbound @ Willow Springs Rd Highway southbound 100m north of Thompson Rd Highway southbound @ 300m north of Austral Park Rd	1 x Magpie 1 x Fox 1 x Possum	2	51	16
6-Feb-17					51	16
13-Feb-17	Magpie - Perished	Highway northbound @ 300m north of Tindalls lane/gate 11	1 x Magpie	1	52	16
20-Feb-17	Wallaby - Perished Fox - Perished	Highway northbound near Gate 17 Highway southbound 50m south of Toolijooa Rd	1 x Wallaby 1 x Fox	1	53	17
27-Feb-17					53	17
6-Mar-17	Unknown bird species - Perished	Highway northbound 50m north of SB11			53	17
13-Mar-17	Brushtail Possum - Perished	Highway northbound @ Tannery Rd	1 x Brushtail Possum	1	54	17
20-Mar-17	Echidna - Perished Magpie - Perished Brushtail Possum - Perished	Highway northbound 50m north of tindalls Lane bridge Highway (Queen St crossing island) Northbound Highway southbound 100m south of KVR	1 x Echidna 1 x Magpie 1 x Brushtail Possum	3	57	17
27-Mar-17	Fox - perished	Highway northbound 500m south of Austral Park Rd	1 x Fox		57	18
3-Apr-17	Fox - perished	Highway northbound 500m south of Tindalls lane	1 x Fox	1	57	19
27-Apr-17	Undistinquishable animal observed	Highway southbound near Woodhill Mountain Rd intersection with highway	Unknown	1	57	19
9-May-17	Echidna - Perished	Highway southbound south of Autral Park Rd	1 x Echidna		58	19
10-May-17	3 perished kangaroos	Highway southbound just south of Toolijooa bridge & northbound just north of Cut 2 (SC0-1) & 1 northbound near BC2 in the centre median	3 x Eastern Grey kangaroos	3	61	19
28-May-17	Wombat - Perished	Highway southbound / in the centre median just north of SB11	1 x Wombat	1	62	19
14-Jun-17	Wallaby - Perished Fox - Perished	Highway southbound just south Cut 1 (SC0-1) Highway northbound / centre median Fill 1 south (SC01)	1 x Wallaby 1 x Fox	2	63	20
18-Jul-17	Fox - perished, Rabbit - perished	Fox - BC1, Rabbit - Opposite Grants property (Donovan Rd)	1 x Fox 1 x Rabbit	2	63	22
19-Jul-17	Wallaby - perished	Cut 2	1 x Wallaby	1	64	22
24-Jul-17	Wombat - Perished	Cut 2	1 x Wombat	1	65	22
31-Jul-17	2 X Kangaroo- Perished	Southbound lanes. 1 at cut 9 and one at SB12	2 x Kangaroo	2	67	22
7-Aug-17	Echidna - Perished	southbound lane. Approx chainage 13100	1 x Echidna	1	68	22
11-Sep-17	Kangaroo - Perished	Northbound side bridge 6 property access	1 x kangaroo	1	69	22
12-Sep-17	Wallaby - Perished	Cut 2 median strip	1 x wallaby	1	70	22
18-Sep-17	Possum - perished, possum/glider - perished	Schofields/Muller's lane area	1 x possum, 1 x possum/glider	2	72	22
25-Sep-17					72	22

2-Oct-17	Kangaroo - Perished	Northbound Cut 7	1 x kangaroo	1	73	22
9-Oct-17					73	22
16-Oct-17	Wood Duck - Perished, Echinda - Perished	Highway Northbound, Mark Radium Park area Highway Northbound near Fill 2	Wood Duck Echinda	2	75	22
23-Oct-17					75	22
30-Oct-17					75	22
6-Nov-17	Echidna - Perished	southbound lane. Approx chainage 19100	1 x Echidna	1	76	22
13-Nov-17	Brushtail possum - Perished	Southbound highway near Schofields lane	1 x Possum	1	77	22
20-Nov-17					77	22
27-Nov-17	Wombat - Perished	Northbound on ramp at Berry north	1 x Wombat	1	77	22
4-Dec-17	Fox - perished	Fill 6 northbound highway	1 x fox	1	77	23
11-Dec-17	Purple - Swamphen	Southbound carriageway Princes Highway @ SB 11	Purple - Swamphen	1	78	23
18-Dec-17					78	23
25-Dec-17					78	23