Roads and Maritime Services

Foxground and Berry bypass Princes Highway upgrade

Microbat Management Plan

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PARSONS BRINCKERHOFF

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1. Introduction

1.1 Purpose

The Southern Myotis (*Myotis macropus*), Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*) and Eastern Horseshoe-bat (*Rhinolophus megaphyllus*) are microchiropteran bats (hereafter referred to as microbats) that utilise crevices in caves or similarly constructed structures (culverts and bridges) as important or supplementary habitat for life history traits such as roosting, periods of torpor and breeding. All three species are known to occur within the study area of the Princes Highway upgrade between Foxground and Berry (the project), with the Southern Myotis and Eastern Bentwing-bat listed as Vulnerable species under the *NSW Threatened Species Conservation Act 1995* (TSC Act).

Some bridge and culvert structures along the project alignment will be replaced, extended, or disturbed during construction related activities, which has the potential to impact individual or local populations of microbats utilising such artificial habitat. Parsons Brinckerhoff developed this Microbat Management Plan (MMP) to minimise impacts to microbats encountered during construction in bridges and culverts within the project boundary. . This MMP must be included in the Construction Flora and Fauna Management Sub-plan (CFFMP).

1.2 Background

New South Wales (NSW) Roads and Maritime Services (Roads and Maritime) is upgrading 11.6 km of the Princes Highway between Toolijooa Road north of Foxground, to Schofields Lane south of Berry. The resulting upgrade will be a four lane divided highway (two lanes in each direction) with median separation. The project includes bypasses of Foxground and Berry localities (refer Figure 1.1).

The project was assessed under Part 3A of the *Environmental Planning and Assessment Act 1979* and approval granted on 22 July 2013 with Conditions of Approval (CoA). To satisfy the Minister for Planning and Infrastructure's CoA B9, Roads and Maritime were required to develop and implement an Ecological Monitoring Program (EcMP) (Parsons Brinckerhoff 2014).

A requirement of the EcMP was to complete bat roost surveys of all bridge and culvert structures that are scheduled for demolition, extension, rehabilitation or disturbance. A total of two bridges and four large culvert structures were inspected during the first round of the EcMP, which was completed in March 2014.

It is important to note that the two locations that microbats were recorded were considered to form the only likely suitable roosting habitats provided by the existing highway structures. The bridge over Broughton Mill Creek was considered to be the only structure within the project area that provides such habitat (the other culvert was located to the south of the project area).

1.3 Management plan objectives

As project conditions and site characteristics will change with progression of project construction, together with the variable nature of roosting, breeding and over-wintering behaviour of microbats, it is essential that this management plan remains adaptive. The objectives of this MMP are to:

- Identify potential threats to cave / crevice-dwelling microbats during construction of the project

- Provide mitigation strategies and procedures to minimise impacts to any microbats found roosting (including periods of torpor) or breeding in structures scheduled for direct disturbance during construction
- Provide additional mitigation measures to minimise long-term impacts to local microbat populations.

1.4 Relevant legislation and guidelines

The main legislation relevant to microbat management for the proposal is:

- *Environmental Planning and Assessment Act 1979* (EP&A Act)
- *National Parks and Wildlife Act 1974* (NPW Act)
- *Threatened Species Conservation Act 1995* (TSC Act) – Southern Myotis and Eastern Bentwing-bat are Vulnerable species under schedule 1 of the TSC Act
- Environmental Protection and Biodiversity Conservation Act 1999 (Commonwealth) (EPBC Act) – Large-eared Pied Bat listed as Vulnerable under the EPBC Act

The main guidelines, specifications and policy documents relevant to this MMP include:

- Policy for translocation of Threatened Fauna in NSW: Policy and Procedure Statement No. 9 Threatened Species Unit (NSW National Parks & Wildlife Service, 2001).

1.5 Limitations

Limitations pertaining to field surveys informing the EcMP (Parsons Brinckerhoff 2014) and project Environmental Assessment (Biosis Research 2012) include a lack of account for temporal variation of roost site selection (over-wintering roosts) or utilisation of particular roost locations in response to other environmental gradients

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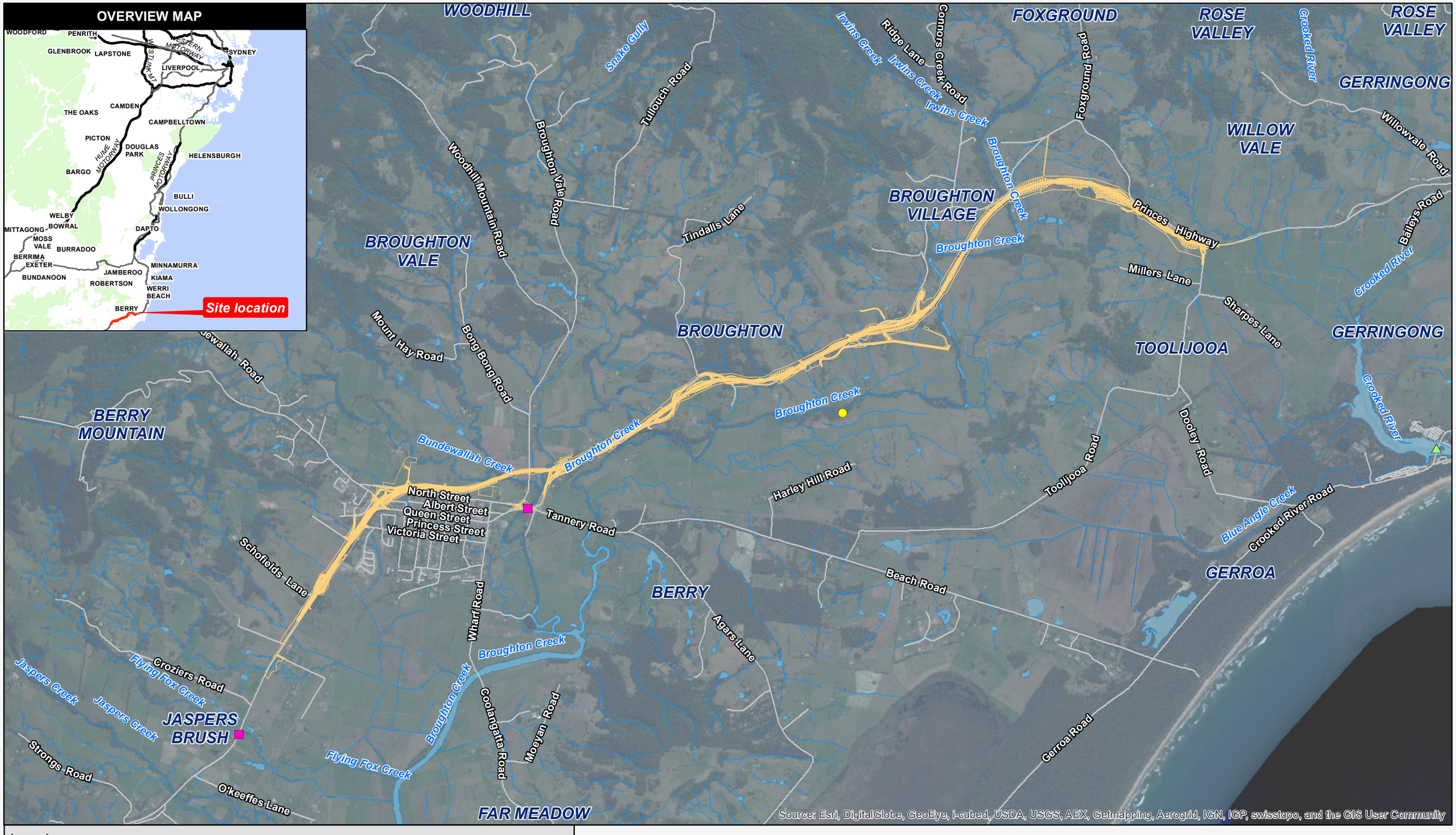
FOXGROUND AND BERRY BYPASS MICROBAT MANAGEMENT PLAN
ROADS AND MARITIME SERVICES



Legend

- Watercourse
- Proposed road design
- Water body
- Roads

Parsons Brinckerhoff 2014
- Southern Myotis (roosting individuals)

Gaia Research 2014
- Southern Myotis (significant population)

Roads & Maritime 2014
- Southern Myotis (roosting colony)

Figure 1.1 Project location and Southern Myotis records

0 500 1,000 m

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2. Microbat records

2.1 Project environmental assessment

A total of 18 species of microbat, including six threatened species, were recorded in the project study area during field surveys informing the Environmental Assessment (Biosis Research 2012) (Table 2.1). One other threatened species, Large-eared Pied Bat (*Chalinolobus dwyeri*), was considered moderately likely to occur within the project study area (Biosis Research 2012). Approximately 79 % of the microbat species listed in Table 2.1 (not including Southern Myotis, which is known to utilise both cave structures and tree hollows) are hollow-dependant bats. Whilst this MMP was specifically developed for mitigating potential impacts to cave or crevice-dwelling microbats, a number of strategies (i.e. staged habitat removal) to ameliorate impacts to hollow-dependent species are detailed in the project CFFMP.

Table 2.1 Species of microbat recorded or with potential habitat in the project study area

Scientific name	Common name	TSC Act (EPBC Act)[1]	Roosting preference	Record type[2,3,4,5]
Chalinolobus dwyeri	Large-eared Pied Bat	**V (V)**	Cave (or similar supplementary structures)	2
Chalinolobus gouldii	Gould's Wattled Bat	-	Tree hollows	3
Chalinolobus morio	Chocolate Wattled Bat	-	Tree hollows	3
Falsistrellus tasmaniensis	Eastern False Pipistrelle	**V**	Tree hollows	3
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	**V**	Cave (or similar supplementary structures)	3
Mormopterus norfolkensis	Eastern Freetail Bat	**V**	Tree hollows	3
Mormopterus sp.	Mormopterus sp. (little penis)	-	Tree hollows	3
Myotis macropus	Southern Myotis	**V**	Cave (or similar supplementary structures) Tree hollows	3, 4
Nyctophilus geoffroyi	Lesser Long-eared Bat	-	Tree hollows	3
Nyctophilus gouldi	Gould's Long-eared Bat	-	Tree hollows	3
Rhinolophus megaphyllus	Eastern Horseshoe-bat	-	Cave (or similar supplementary structures)	3
Saccolaimus flaviventris	Yellow-bellied Sheath-tail Bat	**V**	Tree hollows	3
Scoteanax rueppellii	Greater Broad-nosed Bat	**V**	Tree hollows	3
Scotorepens orion	Eastern Broad-nosed Bat	-	Tree hollows	3
Tadarida australis	White-striped Freetail Bat	-	Tree hollows	3
Vespadelus darlingtoni	Large Forest Bat	-	Tree hollows	3
Vespadelus pumulis	Eastern Forest Bat	-	Tree hollows	3
Vespadelus regulus	Southern Forest Bat	-	Tree hollows	3

Scientific name	Common name	TSC Act (EPBC Act)[1]	Roosting preference	Record type[2,3,4,5]
Vespadelus vulturnus	Little Forest Bat	-	Tree hollows	3, 5

Note: 1: Vulnerable under the NSW *Threatened Species Conservation Act 1995.* 2: Considered moderately likely to occur in the project study area (Biosis Research 2012). 3: Recorded via Anabat (Biosis Research 2012). 4: Observed roosting under bridge and in culvert structures along the existing Princes Highway (Parsons Brinckerhoff 2014). 5: Trapped during surveys informing project Environmental Assessment (Biosis Research 2012).

2.2 Project EcMP bat roost surveys

During targeted bat roost surveys detailed in the project EcMP, the Southern Myotis was recorded roosting in suitable bridge and culvert structures along and near the existing Princes Highway between Foxground and Berry (Figure 1.1). Specifically, the Southern Myotis was recorded roosting at two locations:

- Under a bridge over Broughton Mill Creek near Berry (Photos 1 and 2), which occurs within the project area and has the potential to be impacted by the project.
- In a culvert positioned along Flying Fox Creek, immediately adjacent to the southern extremity of the project just past Berry (Photos 3 and 4). This site is technically outside of the project area and would not be impacted by the project.

These new records follow recent documentation of a large and significant population of the species in the south-east of New South Wales (South Coast Courier 2014).

No other structures provided by the existing Princes Highway were considered to provide suitable roosting habitat for caves or crevice-dwelling microbats.

2.3 Southern Myotis populations in the project locality

During targeted surveys for cave-dwelling microbats as part of the project EcMP, the Southern Myotis was observed roosting under a bridge and culvert structure along the existing Princes Highway. Specifically, one Southern Myotis was recorded under a bridge over Broughton Mill Creek near Berry and another individual was observed in a culvert positioned along Flying Fox Creek, immediately adjacent to the southern extremity of the project just past Berry (refer Figure 1.1).

Mr James Dawson (Senior Team Leader, Ecosystems and Threatened Species, Illawarra Region, Office of Environment and Heritage) was contacted to discuss known local populations of threatened bats and in particular Southern Myotis. Assistance was provided in understanding local issues in relation to the occurrence of this species. Within and adjacent to the project construction boundary, it was noted that important habitat for the Southern Myotis, including breeding habitat, is present in large old growth *Casuarina cunninghamiana* (River Oak) and other riparian vegetation occurring along and adjacent to creek lines and on associated fertile river flats.

The recent records by Parsons Brinckerhoff follow recent documentation of large and significant populations of the species on the south coast of New South Wales, including one along Broughton Creek (Gaia Research 2014) and another which was recorded roosting under a bridge spanning Crooked River in Gerringong (refer Figure 1.1). Importantly, several bridge spans associated with the project are proposed to span Broughton Creek and its floodplain.

Photo 1 Broughton Mill Creek Bridge with Southern Myotis

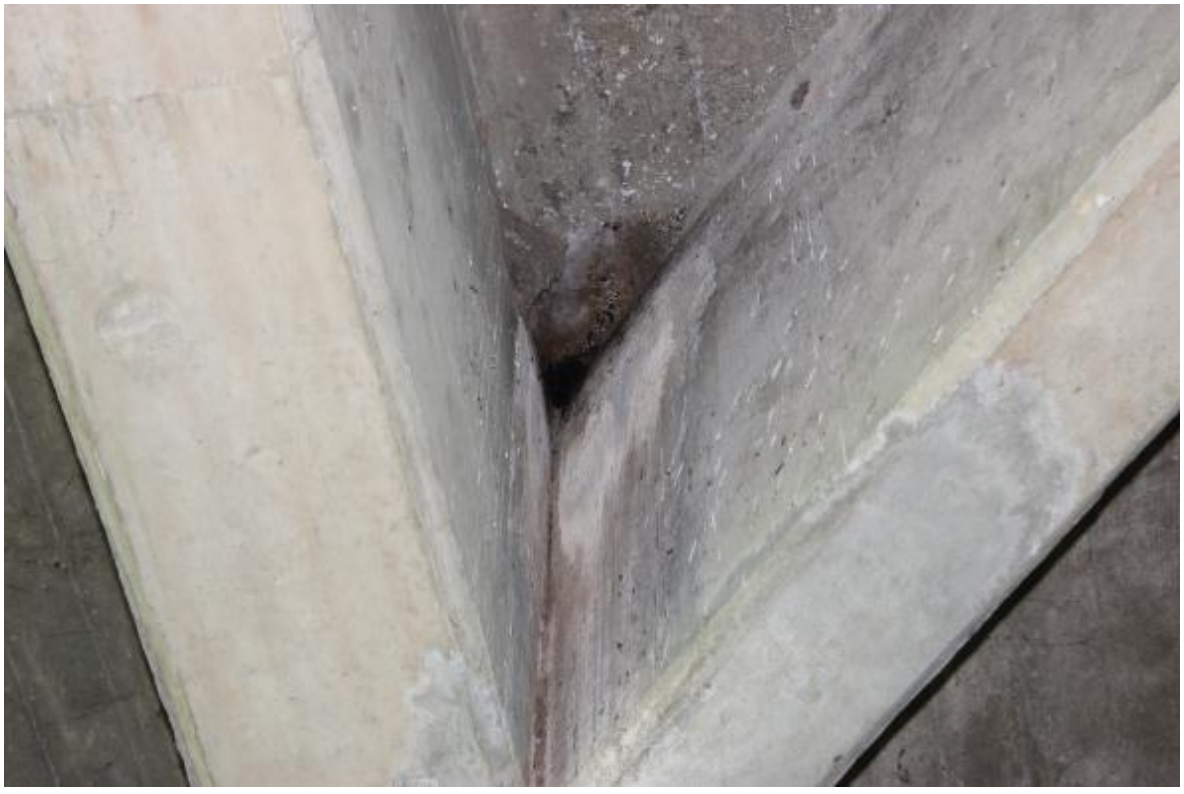

Photo 2 Southern Myotis roost location Broughton Mill Creek Bridge

Photo 3 Flying Fox Creek culvert with Southern Myotis

Photo 4 Southern Myotis roost location in Flying Fox Creek culvert

3. Potential threats to microbats during construction

Some culvert and bridge structures along the existing Princes Highway between Foxground and Berry, which are known to provide roosting habitat for the Southern Myotis (Parsons Brinckerhoff 2014), will not be impacted by construction or operation of the project. However, the removal or disturbance to culverts and bridge structures within the project boundary that provide potential roosting habitat may displace, injure or kill microbats that may utilise these structures on a temporal or infrequent basis. Potential direct and indirect construction related impacts to microbats are detailed below.

3.1 Direct impacts

- Depending on timing of construction works, over-wintering microbats may be injured, killed, or displaced from root sites by demolition, extension, rehabilitation or disturbance to bridge and culvert structures
- Potential disturbance to mature microbats that may utilise bridge and/ or culvert structures as supplementary breeding habitat
- Potential loss of juvenile microbats should a structure be utilised as a maternity structure. Construction works taking place during the breeding season may injure or kill juvenile microbats that are not capable of fleeing direct disturbance.
- Loss of roosting, over-wintering, or breeding habitat, particularly where bat sensitive design has not been incorporated in to final structure design (i.e. structures are not designed with provision of suitable roost conditions for microbats)
- Loss of native vegetation and habitat.

These potential impacts would be mitigated through the use of the management strategies outlined in Section 4.

3.2 Indirect impacts

- Chemical, fuel or solvent spills contaminating waterways being used as foraging grounds by microbats
- Disturbance or reduction in quality of habitat adjacent to the project,
- Reduction of water quality (including release of sediment laden water) in creeks and drainage lines dissecting the project, which could affect foraging success of Southern Myotis
- Noise impacts.
- Significantly increased light.

Measures to mitigate these potential indirect impacts are outlined in Section 4.

4. Microbat management strategies

4.1 Overview

The EcMP (Parsons Brinckerhoff 2014) outlines that monitoring of the bridges and culverts should occur if any individuals are recorded that are likely to be disturbed by the project. However, it is evident that the only records of roosting microbats to this point (as of 12 September 2014) are within structures that Roads and Maritime has indicated will not be removed or directly impacted by the current project.

Within the actual project area, the only record of a roosting microbat is the individual Southern Myotis roosting under the Broughton Mill Creek Bridge (refer Figure 1.1). This bridge will remain in its current form post-construction. There exists a small possibility that the roosting individual (or other individuals that use this bridge intermittently) could be affected by the reconstruction works that are proposed on either side of this bridge. While the likelihood of physical disturbance to the recorded Southern Myotis is remote, impacts such as a temporary increase in light and noise could affect any roosting bats.

The following procedures will therefore be implemented to monitor recorded microbats under bridges and culverts. It should be noted that the EcMP requires a second inspection occurs in Spring 2014 (which would also fulfil requirements of a construction pre-disturbance inspection) and this may identify additional records, for which the following procedures would also be required to be implemented.

4.1.1 General procedure approach

The following management strategies would be implemented to ameliorate potential construction related impacts on cave / crevice dwelling microbats and must be incorporated into the CFFMP:

- Environmental induction training
- Hold points. Incorporating a hold point when obtaining approval to clear or disturb vegetation or structures would ensure that correct process (i.e. pre-clearing inspections) have been adequately completed and signed off by appropriate staff.
- Routine inspection of potential roost structures
- Diurnal pre-clearing inspections for cave/ crevice dwelling microbats
- Planned roost exclusion
- Microbat relocation procedures
- Ecologist on site during works with potential impact to microbats (spotter/catcher)
- Construction work procedures (e.g. preference for seasonal limitation of construction works where practicable)
- Minimising disturbance to existing habitats
- Provision of supplementary roost structures
- Mitigation measures to address indirect impacts
- Reporting procedures.

4.2 Environmental induction training

All personnel and contractors would undergo environmental induction training before commencing work on site in accordance with the CEMP. Information to be included as a minimum during this training would include:

- Profile and identification of cave / crevice-dwelling microbats likely to be encountered during construction works
- Identification of potential roosting habitat under bridge and in culvert structures. Construction personnel would be prohibited from entering structures that provide potential roosting habitat and that are located outside the construction project boundary or operation areas.
- Procedures to be followed in the event that microbats are found or injured
- Bat Lyssavirus and the importance of not handling microbats (unless trained, competent, vaccinated and have appropriate PPE).

4.3 Hold points

The project will use an internal permit system for the construction works listed below, requiring approval to release by the nominated authority prior to the commencement of the activity. A hold point applies to the following construction works relating to microbats:

- Replacement, extension or direct disturbance to bridge and culvert structures within the project boundary identified as containing potential microbat roost sites
- High disturbance, such as increased light levels and high noise or vibration levels (i.e. pile drivers, dumping of rock for bridge abutments) to bridge and culvert structures within the project boundary identified as containing potential microbat roost sites.

4.4 Routine inspection of potential roost structures

In the absence of knowledge pertaining to temporal changes in (roost) habitat preferences of cave or crevice-dwelling microbats, the project ecologist or environmental representative would complete a weekly visual inspection of the bridge over Broughton Mill Creek within the project area that contain potential roost sites (refer Appendix A); such as exposed expansion joints, vertical drainage holes or other crevices. Routine inspections should:

- be completed on this bridge during nearby construction related activities, including increased levels of light, high noise or vibration levels (i.e. pile drivers, dumping of rock for bridge abutments)
- entail simple observations of the underside of the structure and observation for accumulated droppings
- where practicable, make use of a flexible inspection camera (or similar) to inspect obscure crevices.

Routine inspections would also minimise potential delays to construction works by potentially enabling planned roost exclusion prior to preferred seasonal limitation of construction works, which would be considered should microbats be found over-wintering or breeding in suitable structures.

4.5 Pre-clearing surveys for microbats

The project ecologist or a suitably qualified fauna specialist will be engaged by the Contractor to complete pre-clearing surveys for the bridge over Broughton Mill Creek (or any other future identified structure that contains potential roosts) along the project alignment that will be deconstructed, modified, or highly disturbed

(i.e. high noise or vibration levels or increased light) (refer Appendix A for known locations). Prior to the commencement of high disturbance at this nominated bridge and any other culvert or bridge structure identified in the future, a pre-clearance survey will be completed that would consist of one diurnal survey 24 hours prior to the disturbance to determine whether the structure is free of microbats (as best as can be determined).

Diurnal surveys should include the following methods:

- Diurnal search of cavities in structures for roosting microbats. Searches would be aided by torches, headlamps, and flexible inspection cameras.
- Diurnal search of structure for supplementary evidence of structure use (i.e. accumulated droppings)
- If bats are observed or predicted to be roosting from evidence such as accumulated droppings, exit surveys for bats leaving roost sites. would be completed by:
  - Direct observation of the structure for one hour prior to and one after dusk
  - Using ultrasonic Anabat bat detector.

For continuous work on a structure containing potential roosts, only one pre-clearing survey approving works directly to the nominated structure is required. If construction work directly on a structure is intermittent, another pre-clearing survey would be required.

If microbats are detected during a pre-clearing survey, the planned roost exclusion procedure outlined below would be followed, until the project ecologist or suitably qualified specialist can determine that the structure is likely to be free of microbats and only then can works proceed. If roost exclusion has been implemented successfully there is no requirement for completing further pre-clearing surveys.

4.6 Planned roost exclusion

Excluding bats from a roost is a process that allows them to exit unharmed, but not re-enter. Roost exclusion would be employed at those structures where microbats are observed to be actively utilising the structure and where such structures require removal or substantial modification and are therefore located within the project boundary. No such structures have been identified at this stage.

Planned roost exclusion would be used:

- Outside the breeding season for Southern Myotis, Eastern Bentwing-bat, or any other species detected breeding in the structure
- Outside over wintering times for the Southern Myotis, Eastern Bentwing-bat, or other species with potential to utilise such structures (refer Table 2.1).

If roost exclusion is required during construction activities, supplementary roost structures (microbat nest boxes) would be installed in adjacent habitat or nearby structures (that are not impacted by construction activities) prior to the roost exclusion taking place. Roost exclusion would consist of, but not necessarily limited to, the following actions:

- Completion of a pre-clearing inspection in accordance with Section 4.5
- Primary exit points for identified active roost(s) would be determined and marked. Identified roosts would remain in-situ at this stage
- All other unoccupied/ potential roost locations would be sealed using suitable material such as wood or expandable foam. Care and due consideration needs to be given to avoid sealing microbats in the roost.

- Nocturnal surveys would be completed at active roost(s) as per the pre-clearance inspection (Section 4.5). Roost location(s) would then be inspected by the project ecologist using headlamps, torches and flexible inspection cameras to ascertain if all microbats have vacated the roost.
- If clearance is given by the project ecologist, roost locations would be permanently filled or blocked using a suitable material. Importantly, bats displaced during roost exclusion may try to return to the roost for a short period following the procedure. Therefore, it is important that provisions of supplementary roosts are provided in adjacent areas prior to the exclusion taking place. If such structures cannot be adequately installed in adjacent areas, several sub-optimal roost locations should remain in the structure after exclusion from primary roost as an attempt at a staged exclusion. Alternatively, microbat nest boxes could be installed on the underside of the structure, allowing a short period of familiarisation, before transferring the microbat nest box as appropriate (please refer to final paragraph of Section 4.6).
- Where the project ecologist cannot be sure that all microbats have left the roost (i.e. obscure cavity) one-way valves made of clear plastic sheeting could be utilised as a means of preventing re-entry
- Egress to culvert or bridge structure would not be impeded at any stage during a roost exclusion.

Importantly, if a colony of microbats was identified as roosting in or under a particular structure, comprehensive roost exclusion would be required. This would initially include the installation of alternative roost sites (nest boxes) in the structure to allow familiarisation. Once the alternative roost sites are observed to be utilised, the natural roosts sites would be sealed, leaving only the alternative roost sites. These alternative roost sites would then be transferred to the new structure, or elsewhere as determined appropriate by Roads and Maritime, recognised bat expert, project ecologist and the Contractor.

4.7 Spotter / catcher and microbat relocation procedures

The project ecologist or other suitably qualified specialist would be present during initial disturbance and removal of bridge or culvert structures within the project boundary that have been identified as containing potential roosting habitat (refer Appendix A). The project ecologist or other suitably qualified fauna specialist will hold current animal ethics approval and appropriate animal handling permits. Importantly, due to the potential for Bat Lyssavirus, only the project ecologist or other suitably qualified, trained and vaccinated specialist is approved to handle microbats.

If a microbat is uncovered during construction works, the site environmental representative and project ecologist would be contacted to complete the microbat relocation procedure. If a deceased microbat is uncovered during construction works, the site environmental representative and project ecologist would undertake any preservation required prior to donation for testing / research, as well as suitable disposal, if required.

Details of each microbat are to be recorded, including species, sex, weight, forearm length, age, type of structure and roost site were rescued, and relocation site or species fate. The preferred relocation site (ideally near or immediately adjacent to water) would be identified by the project ecologist and depending on seasonal requirements and number of microbats, will involve:

- Dusk / nocturnal release in suitable habitat, or
- Relocation to installed supplementary roost structures (microbat nest boxes).

The site environmental representative contact number would be displayed around the construction site and be included on relevant project plans, work authorisation permits, and on relevant site cards.

4.8 Construction work procedures (preference for seasonal limitation of construction works)

Where practicable, the project would preference the seasonal limitation of construction work should breeding or important over-wintering habitat be identified in structures planned for deconstruction, modification or high disturbance, within the project boundary. This preference for seasonal limitation does not prevent works from being completed at any time, but rather the project should aim to avoid torpor and breeding seasons where possible.

Preference for seasonal limitation of construction works would be considered during the following periods:

- Between November and February, which coincides with Southern Myotis breeding period
- Between June and August, which coincides with the microbat over-wintering period in south-eat Australia.

For example, if a roost exclusion was not feasible due to timing (i.e. a breeding event or individuals in torpor) and seasonal limitation in construction works was determined as being an appropriate measure, a monitoring program would be devised in consultation with relevant parties (Roads and Maritime, Fulton Hogan, the project ecologist and any appointed bat expert) to monitor the structure and microbats. Monitoring could include, noise and vibration monitoring, together with visual inspections of the roost site.

4.9 Minimising disturbance to existing habitat

River Oak and other riparian vegetation occurring along creek lines that dissect the project are known to contain important habitat for the Southern Myotis, including roosting and breeding habitat (Gaia Research 2014). Accordingly, the Contractor should manage the integrity of creek lines and associated riparian vegetation lying adjacent to the project construction boundary. This could be achieved by installing high visibility flagging (or similar) to delineate the project boundary. Environmental no-go signs could also be erected in such areas to minimise disturbance by project personnel in sensitive areas that occur immediately adjacent to the project boundary.

4.10 Provision of supplementary roost structures (microbat nest boxes)

The use of artificial bat roosts is considered a suitable means to encourage passive dispersal of roosts in a particular structure, and to provide supplementary shelter when natural or other constructed roost structures are removed. Some culvert and bridge structures along the existing Princes Highway between Foxground and Berry, which are known to provide roosting habitat for the Southern Myotis (Parsons Brinckerhoff 2014), will not be impacted by construction or operation of the project. However, the removal or disturbance to culverts and bridge structures that provide potential roosting habitat may displace, injure or kill microbats that may utilise these structures on a temporal or infrequent basis. In order to compensate for habitat removed, supplementary bat roost structures would be installed in new bridge and culvert structures, as recommended by the NSW Office of Environment and Heritage, and in adjacent areas (including culverts or bridge sites unaffected by the project) to provide sites for fauna release and compensatory habitat for displaced microbats.

Specifically, provision of supplementary roost structures would be incorporated in to the Nest Box Management Plan as part of the CFFMP. Nest boxes would be installed in accordance with Roads and Maritime 'Biodiversity Guidelines: Guide 8 – Nest Boxes' (NSW Roads and Traffic Authority 2011).

Microbat nest boxes should installed with reference to the Nest Box Management Plan (refer CFFMP).

4.11 Mitigation measures to address indirect impacts

4.11.1 Construction spills

Chemical, fuel or solvent spills have the potential to contaminate creek lines and water bodies in vicinity of the project alignment, which may indirectly impact microbats (particularly Southern Myotis) by potentially reducing foraging efficiency or affecting prey items. Fuel and chemicals would be stored in site compound areas in accordance with the procedures for fuel and chemical storage for the project.

4.11.2 Discharging water from sediment basins

Sediment laden water that may be discharged from construction sediment basins has the potential to contaminate creek lines and water bodies in vicinity of the project alignment, as per construction spills above. Sedimentation of creek lines and water bodies has the potential to indirectly impact microbats by potentially reducing foraging species of Southern Myotis or affecting prey items.

Water from construction basins would meet any Environmental Protection Licence requirements and would be either re-used on site for dust suppression or would be discharged appropriately off site.

4.12 Reporting procedure

For the duration of construction of the project, the project ecologist or site environmental representative must keep records of the number, location and time / date of all microbats detected using bridge / culvert structures along the project alignment and their fate. Similarly, all management strategies employed and work procedures issued to construction crews would be documented.

The project ecologist or site environmental representative would issue a post-construction report that details all relevant information to a Roads and Maritime Environmental Representative. This information would also be included in the regular monitoring required by the EcMP for the project.

5. Monitoring requirements

Table 5.1 details key monitoring tasks required during construction of the project.

Table 5.1 Project monitoring requirements relating to this Microbat Management Plan

Management strategy	Monitoring procedure	Responsibility	Required documentation
Routine inspection of potential roost structures	Specific inspections by an ecologist will occur twice in 2014 as directed by the EcMP. During construction of the project, visual monitoring of potential roost structures within the project boundary (refer Appendix A) for microbats would be completed as part of weekly site inspections by the Site Environmental Representative or Project Ecologist. Routine inspections should be completed as described in Section 4.4, including: ■ observation of bridge and culvert structures in the project area that contain potential roost sites and that are likely to be disturbed during construction related activities ■ simple observation of the underside of the structure and observation for accumulated droppings ■ where practicable, make use of a flexible inspection camera (or similar) to inspect obscure crevices.	Site Environmental Representative (or appropriate delegate), Project Ecologist	Completion of appropriate checklist detailing date and time of inspection and any relevant observations or work instructions provided to work crews
Pre-clearing inspection of potential microbat roost structures	Completion of surveys as described in Section 4.5. Surveys will involve standardised data collection that will ultimately inform a 'Permit to Clear' or similar documentation	Project Ecologist	Completion of appropriate checklist detailing date and time of inspection any relevant observation or work instructions to work crews. Standardised data collection will also inform a clearing completion report submitted to the Contractor Environment Manager following completion of clearing activities during project construction.

Management strategy	Monitoring procedure	Responsibility	Required documentation
Planned roost exclusion	Monitoring will involve standardised survey effort and data collection that would ultimately inform a 'Permit to Clear' or similar documentation. Survey effort would be consistent with Sections 4.5 and 4.6. Data collection would include (but not be limited to): ■ dates and timing of key steps implemented during roost exclusion ■ relevant observations made and outcomes of key steps implemented ■ Outcomes of liaison with the Contractor, Roads and Maritime and NSW OEH.	Site Environmental Representative, Project Ecologist, Contractor	Completion of appropriate checklist detailing date and time of key steps implemented during roost exclusion, relevant observations and work instructions given to work crews. Standardised data collection will also inform a clearing completion report submitted to the Contractor Environment Manager following completion of clearing activities during project construction.
Spotter catcher and microbat relocation	Completion of spotter catcher and microbat relocation activities as described in Section 4.7. Monitoring of clearing works will include standardised data collection including: ■ Procedures, including equipment used, method, time and date ■ Record of fauna activity, including displaced native fauna, fauna rescued, relocated, euthanased, placed into appropriate care ■ Details of each microbat would be recorded, including species, sex, weight, forearm length, age, type of structure and roost site were rescued ■ Location and habitat type of relocated fauna species	Project Ecologist	Completion of appropriate checklist detailing date and time of clearing activities and relevant information regarding relocation, euthanasia or veterinarian treatment for microbats encountered during project construction works. Standardised data collection will also inform a clearing completion report submitted to the Contractor Environment Manager following completion of clearing activities during project construction.
Minimising disturbance to existing habitat	During project construction visual monitoring of key areas (i.e. bridge and culvert structures, creek lines, riparian vegetation and environmental no-go areas) not proposed for disturbance within the project boundary would be completed as part of weekly site inspections	Site Environmental Representative	Completion of appropriate checklist detailing date and time of inspection and any relevant observations or work instructions provided to work crews

6. References

Biosis Research 2012, Foxground and Berry bypass – Princes Highway Upgrade – Environmental Assessment, a report prepared for the NSW Roads and Maritime Services.

Gaia Research 2014, Fauna Surveys in the Berry Corridors: Seven Mile Beach to Brought Vale focus area, a report prepared for Shoalhaven Landcare Association.

NSW Roads and Traffic Authority 2011, *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects*, NSW Roads and Traffic Authority.

Parsons Brinckerhoff 2014, *Princes Highway Upgrade – Foxground to Berry - Ecological Monitoring Program*, a report prepared for the NSW Roads and Maritime Services.

South Coast Courier 2014, *Fishing bats a great catch*, a news article in the South Coast Courier 10 March 2014.

Appendix A

Structures requiring routine inspections and pre-clearing surveys

A1. Routine inspections and pre-clearing surveys

Table A1.1 Bridge and culvert structures requiring routine inspections and pre-clearing surveys

Structure	Roost type	Location	Requirements
Bridge	Structural crevice (Photo 1 and Photo 2)	Broughton Mill Creek (near Tannery Road).Refer to Figure 1.1 for location.	Routine inspection and pre-clearance surveys Where practicable, preference remains for avoiding roost exclusion as this structure itself will not be directly impacted. However, if during construction more than one microbat was observed utilising the structure, then temporary roost exclusion could be warranted (i.e. using plywood to board off roost sites, which can be easily removed following construction related disturbance).