Nest Box Management Plan (Section 6)

Woolgoolga to Ballina Pacific Highway upgrade

September 2014

Woolgoolga to Ballina Pacific Highway Upgrade Section 6- Nest Box Management Plan

Client: Roads and Maritime Services

Prepared by

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1	20-Aug-2014	Internal draft	Cameron Miller- Associate Director	
2	20-Aug-2014	Draft for Client	Cameron Miller- Associate Director	
3	16-Sept-2014	Final for Issue	Cameron Miller- Associate Director	

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Executive Summary

AECOM Australia Pty Ltd was engaged by Roads and Maritime Services (RMS) to deliver the Nest Box Management Plan for Section 6 of the Woolgoolga to Ballina Pacific Highway Upgrade (W2B upgrade). The preparation of this plan incorporated:

- A detailed survey of the section 6 PIR clearing boundary to map and assess each hollow-bearing tree (HBT) that is likely to be removed to allow the construction of the roadway.
- An assessment of the number and size of hollows that each HBT supports.
- The survey of a number of transects in land outside the PIR clearing boundary to inform nest box installation in order to offset the loss of HBT's.
- A determination of the number, type and location of boxes to be installed to offset the loss of HBT's

The W2B upgrade covers approximately 155 km of the Pacific Highway and will involve grade separation interchanges, service roads, and upgrades to local road connections, and is expected to be staged in eleven sections. Section 6 of the W2B covers approximately 9.2 km of the existing highway and extends from Iluka Road, Woombah to Devil's Pulpit

The local landscape has been fragmented by historical clearing for agriculture; however, the study area is connected to a number of large conservation reserves including the Mororo State Forest, Devils Pulpit State Forest and Bundjalung Crown Reserve. The study area also traverses the Tabbimoble Creek and a number of minor creeks and drainage lines. The study area also extends from Chainage 96400 to 105600 of the project area

Hollow-bearing tree inventory

The extent of the clearing boundary plus an additional 5 metres beyond the boundary was surveyed by foot to identify and map all the hollow-bearing trees within the alignment of Section 6. The additional 5 metres beyond the clearing boundary was surveyed to account for the potential accuracy issues associated with the mapping equipment, as well as to allow for any future alterations to the project design.

Following the identification of each hollow-bearing tree, an assessment was made of the number of hollows that the tree supported, as well as an assessment of the characteristics of each hollow. The dimensions of the hollows observed are of particular importance, as this identifies the faunal groups, and potentially the species that may utilise the hollow resource. For each hollow observed, the following information was collected:

- The position of each hollow on the tree:
  - Trunk
  - Limb
  - Spout, or
  - Fissure
- The size of each hollow:
  - small (less than 50mm),
  - medium (51mm-150,) and
  - large (150mm or greater), and
- The height of each hollow in the tree.

Hollow-bearing tree density

The entire Section 6 study area was stratified into zones which were determined during the field survey by dividing the Section 6 reach into four 2000m blocks, and one 1000m block, known as nest box zones. Within each of these nest box zones, a number of transects (typically measuring 200m x 50m or 1 hectare) were surveyed to allow for a determination of the density of hollow-bearing trees to be made adjacent of the clearing boundary.

The average number of HBT's within each quadrat was then used to calculate the density of HBT's per hectare in land adjacent to the project corridor.

Sixty-five HBT's were recorded from within Section 6, providing 180 hollows, of which:

- 45 (25%) were trunk hollows,
- 106 (59%) were located within branches,
- 18 (10%) were spouts, and
- 11 (6%) were fissures in the trunk of the tree.

A two-stage process was adopted in order to calculate the total number of next boxes that are required to be installed to offset the loss of hollows within the clearing boundary,.

Stage 1 allowed for the determination of the number of nest boxes required to be installed for each of the broad fauna groups that may utilise the hollow resource to be removed. This calculation is based on the ground-based assessment of the number of hollows.

Stage 2 allows for the determination of the number of nest boxes as well as the specific design of the boxes to ensure they target the required species. This is done on a proportional basis, therefore if 20% of the tree hollows being removed are considered to be suitable for particular faunal group, then 20% of the nest boxes to be installed should be designed to target that specific faunal group

Nest box installation

In total, 23 next boxes are required to be installed to mitigate the impact of the removal of hollow-bearing trees from Section 6. This includes five additional possum boxes that are required to be installed for every owl/cockatoo box to reduce the potential for competitive interactions between these species.

The contractor for Section 6 is required to install 70% of the total number of boxes prior to the vegetation clearance so as to provide at least temporary refuge for any species that are displaced from their hollows during clearing. The remaining 30% of boxes are to be installed post clearing, and once a final tally of the actual number of hollows functional hollows has been compiled and reviewed. This data will be collected during the supervision of the clearing.

1.0 Introduction

1.1 Scope of works

AECOM has been engaged by Roads and Maritime (RMS) to provide a Nest Box Management Plan (NBMP) for Section 6 of the Woolgoolga to Ballina Pacific Highway Upgrade. This upgrade comprises approximately 155 kilometres of highway and at its completion, will achieve a four lane divided road extending north of Woolgoolga from the end of the Sapphire to Woolgoolga upgrade, to south of Ballina where it will intersect with the Ballina Bypass.

A field assessment of the projects' limits of clearing boundary was undertaken to determine the number, quality and size of the hollows that will be removed to facilitate this section of the alignment. An assessment of land outside of the clearing boundary was also undertaken to determine the density of hollow-bearing trees outside of the project boundary to inform the location of potential receptor sites for nest boxes to be installed.

1.2 Objectives of the Nest Box Management Plan

This NBMP has been prepared as per the Woolgoolga to Ballina Pacific Highway Upgrade Ecological Monitoring Program (RMS 2013) and the Biodiversity Guidelines- Protecting and managing biodiversity on RTA projects (RTA 2011).

Franks and Franks (2006) state that approximately 20% of Australia's native bird and mammal species rely on tree hollows for roosting, nesting and breeding. Such is the importance of hollows as a resource for fauna, in 2006 the loss of hollow bearing trees was listed as a key threatening process under Schedule 2 of the NSW *Threatened Species Conservation Act, 1995* (TSC-Act). The provision of supplementary fauna habitat in the form of artificially constructed nest boxes can help mitigate the impact of hollow-bearing tree removals, particularly for projects that are undertaken on a landscape scale, such as the Pacific Highway Upgrade works.

Appropriate nest box management on this project is one of the five general mitigation measures that are detailed in both the Woolgoolga to Ballina Pacific Highway Upgrade Environmental Impact Statement (RMS 2012).

1.3 Survey limitations

There are a number of limitations that should be considered when reviewing the adequacy of this NBMP:

- At times, the density of vegetation (and particularly the exotic Lantana *lantana camara*) may have obscured some hollows from view. This issue is mitigated to some extent by the application of a margin of error to the final number of nest boxes to be installed.
- The habit of some tree species, such as Broad-leaf Paperbark *Melaleuca quinquenervia* can make the identification of hollow difficult. The characteristic large sheets of papery bark produced by this species in particular can make the accurate inventory of hollows difficult. This issue is mitigated to some extent by the application of a margin of error to the final number of nest boxes to be installed.)
- On occasion, visibility issues prevented the confident determination of hollow depth.
- Mapping was conducted using hand-held (uncorrected) Trimble GPS units. The accuracy of uncorrected GPS data is subject to the accuracy of the unit and access to satellite information (generally less than six metres). As such, these points should not be relied on for design purposes.
- AECOM were denied permission to access the following properties within Section 6 (refer to Figure 1):
  - Lot1/DP1177247- Pacific Highway Mororo, NSW, 2469 (A)
  - Lot2/DP837712- Pacific Highway Mororo, NSW, 2469 (B)
  - Lot10/DP716638- Pacific Highway, Jackybulbin NSW 2463 (C).

Re-survey of the properties for which access could not be obtained is not considered necessary. The clearing boundary predominately followed the property boundary, and was therefore able to be adequately assessed from outside the private land.

2.0 Survey background

2.1 Existing environment

The study area is located in the North Coast Bioregion of New South Wales (NSW), starting some 18 Kilometres north of the township of Maclean, and finishing close to the Tabbimobile Swamp Nature Reserve. The site is within the Northern Rivers Catchment, and covers the Richmond Valley and Clarence Valley Local Government Areas. It has a sub-tropical climate, with a mean annual rainfall of 1462 mm and mean maximum temperatures varying between 19 °C (July) and 26.7 °C (January and February).

Although the local landscape has been fragmented by historical clearing for agriculture, large tracts of intact vegetation provide valuable habitat connectivity between the vegetation within the defined clearing extent and a number of large conservation reserves including the Mororo State Forest, Devils Pulpit State Forest and Bundjalung Crown Reserve. The study area also traverses the Tabbimoble Creek and a number of minor creeks and drainage lines. The study area extends from Chainage 96400 to 105600 of the project area.

Figure 1 overleaf provides a map of the study area in a local and regional context. It also shows those properties for which access was either granted or denied, or for which access could not be confirmed.

2.2 Fauna habitats

The vegetation communities within Section 6 were divided into a total of five potential fauna habitats. Each of these is discussed in more detail below.

Dry sclerophyll forests

Eucalypt dominated dry sclerophyll forest was the most widespread fauna habitat recorded, and typically existed as a tall, dry forest on flat to gently undulating topographies. Within Section 6, the dominant overstorey species within this habitat type included Spotted Gum *Corymbia maculata,* Grey Ironbark *Eucalyptus siderophloia,* Blackbutt *Eucalyptus pilularis* and Red Bloodwood *Corymbia gummifera.*

The structural diversity of this habitat type provides a range of foraging habitat for fauna species such as fallen logs, a dense shrubby understorey, organic material on the forest floor, and the decorticating bark of some of the overstorey species.

Most significantly for threatened species, this habitat provides the highest number of hollow-bearing trees within Section 6, and therefore provides important roosting habitat for hollow-dependant threatened species such as Masked Owl *Tyto novaehollandiae,* Powerful Owl *Ninox strenua,* Glossy Black Cockatoo *Calyptorhynchus lathami,* and the Squirrel Glider *Petaurus norfolcensis.*

Wet Sclerophyll Forests

Wet sclerophyll forest was sparsely distributed within Section 6, but when it was recorded it was from the low to mid-slopes of the undulating rises. Red Mahogany *Eucalyptus resinifera and* Pink Bloodwood *Corymbia intermedia* were the most common overstorey species recorded from this habitat type.

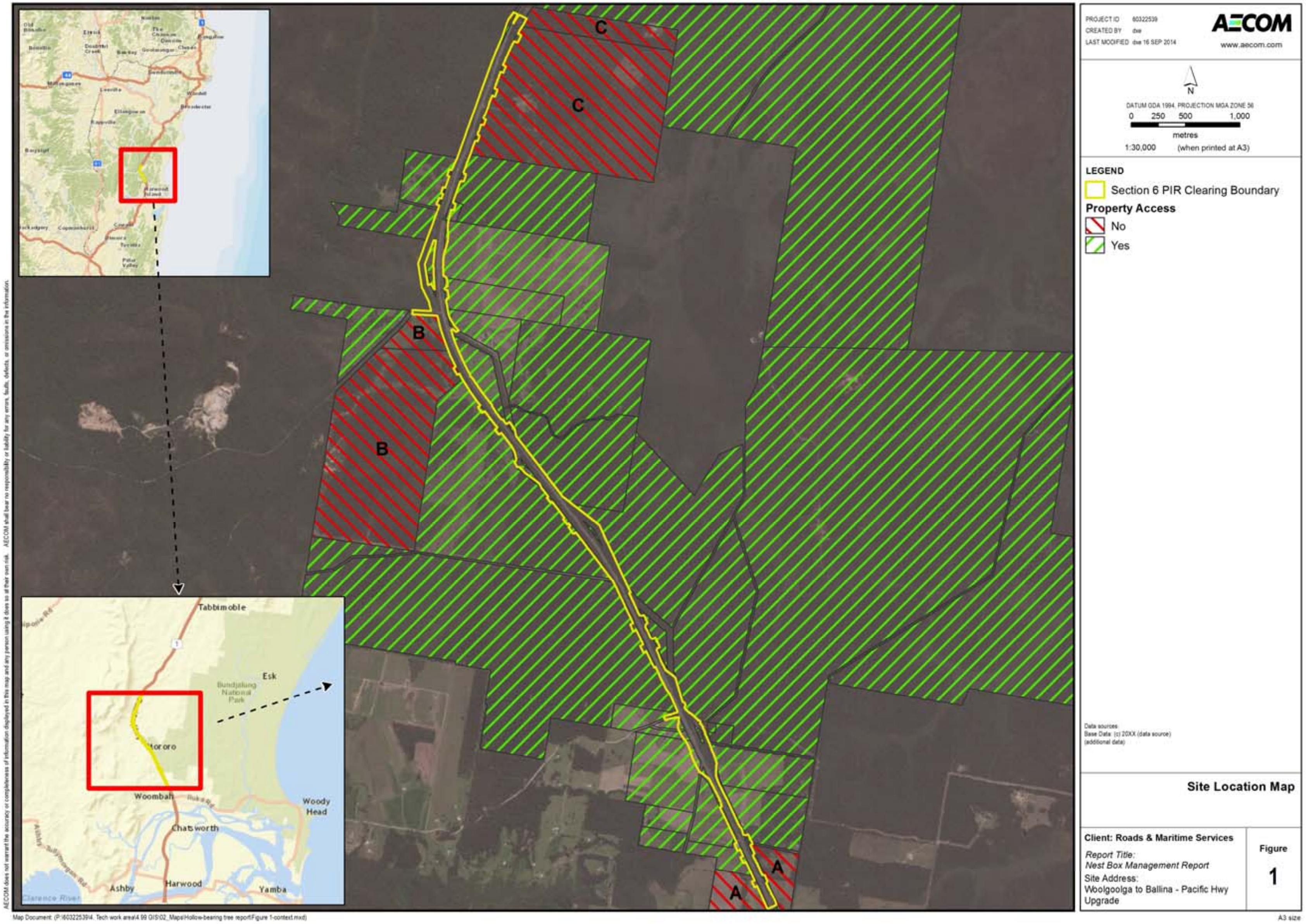
The structural diversity of this habitat type was similar to that of dry sclerophyll forest, and as such, similar foraging habitat was observed.

Only 4.5 hectares of this habitat type was recorded from within Section 6, and therefore was considered less valuable than dry forests for providing hollow-bearing trees. The threatened species likely to utilise this habitat type are consistent with those listed above.

Swamp forest

This habitat typically occurs on seasonally waterlogged floodplains or swampy creek lines. Within Section 6, this habitat type was dominated by various Paperbark *Melaleuca* species, with Swamp Mahogany *Eucalyptus robusta,* Forest Red Gum *Eucalyptus tereticornis,* and Swamp Oak *Casuarina glauca* sub-dominant.

Figure 1- The study area in a local and regional context



Within Section 6, this habitat is most commonly observed in table drains and lower-lying areas in middle of Section 6 from Chainage 101550 to 103800. In addition a small patch is located between Chainage 99050 and 99250.

The species within this habitat type, particularly Swamp Mahogany, are an important food source for a range of significant species including Grey-headed Flying Fox *Pteropus poliocephalus,* Yellow-bellied Glider *Petaurus australis,* Squirrel Glider, and Swift Parrot *Lathamus discolour.* Australasian Bittern *Botaurus poiciloptilus,* and Osprey *Pandion cristatus* also regularly utilise this habitat type. Swamp Mahogany is a recognised as an important feed tree for Koalas *Phascolarctos cinereus,* and hence this habitat type may also provide potential habitat for Koalas.

Aquatic habitat

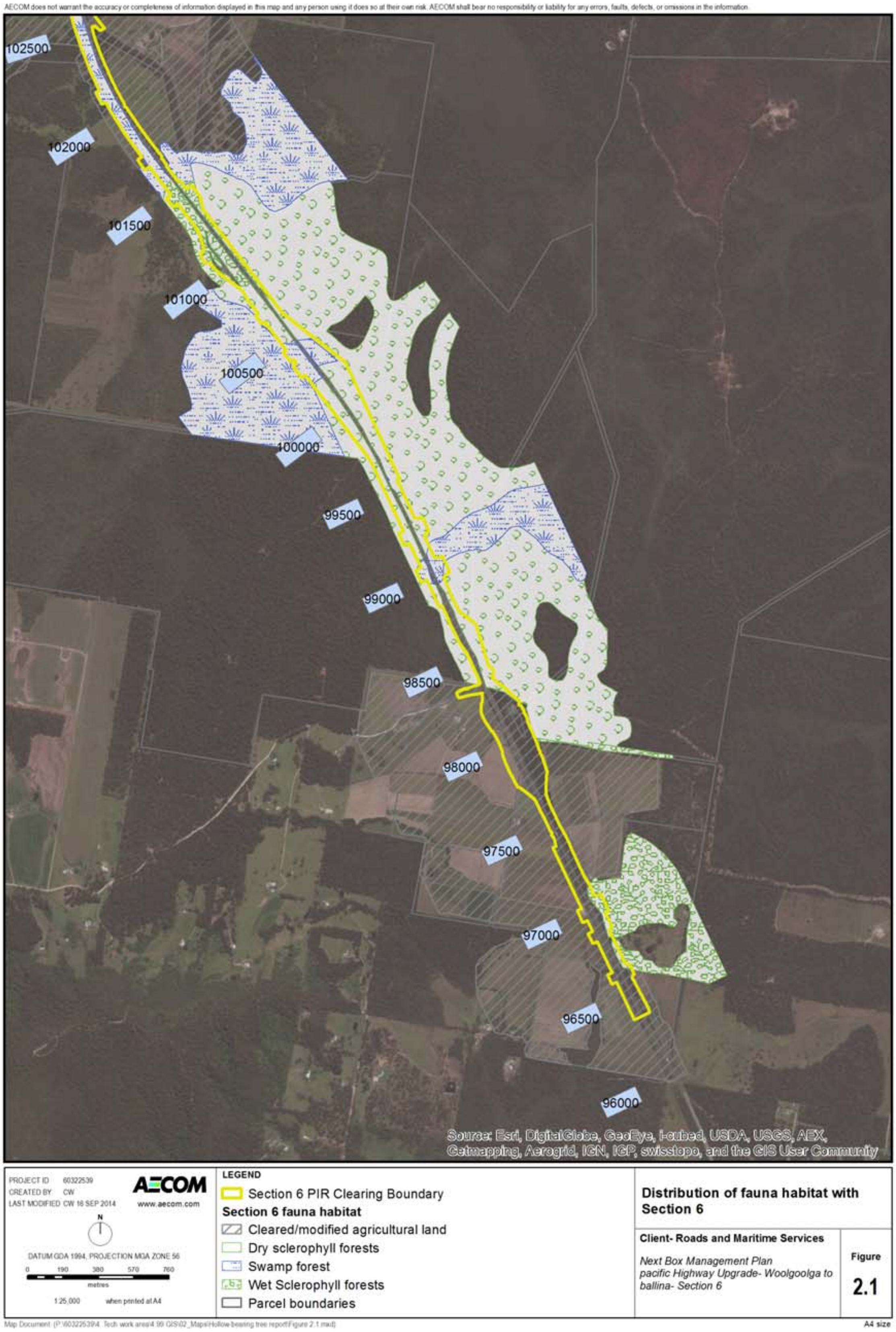
Both permanent streams and creeks, and permanent and ephemeral swamps and waterbodies exist with Section 6. This aquatic habitat provides important foraging, feeding, shelter and breeding habitat for a range of fauna species such as frogs, fish, turtles and waterbirds. Both Myobatrachidae (southern frogs) and Hylidae (tree frogs) are regular utilisers of this habitat, and this includes the threatened Green and Golden Bell Frog *Litoria aurea.*

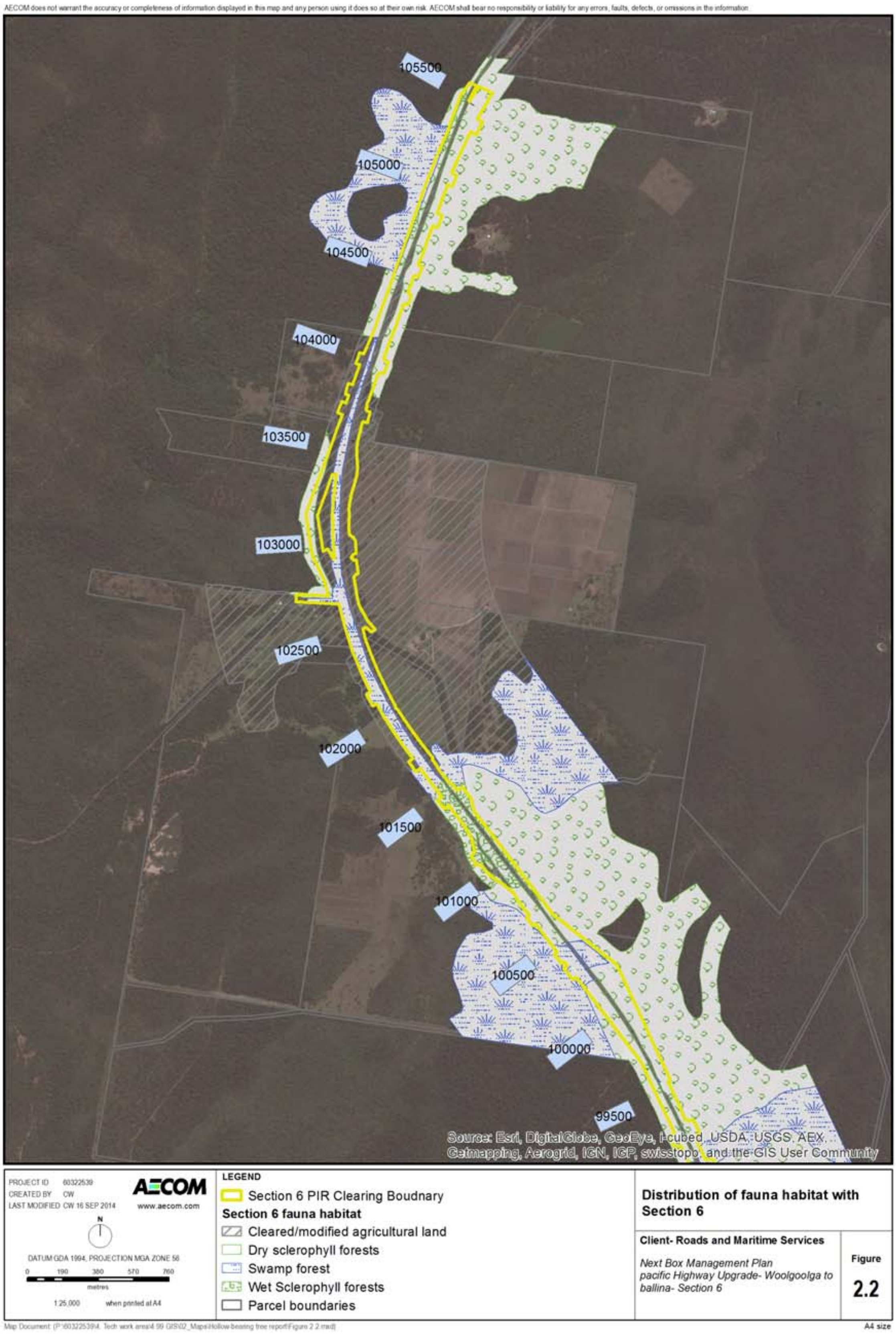
This resource is also important for as a breeding site for local populations of waterbirds as well as migratory species such as Black-necked Stork *Ephippiorhynchus asiaticus* and Latham's Snipe *Gallinago hardwickii.* Threatened fish species such as Oxleyan Pygmy Perch *Nannoperca oxleyana* exist within this habitat type.

Cleared/modified agricultural land

Cleared or intensively modified habitat exists within Section 6, and whilst important roosting and breeding habitat such as hollow-bearing trees are scarce, this land does still provide useful habitat for a range of fauna species. Within Section 6, cleared land is often dominated by crops, typically sugar cane or exists as a grazing land dominated by introduced pasture grasses. These habitats provide useful foraging opportunities for microbats, particularly if farms dams are present, and for owl and reptile species that may frequent the fields in search of prey species. Figure 2, overleaf shows the distribution of fauna habitat within Section 6.

Figure 2-Distribution of fauna habitat within Section 6

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Section 6 PIR Clearing Boudnary
Section 6 fauna habitat
Cleared/modified agricultural land
Dry sclerophyll forests
Swamp forest
Wet Sclerophyll forests
Parcel boundaries
Distribution of fauna habitat with Section 6
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Figure
2.2
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3.0 Survey methodology

3.1 Desktop preparation

Prior to undertaking the field assessment, the study area boundary and the clearing extents of the works, as well as aerial imagery of the study areas were uploaded onto Trimble Nomad® hand-held mappers to guide the field assessment. The information required being collected on each hollow and/or HBT was built into a data collection form to enable the exact location and features of the hollow to be recorded. The information that was built into the form included:

- The health of the hollow-bearing tree (dead or alive)
- The tree species
- An estimate of the height and the Diameter at Breast Height (DBH) of the tree
- The approximate number of hollows per tree
- The position of the hollow in the tree (i.e. trunk, limb, spout)
- The estimate size of hollow- Small (less than 50mm), Medium (51mm-150mm), Large (>150mm)
- Evidence of animal use of the hollow (i.e. wear, grease around entrance, scratching, nesting material)
- The GPS location of the tree.

3.2 Field survey

3.2.1 Hollow-bearing tree inventory

A field assessment (on foot) of the entire extent of clearing (with an additional buffer of 5m beyond the clearing limits) was undertaken during daylight hours between the 10th and the 13th June, 2014. Experienced zoologists were involved in the field assessment, and 12*42 binoculars were utilised to search potential HBT for hollows. Weather conditions were mild, with daytime maximum temperatures fluctuating between 17ºC and 21º with between 2mm and 16mm of rain falling each day, typically overnight.

The extent of the clearing boundary plus an additional 5 metres beyond the boundary was surveyed by foot to identify and map all the hollow-bearing trees within the alignment of Section 6. The additional 5 metres beyond the clearing boundary was surveyed to account for the potential accuracy issues associated with the mapping equipment, as well as to allow for any future alterations to the project design.

A ring of white spray paint was placed around each hollow-bearing tree identified during the survey. A naming convention specific to Section 6 was adopted- 6 was used as a suffix, followed by the sequential numbering of H1, H2, H3 and so on where H signifies a hollow tree, and 1, 2, 3 defines to number of the tree surveyed. This number was spray painted onto the trunk of the tree, and was as affixed to the trunk on an aluminium tag. This was done to ensure that the tree remains identifiable in the event that the spray paint wears off, which may occur on those species with loose or flaky bark.

3.2.2 Hollow characteristics

Following the identification of each hollow-bearing tree, an assessment was made of the number of hollows that the tree supported, as well as an assessment of the characteristics of each hollow. The dimensions of the hollows observed are of particular importance, as this identifies the faunal groups, and potentially the species that may utilise the hollow resource. For each hollow observed, the following information was collected:

- The position of each hollow on the tree:
  - Trunk
  - limb
  - spout, or
  - Fissure.

- The size of each hollow:
  - small (less than 50mm),
  - medium (51mm-150,) and
  - large (150mm or greater).
- The height of each hollow in the tree.

3.2.3 Hollow-bearing tree density

The entire Section 6 study area was stratified into zones which were determined during the field survey by dividing the Section 6 reach into four 2000m blocks, and one 1000m block, known as nest box zones. These blocks were defined using the chainage information provided by RMS. The length of the nest box zones was determined following the survey of HBT's, with the divisions of each nest box zone occurring where there were logical blocks of HBT's. Within each of these nest box zones, a number of transects (typically measuring 200m x 50m or 1 hectare) were surveyed to allow for a determination of the density of hollow-bearing trees to be made adjacent of the clearing boundary. The number of transects surveyed within each nest box zone was determined by evaluating the likely number of nest boxes that may need to be installed adjacent to each zone. The less nest boxes requiring installation, the less transects were completed. Transects were only completed in areas adjacent to the alignment that could be considered ideal receptor site for the nest boxes. Further information on this is provided in section 0, overleaf.

The average number of HBT's within each quadrat was then used to calculate the density of HBT's per hectare in land adjacent to the project corridor.

4.0 Survey results

4.1 Field survey

4.1.1 Hollow-bearing tree inventory

Sixty-five HBT's were recorded from within Section 6, providing 180 hollows (see Figure 3, overleaf). As could be reasonably expected, the majority of the HBT's recorded were from areas of the alignment that were adjacent to and contiguous with, large tracts of overstorey vegetation. Indeed 48 of the 66 HBT's (or 73% of the total HBT's) were recorded from the last 3km's of Section 6 where roadside vegetation is contiguous with the Bunjalung Crown reserve and the Tabbimobile State Forest. Whilst it is recognised that these forests are managed forestry coupes, the 50m of vegetation from the property boundary are retained as buffers to the logging activities, and therefore support high densities of trees that are of sufficient age to have formed hollows.

4.1.2 Hollow characteristics

Of the 180 hollows recorded from Section 6:

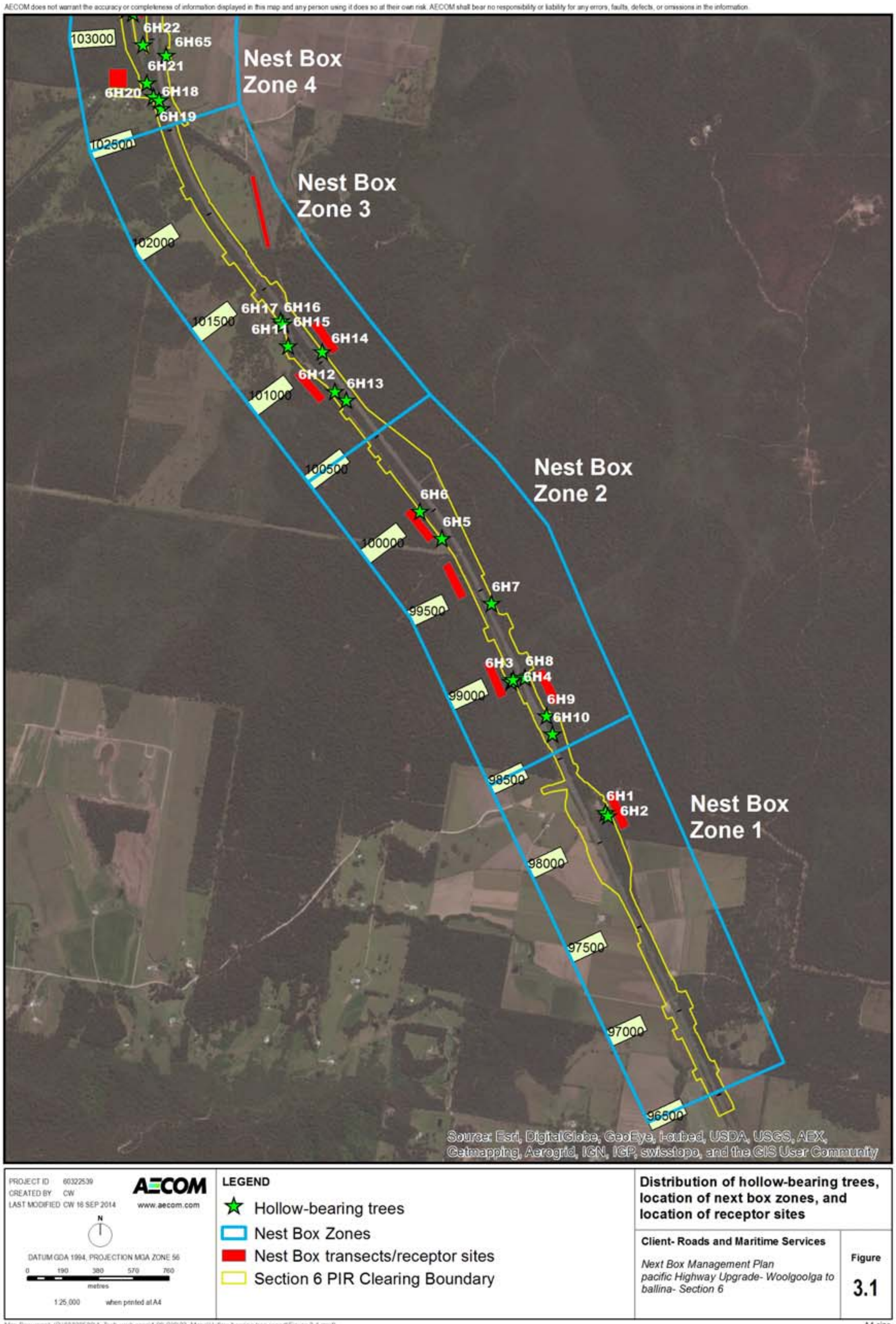
- 45 (25%) were trunk hollows,
- 106 (59%) were located within branches,
- 18 (10%) were spouts, and
- 11 (6%) were fissures in the trunk of the tree.

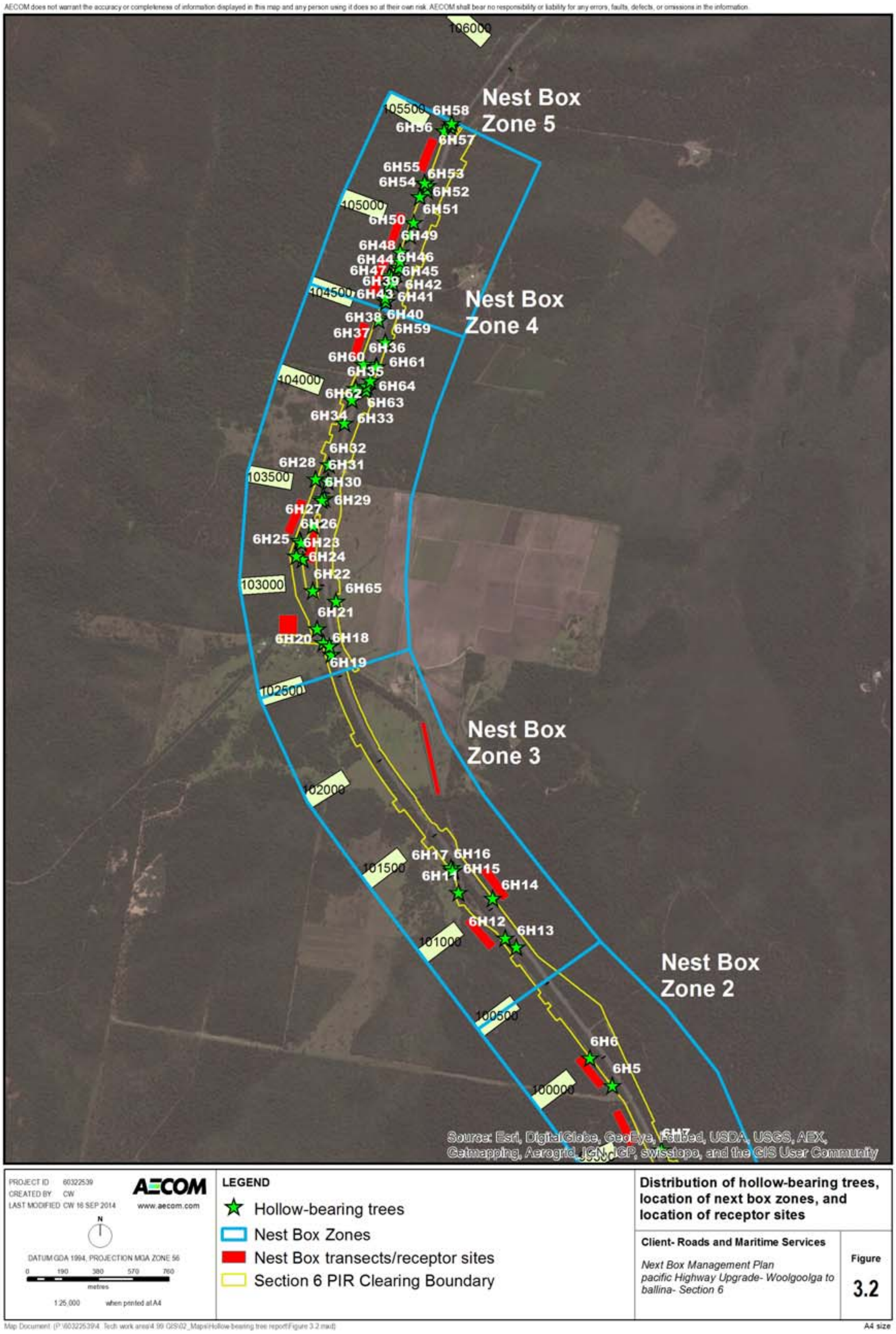
Each of these hollows was classified into sizes to allow for a determination of the fauna species which may preferentially utilise the hollow resource. Of the 180 hollows:

- 50 (28%) were small hollows (<50mm in size)
- 100 (5%) were medium hollows (51-150mm)
- 30 (17%) were large hollows (>151mm).

Of the 50 smaller hollows, 11 (22%) were observed as longitudinal fissures in the trunk of trees. These hollow features were more prevalent in stags, are an important habitat feature microbats.Survey for fissures almost certainly underestimates the actual number of these features that a tree supports. Some stags may support 20 or more fissures, and the actual number can be very difficult to quantify. As such for this assessment, a single fissure was recorded against each tree that supported this feature.

Figure 3-Location and distribution of HBT's within Section 6





Nest Box Zone 5
Nest Box Zone 4
Nest Box Zone 3
Nest Box Zone 2
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Hollow-bearing trees
Nest Box Zones
Nest Box transects/receptor sites
Section 6 PIR Clearing Boundary
Distribution of hollow-bearing trees, location of next box zones, and location of receptor sites
Client- Roads and Maritime Services
Next Box Management Plan
pacific Highway Upgrade- Woolgoolga to ballina- Section 6
Figure
3.2
A4 size

Only 21% of the trees surveyed supported a single hollow. The HBT's surveyed in Section 6 had an average of 2.7 hollows per tree.

4.1.3 Hollow-bearing tree density

Inside the clearing boundary

AECOM have calculated the density of HBT per hectare of vegetation that is likely to be cleared. This has been done by using the extent of the vegetation communities within the clearing boundary as a measure of the total area of vegetation to be cleared within Section 6. In total, there is 69.7 hectares of eight different vegetation communities that exist within the clearing boundaries of Section 6. With a total of 65 HBT recorded from within the clearing boundary, Section 6 supports a HBT density of 0.93 HBT/hectare.

A discussion of the density of HBT's per vegetation community is perhaps a more informative approach to document the losses of HBT's and will allow a comparison to be made of the impact of clearing each vegetation community. Within Section 6:

- Blackbutt - bloodwood dry heathy open forest on sandstones of the northern North Coast- 0.77 HBT/hectare
- Forest Red Gum - Swamp Box of the Clarence Valley lowlands of the North Coast- 1.2 HBT/hectare
- Grey Gum - Grey Ironbark open forest of the Clarence lowlands of the North Coast- 0.96 HBT/hectare
- Narrow-leaved Red Gum woodlands of the lowlands of the North Coast- 1.1 HBT/hectare
- Paperbark swamp forest of the coastal lowlands of the North Coast- 0.58 HBT/hectare
- Red Mahogany open forest of the coastal lowlands of the North Coast- 0.97 HBT/hectare
- Spotted Gum - Grey Ironbark - Pink Bloodwood open forest of the Clarence Valley lowlands- 5.5 HBT/hectare
- Tallowwood dry grassy forest of the far northern ranges of the North Coast- 0 HBT/hectare

Outside the clearing boundary

AECOM undertook transect surveys outside of the project boundary to determine the density of HBT/hectare in order to locate potential receptor sites for the nest boxes that will be installed following clearance. There were a number of parameters that informed the location of where these transects would be placed. These included:

- Permission to access the land for surveys.
- Relative ease of accessibility for the installation of boxes.
- Proximity of receptor site to the location of the potential losses.
- Location of the receptor sites within the same vegetation community as the losses
- Ensuring that the potential receptor sites are not located within the boundaries of a potential logging coupe

AECOM completed 15 transects outside the clearing boundary, each measuring 200m x 50, (1 hectare.) The average HBT per hectare (total combined) was 1.3 HBT per hectare outside the clearing boundary. The following average densities of HBT per hectare were recorded from outside the project boundaries:

- Blackbutt - bloodwood dry heathy open forest on sandstones of the northern North Coast- 1.3 HBT/hectare
- Forest Red Gum - Swamp Box of the Clarence Valley lowlands of the North Coast- 1.6 HBT/hectare
- Grey Gum - Grey Ironbark open forest of the Clarence lowlands of the North Coast- 1 HBT/hectare
- Narrow-leaved Red Gum woodlands of the lowlands of the North Coast- 1 HBT/hectare
- Paperbark swamp forest of the coastal lowlands of the North Coast- 1.5 HBT/hectare.

No transects were located within the following vegetation communities:

- Red Mahogany open forest of the coastal lowlands of the North Coast
- Spotted Gum - Grey Ironbark - Pink Bloodwood open forest of the Clarence Valley lowlands
- Tallowwood dry grassy forest of the far northern ranges of the North Coast.

These communities were not surveyed as they will suffer the smallest clearance (by area) and supported the lowest HBT density of hollow-bearing trees of all vegetation communities surveyed. Furthermore, the extent of these communities outside of the clearing boundaries was limited, and patches of these communities were often discontinuous with large patches of overstorey vegetation, limiting their suitability as receptor sites for boxes.

5.0 Number of boxes required

The section provides a discussion of the number and type of next boxes that are required to be installed to mitigate the impact of the removal of the hollow resources within Section 6. A two-stage process is to be adopted, as per the Request for Tender documentation.

Stage 1

Stage 1 allows for the determination of the number of nest boxes required to be installed for each of the broad fauna groups that may utilise the hollow resource to be removed. This calculation is based on the ground-based assessment of the number of hollows.

The following formula has been utilised to calculate the number of next boxes required:

A x B x 1.2 = Proposed number of nest boxes required where:

$$A = \frac{\text{Number of identified HBT's within the clearing footprint of a specified area}}{\text{Area (ha) of vegetated land identified for removal}} = \text{Density HBT/ha}$$

$$B = \frac{\text{Total number of hollows identified}}{\text{Total number of HBT's within the area}} = \text{Mean number of functional hollows per HBT}$$

1.2 = 20% error factor built in to accommodate for the difficulties associated with identifying tree hollows in habitat with one or more of the following factors:

- Dense lower or mid stratum.
- Particular tree species (i.e. Broad-leaved paperbark) that are difficult to accurately critique for tree hollows.
- Adverse weather conditions during the completion of the surveys.

This error factor can be adjusted to suit the habitat and area surveyed, and the confidence in the assessor of the results.

The proposed number of nest boxes is rounded up to the nearest whole number. Table 1, below provides the total number of boxes based in stage 1 calculations and Table 2, overleaf provides the average density of HBT's in potential receptor site outside the project clearing boundary

Table 1- Number of boxes required based on stage 1 calculations

Zone	Chainages	No of HBTs	Number of tree hollows identified	Mean number of functional hollows per HBT	Area removed (ha)	Density of HBT's per hectare	No of nest boxes required
1	96500-98499	2	10	5	12.38	0.16	1
2	98500-100499	8	23	2.88	26.4	0.3	1
3	100500-102499	7	18	2.57	16.17	0.43	1
4	102500-104499	27	79	2.93	22.87	1.18	4
5	104500-105499	21	50	2.38	9.12	2.3	7

Table 2- Average density of HBT's in areas adjacent to the project corridor

Zone	Chainages	Average number of HBT's per Hectare-Adjacent	Nest boxes required if <4 HBT's per hectare	Number of next boxes required
1	96500-98499	1	Yes	1
2	98500-100499	1.5	Yes	1
3	100500-102499	0.7	Yes	1
4	102500-104499	1.5	Yes	4
5	104500-105499	1.3	Yes	7

Stage 2

Stage 2 allows for the determination of the number of nest boxes as well as the specific design of the boxes to ensure they target the required species. This is done on a proportional basis, therefore if 20% of the tree hollows being removed are considered to be suitable for particular faunal group, then 20% of the nest boxes to be installed should be designed to target that specific faunal group. In addition, for every cockatoo/owl nest box to be installed within a given area, an additional possum box is required to try and reduce the potential for interactions between these species in the search for nesting or sheltering resources.

Given the few nest boxes that are required to be installed for Section 6, calculating the number of boxes to be proportionally installed for each faunal group is meaningless for nest box zones 1, 2 and 3 as only one box is required to be installed in each of these zones. Given the low number of boxes, AECOM is proposing that one box be installed to compensate for each of the hollow sizes that may be lost as a result of the clearing. As such, even though only one box is required to be installed, AECOM propose to install two boxes in zone 1, three boxes in zone 2 and 4 boxes in zone 3 to better account for the range of species that would likely utilise the hollows. The required box types for nest box zones 4 and 5 have been calculated based on the proportional approach detailed above (see Table 3, below).

Table 3- Number and type of nest boxes per nest box zone

Zone	Chainages	Total number of nest boxes required	Number of specific box types required									
			Small Gliders	Large Gliders	Possums	Microchiropteran Bats	Small Birds	Parrots	Small Owls	Large Owls	Cockatoos	Additional Possum
1	96500-98499	2	1				1					
2	98500-100499	3		1	1				1			
3	100500-102499	4				1		1		1		1
4	102500-104499	6	1	1						1	1	2
5	104500-105499	8	1		1		1	1		1	1	2

In total, 23 next boxes are required to be installed to mitigate the impact of the removal of hollow-bearing trees from Section 6. This includes five additional possum boxes that are required to be installed for every owl/cockatoo box to reduce the potential for competitive interactions between these species.

6.0 Nest box specification

6.1 Background

AECOM have closely followed the 'Biodiversity Guidelines- Protecting and managing biodiversity on RTA projects' (RTA, 2011) when preparing this advice.

This document was produced by RTA (now RMS) to provide guidance on minimising the impact of hollow loss by providing supplementary fauna habitat in the form of artificial hollows. The guide is to be applied to any RMS project where hollow-bearing trees are to be removed and where nest boxes are used to mitigate habitat loss or when roost boxes are required to manage microbats in bridges (RTA, 2011).

6.2 Nest box construction

Table 4, below provides the recommended nest box dimensions for those target fauna groups (adapted from Franks and Franks, 2006) and based those species outlined in Table 3. Materials to be used for the construction of the boxes can be varied. Typically, plywood made from plantation timber is the most common construction material used in the construction of the boxes, but boxes constructed from recycled plastic sheet are becoming more prevalent. Regardless of the material used, the thickness of the walls and lid of the box should be 30mm or greater to ensure that the occupants of the box are adequately insulated against the cold and the heat.

Table 4- Nest box specifications

Nest box type	Species	Total number required	Internal dimensions (mm)	Depth/ of chamber (mm)	Entrance diameter (mm)	Height above ground (m)	Distance between same type of boxes (m)	Distance between boxes
Microchiropteran bats	Southern Myotis, Eastern Freetail Bat, Eastern False Pipistrelle	1	N/A	400	30 hole 20 slot	3-5	50	Slot to be provided at the bottom of the box. Shade cloth or denim should be fixed to the inside of the box. Heavily grooved landing pad should be provided at the bottom of the box.
Small Glider	Squirrel Glider	3	150 x 250	300	45	3-6	60-100	Position entrance to face tree for squirrel gliders
Large Gliders	Yellow-bellied Glider	2	250 x 300	400	80	6-8	180-200	
Possums	Brushtail Possum	7	250 x 300	400	85-100	5-8	100	Mesh or grooves in the box will encourage young to climb.
Small birds	Brown Treecreeper,	2	150 x 150	350	60	2-4	50	
Parrots	Little Lorikeet, Double-eyed Fig parrot	2	200 x 200	400	65	5-8	100	Layer of sawdust should be provided in the base of the box
Small Owls	Sooty owl, Boobook Owl	1	250 x 300	500	100	8-10	150	Short , horizontal entrance spout
Large Owls	Powerful Owl, Masked Owl	3	400 x 400	600-750	100-150	6-12	>500	Short , horizontal entrance spout
Cockatoos	Glossy Black Cockatoo	2	300 x 400	1200	200	8-10	200	Regularly chew on the box- should ideally be constructed from plastic, or alternatively, a chewing block should be attached to the box. Angled spout entrance.

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Construction

Whilst the dimensions of the boxes (provided above) is the most important factor is the construction of nest boxes, the following design suggestions should be considered:

- The entrance hole should be no larger than is required to attract the target fauna group or species.
- The entrance should be close to the top of the box to regulate the amount of light than can enter the box.
- Either rough-sawn timber, or grooves cut into the face of the box will allow animals to grip to the face of the box.
- The lid of the box should overhang the sides by more than 25mm to prevent moisture from entering the box during rainfall.
- The outside of the box should be painted with non-toxic, dark coloured, exterior grade water-based paint. Interior of the box should be left untreated.
- Between three and five holes should be drilled in the base of the box to allow for moisture to drain.
- Non-toxic woodchips, wood shavings or sawdust can be beneficial if placed in the base of glider, bird and possum boxes to provide additional insulation during colder months.
- Grip in the form of mesh, or grooves cut into the walls of the box should be provided to allow young to climb out of the box.
- A hinged lid of preferable to allow for any future monitoring works to occur. This will also allow for easier eviction of exotic species should the need arise.
- Care should be taken to ensure that there are no exposed screw or nail ends in the box
- Boxes should be glued using non-toxic glue

Exotic Species

- Rear openings for bats and gliders may discourage habitation by the exotic Indian Mynah *Acridotheres tristis* and the competitive, but native, Rainbow Lorikeet *Trichoglossus haematodus*
- Carpet attached to the underside of the lid is thought to act as a deterrent to the European Bee *Apis mellifera.*
- Similarly, insecticidal cattle ear tags can be placed near the entrance to the box to discourage European Bees.
- A hinged lid allows for easier eviction of exotic species

7.0 Distribution and position of nest boxes

This section expands upon the discussion begun in Section 6 to outline the number and location of the boxes to be installed to mitigate the removal of HBT's within the clearing boundary. The appropriate selection of receptor sites for nest boxes is of critical importance to ensuring that this mitigation program is successful. In general, the following guidelines were considered when selecting a receptor site:

- That the density of HBT's in the receptor site is less than 4 HBT/Ha
- That the receptor site is located as close as practicable to the site of the loss of HBT, but at a maximum is not outside the nest box zones that the losses will occur in.
- The habitat connectivity of the receptor site- sites with best habitat connectivity through the landscape were considered first.
- Habitat connectivity between the removals and the receptor site.
- The crown land is selected preferentially over private land, but only where
    - No logging will occur if the land is a logging coupe.
- Sites should support stands of trees of mixed age
- Availability of alternative habitat resources for the target species such as Allocasuarina for Glossy Black Cockatoos as well as winter and spring flowering Eucalypt species.

Table 5- Details of selected proposed receptor sites for next box offsets

Zone	Chainages	Side of Carriageway	Tenure	Notes	Photo
1	96500-98499	East	NSWPWS	Bunjalung National Park. Tall, mature Eucalyptus with easy access for installation. Low density of existing hollow resources. Grey Gum – Grey Ironbark open forest of the Clarence lowlands of the North Coast.	
2	98500-100499	East and west	SFNSW	Mororo State Forest- Ideal receptor sites exist on both sides of the alignment. Many tall Blackbutt in good condition. Blackbutt – bloodwood dry heathy open forest on sandstones of the northern North Coast.	

Zone	Chainages	Side of Carriageway	Tenure	Notes	Photo
3	100500-102499	East and West	Private and SFNSW	East side of alignment is Mororo state forest (DP751394). West side is privately owned- landholder would be willing to discuss next box placement (DP836263).. Good access for installation on both sides of the alignment.	
4	102500-104499	West and between carriageways	Private and RMS	West side of alignment is good receptor site. Privately owned but landowner permitted access (DP1186280). No discussion was held with landowner regarding installing nest boxes on the property, Between north and south carriageways may be suitable for bird and/or glider box. Good access to receptor sites via Pine Road extension	
5	104500-105499	West	SFNSW	Bunjalung crown reserve- good receptor sites west of alignment. Mature forest red gum. Easy access for installation Private property access was denied on the eastern side of the alignment between chainages 104000 & 105470.	

Following the completion of detailed design for Section 6 and prior to construction individual property access agreements will be negotiated for each nest box zone by Roads and Maritime.

8.0 Nest box installation

8.1 Timing of the installation

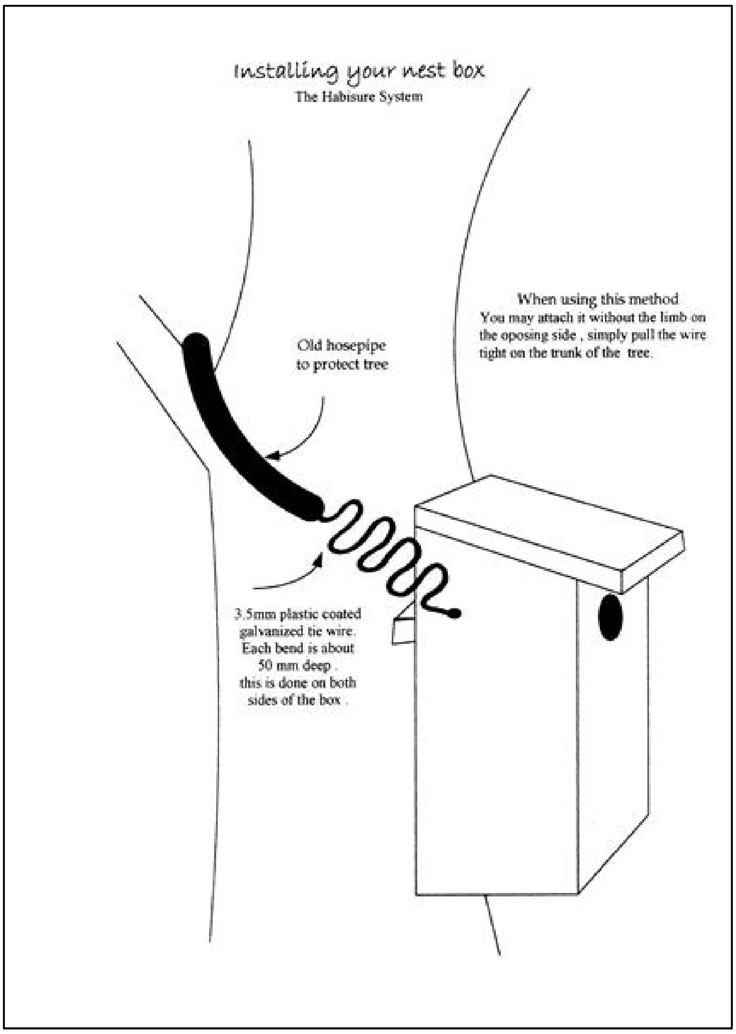
The relevant contractor for Section 6 is required to install 70% of the total number of boxes prior to the vegetation clearance. This is done so as to provide at least temporary refuge for any species that are displaced from their hollows during clearing. The remaining 30% of boxes are to be installed post clearing, and once a final tally of the actual number of hollows functional hollows has been compiled and reviewed. This data will be collected during the supervision of the clearing.

During the installation, the contractor's environmental manager should engage an experienced ecologist to be on-site during the installation of the nest boxes. The ecologist would be responsible for determining the height, the density, the location and the aspect of the installed box.

8.2 Attachment of nest boxes to trees

The Habisure® system, as designed by Franks and Franks (2006) is the preferred method of installation of nest boxes (RTA, 2011). An illustration of this method of installation is provided overleaf (from Franks and Franks, 2006). The bends that are provided in the 3.5mm plastic coated galvanised wire allow for the growth of the tree to which the nest box is attached. As the tree grows, the coils of wire expand, allowing for the increasing size of the trunk whilst ensuring that the box does not impact the bark of the tree. Hosepipe or similar is to be placed around the wire to ensure no impact to the tree.

Figure 4- the Habisure® system of next box installation



The Habisure® method does require the presence of a lateral branch from which to 'hang' the nest box. Should a lateral branch not be present or not be in the required spot in order to ensure the nest box is correctly installed, Franks and Franks (2006) provide an alternative approach, utilising a spring in place of the wire coil. This is attached to the tree with the spring stretched so as to hold the box tightly to the trunk of the tree. Although the spring allows for the tree to grow, this method does require more regular monitoring than the method pictured above.

Next boxes should be installed at or close to the heights that are recommended for the target species as listed in Table 4. Boxes should be as high as possible to avoid predation and discourage human interference, but low enough to enable monitoring and maintenance work to occur. If a number of nest boxes are to be installed in a similar area, heights of boxes should vary to mimic the random heights of natural hollows. The height of the boxes should also be cognisant of Occupational Health of Safety Issues, and should only be undertaken by installers who are accredited to work at heights. Elevated Work Platforms (EWP's) are commonly used to install boxes however these are often only suitable on stable ground. Arborists allow for the boxes to be placed in trees that may be inaccessible to EWP's and can result on a more natural distribution of boxes.

Ultimately, the location of the boxes should be determined by an ecologist, and the following points are to be considered when installing nest boxes:

- Install boxes as close as possible to the location of the HBT to be removed.
- Install nest boxes for gliders and possums on Rough-barked trees (which are typically easier for them to climb than smooth-barked species).
- Install nest boxes in close proximity to any potential food sourced for the target species.
- Install nest boxes for microchiropteran bats near water sources or near potential flyways.
- Install nest boxes with consideration of any planned fauna connectivity structures– aerial crossings & culverts.
- Do not install next boxes on trees with existing hollows (as the presence of other hollow-dependant fauna may encourage competitive behaviours).
- Do not install nest boxes in areas with a high concentration of Indian Mynahs if possible. This species prefers to nest high in the canopy, so this should be considered when installing boxes (RTA, 2011).

Boxes should be orientated between northwest and east to ensure that the boxes avoid the hot afternoon sun and the dominant direction of severe storms. An important consideration for boxes that are installed on road jobs is to orientate the boxes away from the artificial light that is provided by street lights or likely paths of headlights from vehicles or the lighting of an amenity blocks along the alignment.

To ensure adequate monitoring into the future, nest boxes must be given a unique identification number. This number should be visible from the ground and without the need for a ladder. This can be achieved by fixing an aluminium tag to the tree to which the box is attached, or alternatively by painted the number on the base of the box in large enough text so as to be easily seen. Following the installation of each box, the nest box location should be recorded using a GPS. The identification number, nest box type, tree species, DBH of the host tree, the nest box height, and the orientation of the box should be recorded.

9.0 Nest box monitoring and maintenance

The following section provides a summary of the key monitoring and management objectives as detailed in the Woolgoolga to Ballina Pacific Highway Upgrade Ecological Monitoring Program (RMS, 2013).

9.1 Site selection

Monitoring is to be undertaken for the sites where nest boxes have been located.

9.2 Timing and frequency

The first round of monitoring is to be undertaken 12 months after the installation of the nest boxes. A summer and a winter census is to be undertaken to account for seasonal variation in the use of the nest boxes. Annual monitoring and maintenance is to be undertaken until such time as the effectiveness of the nest boxes has been proven over three consecutive monitoring periods.

Table 6- Timing of the key actions of this NBMP

Management Action	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Responsibility	Documentation requirements
Pre-construction										
Prepare NBMP	✓								RMS	Construction environmental management plan (CEMP) and G36 Quality Spec
Construction										
Commission construction of nest boxes	✓								Contractor	CEMP and G36 Quality specification
Nest box installation- pre-clearing 70% / post clearing 30%	✓								Contractor	CEMP and G36 Quality specification
Review of final nest box requirements following post clearing survey	✓								Contractor	CEMP and G36 Quality specification
Monitoring										
Summer and winter			✓	✓		✓		✓	RMS	Yearly report aligned with sample periods. Final nest box report in Year 8
Maintenance										
Maintenance of boxes			✓	✓		✓		✓	Post construction RMS	Maintenance records

9.3 Monitoring methods

This nest box management plan has detailed the number and type of nest boxes that are required to compensate for the losses of HBT's in Section 6.

Monitoring is required to determine the occupation of the boxes by the target species, and to highlight any maintenance actions that are required.

During each monitoring event, a visual inspection of each nest box should be conducted to collect the following information

- Inspection dates, weather conditions (i.e. rain, cloud cover, ambient temperature,) and time each box was inspected.
- Nest box number.
- Is the nest box currently occupied by native fauna?
- If yes, what species?
- If not, are there signs that the box has been used by pest species (European Bees, Indian Mynahs, and Termites)?
- Is there any deterioration of the nest box?
- Is there any maintenance required?
- Has the surrounding landscape changed (i.e. clearing, partial clearing, fauna mitigation devices such as underpasses installed).

Visual inspection enables the observer to perform a close inspection for signs of faunal habitat including feathers, droppings/scats, hair, nesting material and animals themselves. At the time of this inspection, some maintenance considerations/actions could be undertaken, for example changing the orientation of a nest box to better address thermoregulatory considerations.

Factors that need to be considered as part of the maintenance schedule include:

- The need to remove exotic pest species such as European Bees, Indian Mynahs and Termites.
- Replacement of fallen or damaged nest boxes. The GPs location of any damaged boxes needs to be recorded.
- Re-positioning, re-installation and/or relocation of any wrongly installed nest boxes.
- Checking that each box is not holding water.
- Removing excess nesting material as this may impede access over time.

9.4 Performance indicators and corrective actions

The performance of the nest box program is to be assessed against the following criteria:

- Use of nest boxes by a wide range of native fauna (considered that success is deemed to be 50% of installed boxes being utilised by native fauna).
- Use of nest boxes designed for target species by those species (i.e. Brush-tailed Phascogale nest boxes being used by that species.)
- Low rates of exotic or pest fauna using the boxes.
- Reduced maintenance requirements.

Table 7, below details some contingency measures that are suggested to account for any issues with the nest box program that may be raised during the monitoring works.

Table 7- proposed contingency measures

Mitigation measures	Performance indicator	Corrective actions	Responsibility
Nest boxes	Nest box not being used by target species	Review the location, type and number of nest boxes used	RMS is responsible for engaging suitably qualified ecologists to undertake the monitoring and suitably qualified contractors to undertake the maintenance
	Poor uptake/usage rate by native fauna		
	Nest boxes become occupied by exotic or invasive fauna	Review/change nest box design and/or placement on tree to exclude undesirable species, treat if applicable, or relocate those next boxes to another location	
	Nest boxes deteriorating rapidly and requiring maintenance	Identify causes of nest box failure, modify design if necessary and construct accordingly	

10.0 References

Franks, A and Franks, S (2006) *Nest Boxes for Wildlife: A Practical Guide.* Bloomings Books, Melbourne.

Gibbons, P and Lindenmayer, D (2002) *Tree hollows and wildlife conservation in Australia.* CSIRO Publishing

RMS (2012) Pacific Highway Upgrade: Woolgoolga to Ballina Environmental Impact Statement. NSW Roads and Maritime Services, NSW Government, Sydney

RMS, Aurecon and Sinclair Knight Merz (2013) *Woolgoolga to Ballina Pacific Highway Upgrade- Ecological Monitoring Program*. Roads and Maritime Services, NSW Government, Sydney

RTA (2011) *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects.* Roads and Traffic Authority of New South Wales, Environment Branch, Sydney.

Appendix A

Details of all hollows observed within the study area

Unique ID	Capture Date	Species	ycoord	xcoord	DBH (cm)	Height of tree (m)	total number of hollows	Tree condition	Large trunk	large branch	Large spout	Medium trunk	Medium branch	Medium spout	Small trunk	Small spout	Small branch	Fissures	Notes
6H1	11/06/14	Stag	-29.3321	153.237	95	25	7	Dead							4		3		
6H2	11/06/14	Stag	-29.3323	153.237	90	25	3	Dead									3		
6H3	11/06/14	Spotted Gum	-29.3257	153.232	118	30	2	Alive								1	1		
6H4	11/06/14	Stag	-29.3258	153.232	75	20	3	Dead								2	1		
6H5	11/06/14	Stag	-29.3189	153.228	88	30	3	Dead									3		
6H6	11/06/14	Small-fruited Grey Gum	-29.3175	153.227	120	30	4	Alive									3		
6H7	11/06/14	Stag	-29.322	153.231	55	12	2	Dead							1		1		
6H8	11/06/14	Pink Bloodwood	-29.3256	153.233	55	30	2	Alive							1		1		Hollow with visible wear
6H9	12/06/14	Pink Bloodwood	-29.3274	153.234	123	30	3	Alive		1			2						
6H10	12/06/14	Stag	-29.3283	153.234	100	30	4	Dead					4						Whole tree hollow
6H11	12/06/14	Small-fruited Grey Gum	-29.3095	153.22	119	30	2	Alive			1		1						
6H12	12/06/14	Stag	-29.3117	153.222	110	18	1	Dead					1						
6H13	12/06/14	Stag	-29.3121	153.223	80	30	2	Dead				2						1	
6H14	12/06/14	Stag	-29.3098	153.222	150	25	3	Dead	2			1							Whole tree hollow
6H15	12/06/14	Forest Red Gum	-29.3083	153.219	180	35	3	Alive						3					
6H16	12/06/14	Forest Red Gum	-29.3084	153.219	110	35	4	Alive						4					
6H17	12/06/14	Forest Red Gum	-29.3085	153.219	85	35	3	Alive					3						
6H18	12/06/14	Pink Bloodwood	-29.298	153.213	120	30	3	Alive		1			2						
6H19	12/06/14	Forest Red Gum	-29.2976	153.212	100	25	2	Alive					2						

Unique ID	Capture Date	Species	ycoord	xcoord	DBH (cm)	Height of tree (m)	total number of hollows	Tree condition	Large trunk	large branch	Large spout	Medium trunk	Medium branch	Medium spout	Small trunk	Small spout	Small branch	Fissures	Notes
6H20	12/06/14	Stag	-29.2974	153.212	100	30	1	Dead										1	
6H21	12/06/14	Forest Red Gum	-29.2967	153.212	120	30	3	Alive		1			2						Whole tree hollow
6H22	12/06/14	Stag	-29.2949	153.212	150	20	7	Dead	1				4					1	
6H23	12/06/14	Forest Red Gum	-29.2934	153.211	120	25	1	Alive				1							
6H24	12/06/14	Forest Red Gum	-29.2932	153.211	120	25	1	Alive	1										
6H25	12/06/14	Swamp Box	-29.2926	153.211	90	20	4	Alive	1			1	1		1				
6H26	12/06/14	Forest Red Gum	-29.2924	153.211	75	25	2	Alive						2					
6H27	12/06/14	Stag	-29.2917	153.212	110	25	6	Dead		1			4					1	
6H28	12/06/14	Small-fruited Grey Gum	-29.2895	153.212	85	30	2	Alive				1				1			
6H29	12/06/14	Stag	-29.2905	153.212	90	25	1	Dead										1	
6H30	12/06/14	Forest Red Gum	-29.2904	153.212	100	30	1	Alive					1						
6H31	12/06/14	Stag	-29.2896	153.212	60	15	2	Dead				1	1						
6H32	12/06/14	Small-fruited Grey Gum	-29.2888	153.212	100	30	3	Alive									3		
6H33	12/06/14	Forest Red Gum	-29.2868	153.213	125	15	1	Alive	1										
6H34	12/06/14	Stag	-29.2856	153.214	80	25	4	Dead									3	1	
6H35	12/06/14	Stag	-29.2851	153.214	90	30	2	Dead					1					1	
6H36	12/06/14	Small-fruited Grey Gum	-29.2839	153.214	110	35	6	Alive	1				5						Scratching on trunk
6H37	12/06/14	Small-fruited Grey Gum	-29.2817	153.215	85	35	3	Alive	1				2						
6H38	13/06/14	Forest Red Gum	-29.2809	153.216	80	25	5	Alive	2			1	2						

Unique ID	Capture Date	Species	ycoord	xcoord	DBH (cm)	Height of tree (m)	total number of hollows	Tree condition	Large trunk	large branch	Large spout	Medium trunk	Medium branch	Medium spout	Small trunk	Small spout	Small branch	Fissures	Notes
6H39	13/06/14	Forest Red Gum	-29.2807	153.216	100	18	1	Alive	1										
6H40	13/06/14	Swamp Box	-29.2807	153.216	85	20	3	Alive	1			2							Evidence of wear around large hollow
6H41	13/06/14	Forest Red Gum	-29.28	153.216	100	25	4	Alive	2				2						
6H42	13/06/14	Stag	-29.28	153.216	75	30	4	Dead				2	1					1	
6H43	13/06/14	Forest Red Gum	-29.2797	153.216	85	22	2	Alive		1		1							
6H44	13/06/14	Pink Bloodwood	-29.2796	153.216	90	25	1	Alive				1							
6H45	13/06/14	Forest Red Gum	-29.2796	153.216	75	25	2	Alive				1					1		
6H46	13/06/14	Stag	-29.2795	153.216	60	18	2	Dead							2			1	
6H47	13/06/14	Stag	-29.2792	153.216	70	22	2	Dead					2						
6H48	13/06/14	Forest Red Gum	-29.2789	153.216	100	25	3	Alive					2				1		
6H49	13/06/14	Stag	-29.2784	153.216	80	25	2	Dead	1				1						
6H50	13/06/14	Forest Red Gum	-29.2776	153.217	80	25	1	Alive						1					
6H51	13/06/14	Forest Red Gum	-29.277	153.217	95	30	1	Alive					1						
6H52	13/06/14	Pink Bloodwood	-29.2758	153.217	75	15	1	Alive									1		
6H53	13/06/14	Forest Red Gum	-29.2754	153.218	80	25	3	Alive					1				2		
6H54	13/06/14	Stag	-29.2752	153.218	75	20	3	Dead	1				2						
6H55	13/06/14	Stag	-29.2751	153.218	65	25	4	Dead		1			2					1	Whole tree hollow
6H56	13/06/14	Small-fruited Grey Gum	-29.2725	153.219	130	35	3	Alive	1				2						
6H57	13/06/14	Stag	-29.2722	153.219	65	15	2	Dead	1									1	Whole tree hollow

Unique ID	Capture Date	Species	ycoord	xcoord	DBH (cm)	Height of tree (m)	total number of hollows	Tree condition	Large trunk	large branch	Large spout	Medium trunk	Medium branch	Medium spout	Small trunk	Small spout	Small branch	Fissures	Notes
6H58	13/06/14	Spotted Gum	-29.2724	153.219	65	20	1	Alive				1							
6H59	13/06/14	Stag	-29.2828	153.216	75	25	2	Dead				1	1						
6H60	13/06/14	Grey Ironbark	-29.284	153.215	85	30	1	Alive					1						Hollow occupied by bees
6H61	13/06/14	Small-fruited Grey Gum	-29.284	153.215	90	30	4	Alive		1			2					1	
6H62	13/06/14	Pink Bloodwood	-29.2847	153.215	105	30	5	Alive					5						Hollow occupied by bees
6H63	13/06/14	Pink Bloodwood	-29.285	153.215	100	30	3	Alive				1	2						
6H64	13/06/14	Forest Red Gum	-29.2852	153.214	120	30	5	Alive	1			1	3						
6H65	13/06/14	Forest Red Gum	-29.2954	153.213	140	30	4	Alive		1			3						