



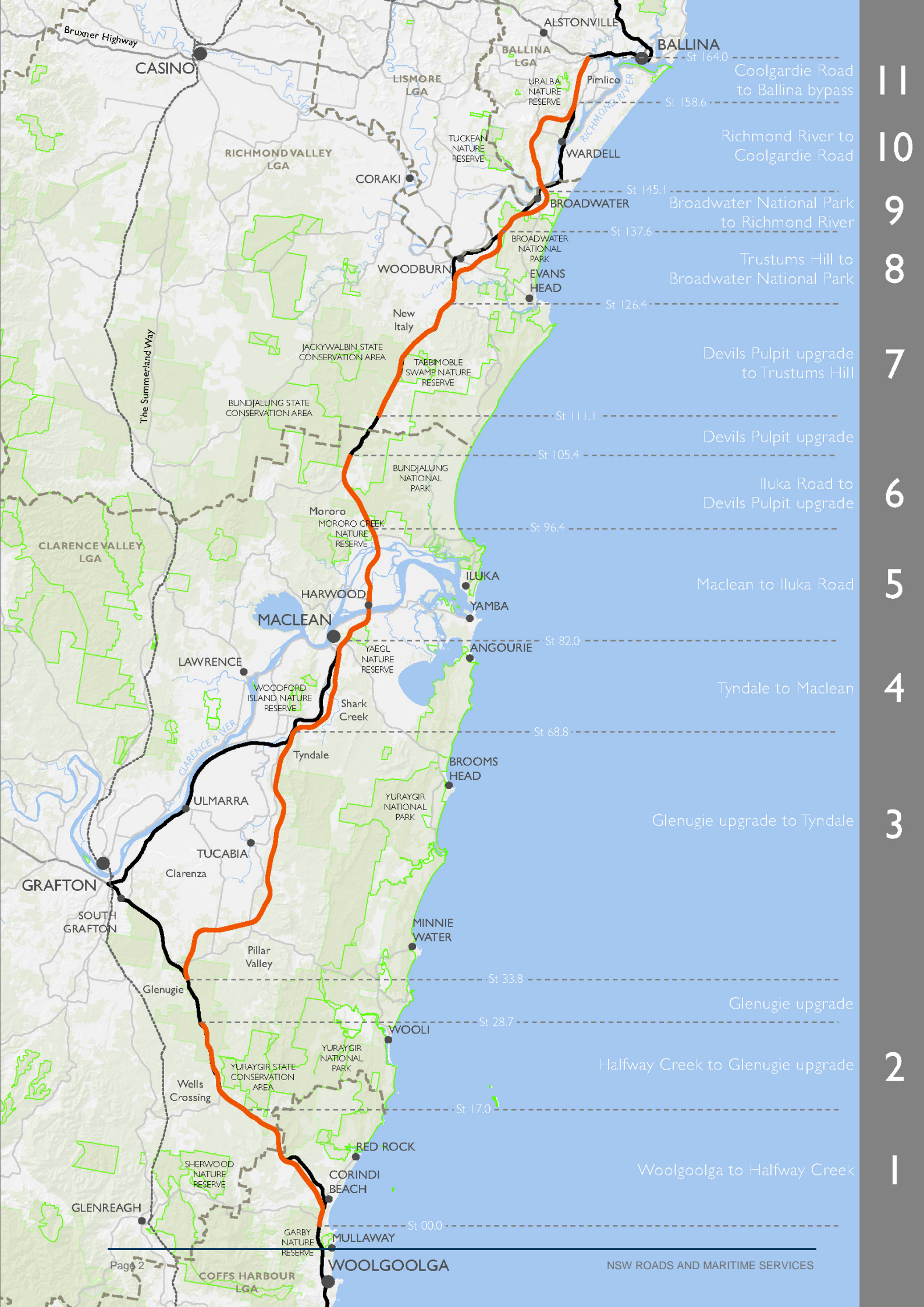
Roads &  
Maritime

# **Koala Management Plan**

## **Sections 1 and 2**

### **Woolgoolga to Ballina Pacific Highway upgrade**

April 2015



11  
10  
9  
8  
7  
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5  
4  
3  
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1

Coolgardie Road to Ballina bypass  
Richmond River to Coolgardie Road  
Broadwater National Park to Richmond River  
Trustums Hill to Broadwater National Park  
Devils Pulpit upgrade to Trustums Hill  
Devils Pulpit upgrade  
Iluka Road to Devils Pulpit upgrade  
Maclean to Iluka Road  
Tyndale to Maclean  
Glenugie upgrade to Tyndale  
Glenugie upgrade  
Halfway Creek to Glenugie upgrade  
Woolgoolga to Halfway Creek

St 164.0  
St 158.6  
St 145.1  
St 137.6  
St 126.4  
St 111.1  
St 105.4  
St 96.4  
St 82.0  
St 68.8  
St 33.8  
St 28.7  
St 17.0  
St 00.0

BRUXNER HIGHWAY  
CASINO  
LISMORE LGA  
RICHMOND VALLEY LGA  
CORAKI  
WOODBURN  
NEW ITALY  
JACKY WALBIN STATE CONSERVATION AREA  
BUNDJALUNG STATE CONSERVATION AREA  
BUNDJALUNG NATIONAL PARK  
MORORO MORORO CREEK NATURE RESERVE  
HARWOOD  
MACLEAN  
LAWRENCE  
TYNDALE  
ULMARRA  
TUCABIA  
CLARENZA  
SOUTH GRAFTON  
GRAFTON  
SOUTH GRAFTON  
GLENUGIE  
WELLS CROSSING  
GLENREAGH  
SHERWOOD NATURE RESERVE  
COFFS HARBOUR LGA  
WOOLGOLGA

ALSTONVILLE  
BALLINA LGA  
URALBA NATURE RESERVE  
PIMLICO RIVER  
RICHMOND RIVER  
WARDDELL  
BROADWATER  
BROADWATER NATIONAL PARK  
EVANS HEAD  
TUCKEAN NATURE RESERVE  
TABBIMBLE SWAMP NATURE RESERVE  
YAMBBA  
ANGOURIE  
BROOMS HEAD  
YURAYGIR NATIONAL PARK  
MINNIE WATER  
CORINDI BEACH  
MULLAWAY  
GARBY NATURE RESERVE

The Summerland Way  
CLARENCE VALLEY LGA  
CLARENCE RIVER  
WOODFORD ISLAND NATURE RESERVE  
SHARK CREEK  
YURAYGIR STATE CONSERVATION AREA  
YURAYGIR NATIONAL PARK

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# Acronyms and abbreviations

| Acronym / abbreviation | Description                                                          |
|------------------------|----------------------------------------------------------------------|
| BACI                   | Before After Control Impact                                          |
| CEMP                   | Construction Environmental Management Plan                           |
| CMS                    | Construction Method Statements                                       |
| NSW CoA                | New South Wales Conditions of Approval                               |
| Cth                    | Commonwealth                                                         |
| DP&E                   | NSW Department of Planning and Environment                           |
| DoE                    | Commonwealth Department of Environment,                              |
| EIS                    | Environmental Impact Statement                                       |
| ER                     | Environmental Representative                                         |
| EMS                    | Environmental Management System                                      |
| EP&A Act               | <i>Environmental Planning and Assessment Act 1979 (NSW)</i>          |
| EPA                    | NSW Environment Protection Authority                                 |
| EPBC Act               | <i>Environment Protection and Biodiversity Conservation Act 1999</i> |
| FFMP                   | Flora and Fauna Management Plan                                      |
| LGA                    | Local Government Area                                                |
| NSW                    | New South Wales                                                      |
| OEH                    | NSW Office of Environment and Heritage                               |
| Project area           | Area within the project boundary                                     |
| Qld                    | Queensland                                                           |
| Roads and Maritime     | Roads and Maritime Service                                           |
| S/PIR                  | Supplementary Preferred Infrastructure Report                        |
| the project            | Woolgoolga to Ballina Pacific Highway Upgrade Project                |
| TSC Act                | <i>Threatened Species Conservation Act 1995 (NSW)</i>                |

# 1. Introduction

## 1.1 Project overview

NSW Roads and Maritime Services (Roads and Maritime) has received approval for the Woolgoolga to Ballina (W2B) Pacific Highway upgrade project (the project / the action), on the NSW North Coast. Approvals were granted, subject to conditions, under Part 5.1 of the *Environmental Planning and Assessment Act 1979* (NSW EP&A Act) on 24 June 2014 and the *Environment Protection and Biodiversity Conservation Act 1999* (Australian EPBC Act) on 14 August 2014. The location of the project is shown in the figure above.

Since 1996, both the Australian and NSW governments have contributed funds to the upgrade of the 664-kilometre section of the Pacific Highway between Hexham and the Queensland border as part of the Pacific Highway Upgrade Program.

The project will upgrade around 155 kilometres of highway and represents the last priority (known as 'Priority 3' in the upgrade program) in achieving a four-lane divided road between Hexham and the NSW/Queensland Border. The project has been divided into 11 Sections as illustrated in the figure above and construction is to be staged. Up to five stages of construction may be implemented over approximately five years. Stage 1 is confirmed and encompasses Section 1: Woolgoolga to Halfway Creek, and Section 2: Halfway Creek to Glenugie. These stages are detailed in the Staging Report prepared to satisfy NSW CoA A7.

Key features of the upgrade include:

- Duplication of 155 kilometres of the Pacific Highway to a motorway standard (Class M) or arterial road (Class A), with two lanes in each direction and room to add a third lane if required in the future
- Split-level (grade-separated) interchanges at Range Road, Glenugie, Tyndale, Maclean, Yamba / Harwood, Woombah (Iluka Road), Woodburn, Broadwater and Wardell
- Bypasses of South Grafton, Ulmarra, Woodburn, Broadwater and Wardell
- About 40 bridges over rivers, creeks and floodplains, including major bridges crossing the Clarence and Richmond rivers
- Bridges over and under the highway to maintain access to local roads that cross the highway
- Access roads to maintain connections to existing local roads and properties
- Structures designed to encourage animals over and under the upgraded highway where it crosses key animal habitat or wildlife corridors
- Rest areas located at about 50 kilometre intervals at Pine Brush (Tyndale), north of Mororo Road and north of the Richmond River
- A heavy vehicle checking station near Halfway Creek and north of the Richmond River.

The project will be jointly funded by the NSW and Australian governments. Both governments have a shared commitment to finish upgrading the highway to a four-lane divided road as soon as possible. Construction timing for Sections 1 and 2 is estimated for commencement in April 2015 and completion of the entire project is planned for the end of 2020. The project does not include the Pacific Highway upgrades at Glenugie and Devils Pulpit which are located between Woolgoolga and Ballina. These are separate projects and are now complete. Altogether, these three projects will upgrade 164 kilometres of the Pacific Highway. The project includes a partial upgrade of the existing dual carriageways at Halfway Creek.

A more detailed description of the Woolgoolga to Ballina Pacific Highway upgrade is found in the *Pacific Highway upgrade: Woolgoolga to Ballina Environmental Impact Statement* prepared by Roads and Maritime in December 2012. Further information is found in the Roads and Maritime Services *Woolgoolga to Ballina Pacific Highway Upgrade – Submissions/Preferred Infrastructure Report* (PIR) dated 2013 and the W2B Staging Plan.

## 1.2 Purpose of the plan

The Koala is listed as a vulnerable species under the EPBC Act and the *Threatened Species Conservation Act 1995* (NSW) (TSC Act). This Koala Management Plan has been developed to meet the requirements of the NSW Government Approval – Ministers Condition of Approval D8, and Commonwealth EPBC Approval CoA 8 for Stage 1 of Works: Sections 1 and 2. MCoA D9 is not required for Stage 1 as it is not within koala populations at Coolgardie/Bagotville, Broadwater and Woombah/Illuka. The requirements of this approval and where they are addressed in this report are detailed in Table 1.1 below. This Koala Management Plan forms part of the Roads and Maritime Service Biodiversity Mitigation Framework (BMF) which addresses the overall Ministerial Conditions of Approval for the Project. The BMF also details the biodiversity plans, programs and strategies that have been prepared and how they inform and relate to each other.

**Table 1-1: Project Approval requirements and where they are addressed.**

| Approval requirements |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Where addressed |
|-----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| <b>NSW approval</b>   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                 |
| NSW CoA D8            | <i>The Applicant shall prepare and implement Threatened Species Management Plans to detail how impacts of the SSI will be minimised and managed specifically for each species identified as significantly impacted in the documents listed in condition A2 or in accordance with condition D1.</i>                                                                                                                                                                                                                                                                                                                                                                 | This report     |
|                       | <i>The Plans shall be developed from the draft Threatened Species Management Plans included in the documents listed in condition A2(c) (subject to condition D9), in consultation with OEH, DPI (Fisheries) and DoE, and to the satisfaction of the Secretary, and shall include but not necessarily be limited to:</i>                                                                                                                                                                                                                                                                                                                                            |                 |
| (a)                   | <i>demonstration that adequate surveys have been undertaken to assess the impacts of the SSI with reference to the Mitigation Framework developed under condition D1, including baseline data collected from surveys, undertaken by a suitably qualified and experienced ecologist on threatened species and ecological communities within all habitat areas to be cleared of vegetation for the SSI, that are likely to contain these species and that are likely to be adversely impacted by the SSI (as determined by a suitably qualified expert). The data shall address the densities, distribution, habitat use and movement patterns of these species;</i> | Chapter 2       |
| (b)                   | <i>identification of potential impacts on each species;</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Chapter 2.4     |
| (c)                   | <i>details of and demonstrated effectiveness of the proposed avoidance and mitigation and management measures to be implemented for each threatened species including measures to at least maintain habitat values of habitat areas compared to baseline data and maintain connectivity for the relevant species;</i>                                                                                                                                                                                                                                                                                                                                              | Chapter 3       |
| (d)                   | <i>an adaptive monitoring program to assess the use of the mitigation measures identified in conditions B10 and D2. The monitoring program shall nominate appropriate and justified monitoring periods, performance parameters and criteria against which effectiveness of the mitigation measures will be measured and include operational road kill and fauna crossing surveys to assess the use of fauna crossings and exclusion fencing implemented as part of the SSI;</i>                                                                                                                                                                                    | Chapter 7       |

|                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |             |
|------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|
| (e)                          | <i>monitoring methodology for threatened flora and fauna adjacent to the SSI footprint;</i>                                                                                                                                                                                                                                                                                                                                                                                       | Chapter 7   |
| (f)                          | <i>goals and performance indicators to measure the success of mitigation measures, which shall be specific, measurable, achievable, realistic and timely (SMART), and be compared against baseline data;</i>                                                                                                                                                                                                                                                                      | Chapter 7   |
| (g)                          | <i>methodology for the ongoing monitoring of road kill, the species densities, distribution, habitat use and movement patterns, and the use of fauna crossings during construction and operation of the SSI, including the proposed timing, and duration of that monitoring;</i>                                                                                                                                                                                                  | Chapter 7   |
| (h)                          | <i>provision for the assessment of monitoring data to identify changes to habitat usage and whether this can be attributed to the SSI;</i>                                                                                                                                                                                                                                                                                                                                        | Chapter 7   |
| (i)                          | <i>details of contingency measures that would be implemented in the event of changes to habitat usage patterns, entities, distribution, and movement patterns attributable to the construction or operation of the SSI, based on adequate baseline data;</i>                                                                                                                                                                                                                      | Chapter 7   |
| (j)                          | <i>mechanisms for the monitoring, review and amendment of these plans;</i>                                                                                                                                                                                                                                                                                                                                                                                                        | Chapter 7   |
| (k)                          | <i>provision for ongoing monitoring during operation of the SSI (for operation/ongoing impacts) until such time as the use and effectiveness of mitigation measures can be demonstrated to have been achieved over a minimum of three successive monitoring periods, unless otherwise agreed by the Secretary in consultation with the OEH, DPI (Fisheries) and DoE; and</i>                                                                                                      | Chapter 7   |
| (l)                          | <i>provision for annual reporting of monitoring results to the Secretary and the OEH, DPI (Fisheries) and DoE, or as otherwise agreed by those agencies.</i>                                                                                                                                                                                                                                                                                                                      | Chapter 7   |
|                              | <i>In developing the Plans, the Applicant shall demonstrate to the satisfaction of the Secretary and DoE, how the public authorities and expert reviewer recommendations provided for each draft plan in the documents listed in condition A2(c) have been addressed, including detailed justification of any variance from the recommendations of the expert reviewer of the management plans, including analysis of potential risk to the threatened species.</i>               |             |
|                              | <i>The Plans must be submitted and approved by the Secretary prior to commencement of construction of the relevant stages of the action, and implemented prior to commencement of construction of the relevant stages, unless otherwise agreed by the Secretary.</i>                                                                                                                                                                                                              |             |
| <b>Commonwealth approval</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |             |
| EPBC-8                       | <b>The approval holder must develop a Koala Management Plan(s) pursuant to the requirements of NSW approval conditions D8 and D9 for each relevant stage(s). The Koala Management Plan must minimise impacts to the Koala to the satisfaction of the Minister and must be submitted to the Minister for approval. The relevant stage(s) cannot commence until the Koala Management Plan for that stage is approved by the Minister. The approved Plan(s) must be implemented.</b> | This report |
|                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |             |



| S/PIR Environmental management measure |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |           |
|----------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| EMM-B11                                | <p><i>The threatened species management plans prepared for the project will be finalised, as relevant to the element of the project to be constructed. Development of the plans will include responding, where feasible and reasonable to:</i></p> <ul style="list-style-type: none"> <li>• <i>Recommendations from expert review undertaken as part of the Submissions / Preferred Infrastructure Report (and detailed in section 1.4 of the management plans).</i></li> <li>• <i>Any conditions of approval.</i></li> <li>• <i>Results from baseline monitoring undertaken.</i></li> </ul> <p><i>The threatened species management plans will be finalised in consultation with the relevant State and Federal government agencies</i></p> | This plan |

This plan identifies the potential and residual impacts of the Pacific Highway upgrade on the Koala (*Phascolarctos cinereus*) populations and areas of potential Koala habitat between Woolgoolga and Ballina, focusing primarily on Stage 1 of Works: Sections 1 and 2 of the highway upgrade. The plan outlines existing knowledge of Koala populations, their habitat and distribution, the proposed mitigation measures to be implemented for the Koala, and a program for monitoring the effectiveness of these measures and the viability of designated 'important populations'.

The objectives of the Koala Management Plan include providing:

- An effective process for ensuring the long-term conservation of the Koala in the region, including consideration of the concerns of key stakeholders, and expert review.
- A summary of the locations where Koala populations and their habitat occur, together with those areas which would likely be impacted by the project, focusing on updated information for Sections 1 and 2.
- Management and mitigation measures that would be implemented during the pre-construction, construction and operation phases of the highway upgrade to minimise impacts on Koala populations.
- A monitoring program to be implemented during pre-construction, construction and operation of the project to assess the effectiveness of the mitigation measures and to assess any changes to the conservation status of the Koala in the region.

### 1.3 Management structure and plan updates

#### Management structure

This species management plan provides a framework for any part of the proposed upgrade between Woolgoolga to Ballina. This plan has been updated as part of the detailed design for Section 1 and Section 2 of the project.

This plan informs future monitoring and reporting, identifies the general locations proposed for conducting monitoring and the methods, variables and timing of the proposed monitoring program. Details have been provided on the parameters for selecting the final monitoring sites, both impact and control sites. It is not possible to select the monitoring sites at this point in the planning and design process as this requires consultation with affected landowners and confirmation of landowner access. Details of the locations of these monitoring sites will be presented in the first annual monitoring report, along with the sampling regime that is proposed for subsequent years at these locations.

General responsibilities for environmental management are outlined in the Construction Environmental Management Plan (CEMP) and the Construction Flora and Fauna Management Plan (FFMP).

Responsibilities for implementation of the Koala Management Plan have been described throughout and summarised in Chapter 8. This plan operates in conjunction with the (CEMP) and project-specific flora and fauna management plans (FFMP) for Section 1 and Section 2, and will be incorporated into a wider framework that includes such plans.

Following approval of the plan, the construction contractor and the ecologists engaged for the relevant project sections will be responsible to oversee implementation of the plan during the construction phase. Roads and Maritime Services will be responsible for the operational phase/management measures associated with this plan.

## **Plan updates**

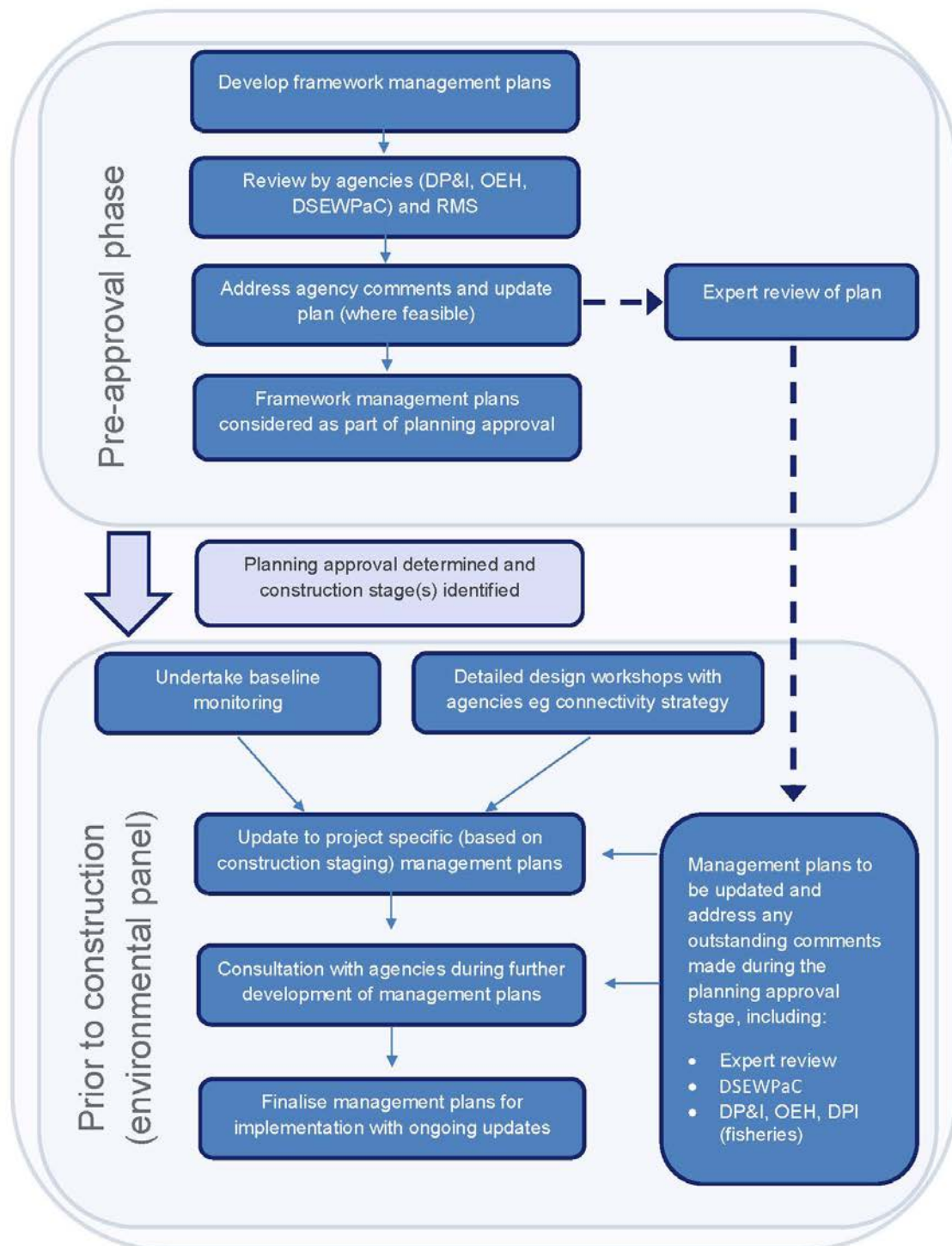
The plan is intended to be a dynamic document subject to continual improvement. The management plan has been updated as required to meet the mitigation and management measures committed to in the Environmental Impact Statement (EIS) and Submission/Preferred Infrastructure (SPIR) reports, and complies with the relevant Conditions of Approval (CoA) for the project.

This plan (Version 2) has been updated following independent expert review and review by DoE, EPA and DP&E (see Appendix C) so that it addresses the changes arising from those reviews. Version 2 also addresses the Conditions of Approval set down by the NSW State Government and the Australian Government as they relate to Sections 1 and 2 of the project (Table 1-1).

A summary of the process for updating the plan is illustrated below in Figure 1-1.

NSW CoA D8 requires the plan to be submitted and approved by the Secretary of the NSW Department of Planning and Environment (DP&E) prior to commencement of construction of the relevant stages of the action, and implemented prior to commencement of construction of the relevant stages, unless otherwise agreed by the Secretary.

Figure 1-1 Process to develop management plan



## 1.4 Plan authors and expert review

### Authors

Table 1-2 details the qualifications and experience of authors of this Koala Management Plan.

**Table 1-2 Author qualifications and experience**

| Personnel       | Qualifications                                                                                                                                                                                           | Experience                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|-----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Chris Thomson   | Bachelor of Applied Science and Graduate Certificate in Natural Resources                                                                                                                                | <p>Chris is a SKMs practice leader for terrestrial fauna and has a Bachelor of Applied Science and Graduate Certificate in Natural Resources and seventeen years professional experience managing biodiversity assessments and scientific reporting. He is a highly experienced field ecologist with extensive experience on major road projects with the Roads and Maritime, having worked widely throughout NSW as the technical lead on a range of environmental assessments including several Pacific Highway upgrades, in addition to the Hume Highway, Great Western Highway, Princes Highway and New England Highway along with numerous large and small arterial road projects including the M5, M4, Westlink M7 and Westconnex.</p> <p>Chris has comprehensive knowledge of Commonwealth and NSW threatened species legislation, policies and guidelines and has extensive experience in the design of avoidance and mitigation measures for minimising impacts on threatened species with a high level of experience on infrastructure projects including the development of compensatory habitat and offset strategies, biodiversity connectivity strategies, mitigation and monitoring strategies and threatened species management plans.</p> |
| Valerie Hagger  | Bachelor of Applied Science (Environmental Science) with Honours in Ecology (First Class), University of Queensland (2001)<br>Masters of Science (Conservation Biology), University of Queensland (2011) | Valerie is a Senior Ecologist and has ten years environmental consulting experience specialising in environmental impact assessment (EIA), ecological survey and monitoring, ecological assessment, management and approvals, and project management. She has successfully managed numerous environmental and ecological projects for Defence and mining clients, and has been the ecology technical lead on many EIA projects for water supply infrastructure and mining. Valerie is competent in conducting baseline flora and fauna surveys, vegetation (regional ecosystem) surveys and mapping, assessing impacts on ecological values, developing management plans and monitoring strategies for threatened species, ecological communities, weeds and pest animals and rehabilitation, and developing offsets strategies. She is also accomplished in climate change vulnerability assessments on biodiversity                                                                                                                                                                                                                                                                                                                                      |
| Dr Chris Schell | PhD, BAppSc (Hons)                                                                                                                                                                                       | Fourteen years consulting experience and 24 years research experience (flora and fauna). Chris assisted with updating the plan following the initial agency review.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Dr Rod Kavanagh | Dip.Appl.Sc.(Agriculture), Grad.Dip.Nat.Res.(Wildlife Management)-University of New England, M.Sc. (Forest Ecology)-Australian National University, Ph.D (Conservation Biology)-University of Sydney.    | 35 years as a senior wildlife research scientist with State Forests of NSW and the NSW Department of Primary Industries, and three years as an ecological consultant with Niche Environment and Heritage. Rod has published more than 80 peer-reviewed papers in scientific journals about Australian forest fauna. His research and consulting work has included numerous studies investigating the distribution, habitat and ecology of the Koala in NSW, as well as the response of this species to logging, drought, high temperatures and habitat restoration.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |

## Expert review

An expert review of Version 1 of the plan was undertaken in August 2013 by Associate Professor Robert Close from the University of Western Sydney and Australian Museum Business Services. Robert's principal field of interest is marsupial biology, which includes cytogenetics, formation of new species, hybridisation of existing species, fertility of hybrids, and ecology. Robert has conducted a study of Koalas in the Campbelltown region since 1990 that has included supervision of graduated PhD students. The Campbelltown study has largely been ecological and genetic but has become a community-associated research program, with feedback from the community leading to increased sightings of Koalas. Since October 1995, Robert and his colleagues have published a weekly column in the Macarthur Advertiser principally describing their Koala research. The project has provided long-term family data for Koalas that include four generations of Koalas.

In 1999 Robert joined the Australian Museum Consulting team to conduct research on the effects of the Pacific Highway upgrades at Yelgun to Chindera and at Bonville on the respective local Koala populations. Robert has published over 50 articles on mammals and marsupials, nine of these have been specifically on the Koala.

A curriculum vitae for Associate Professor Robert Close is provided in Appendix A, and a copy of his review is provided as Appendix B. The recommendations provided in this review, and the responses by RMS to the recommendations, are summarised in Appendix B.

## Agency review

Version 2 of the Plan was reviewed in February 2015 by NSW Department of Planning and Environment, NSW Environment Protection Authority and the Commonwealth Department of Environment. The comments and requirements of the three Agencies are listed in Appendix C, together with the responses by RMS to them.

## 2. Koala populations

Figures 2-1 to Figure 2-11 at the end of this chapter show the distribution of Koala records, habitat quality classes for the species, the distribution of vegetation types containing preferred Koala food tree species and proposed dedicated connectivity structures.

### 2.1 Existing knowledge

#### 2.1.1 Conservation status

The Koala (*Phascolarctos cinereus*) is listed as a vulnerable species under the New South Wales *Threatened Species Conservation Act 1995* (TSC Act).

The Koala (*Phascolarctos cinereus*) (combined population in Queensland, New South Wales and the Australian Capital Territory) is listed as a vulnerable species under the Australian Government *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

#### 2.1.2 Habitat requirements

The Koala inhabits a range of *Eucalyptus*-dominated forest and woodland communities where favoured food trees are present (Hindell and Lee 1990, DECC 2008), which may also include isolated paddock trees (White 1999). The quality of the habitat for Koalas is influenced by a range of factors (Reed *et al.* 1990, DECC 2008), such as:

- Species and size of trees present.
- Structural diversity of the vegetation.
- Soil nutrients.
- Climate and rainfall.
- Size and disturbance history of the habitat patch.

The Koala is a folivore with a diet restricted primarily to the foliage of *Eucalyptus* species, however the species is also known to consume the foliage of related genera, including *Corymbia*, *Angophora* and *Lophostemon* species. *Leptospermum* and *Melaleuca* species have also been identified as a source of fodder for the Koala (DSEWPaC 2013).

A list of Koala food trees, categorised as primary, secondary and supplementary food trees, for the NSW North Coast is provided in Appendix 2 of the NSW Koala Recovery Plan (DEC 2008). The presence of these tree species as either canopy dominants or main associated species in each of the BioMetric Vegetation Types known to be present along the highway upgrade are shown in Table 2-1 (see Vegetation Types Database at:

[http://www.environment.nsw.gov.au/resources/nature/BioMetric\\_Vegetation\\_Type\\_CMA.xls](http://www.environment.nsw.gov.au/resources/nature/BioMetric_Vegetation_Type_CMA.xls)).

**Table 2-1 Occurrences of Koala food tree species on the NSW north coast listed according to the BioMetric Vegetation Types known to be present along the highway upgrade.**

| BioMetric vegetation types showing the dominant or associated tree species known to be food trees for the Koala | Koala food tree species                   |                                       |                                              |
|-----------------------------------------------------------------------------------------------------------------|-------------------------------------------|---------------------------------------|----------------------------------------------|
|                                                                                                                 | Primary                                   | Secondary                             | Supplementary                                |
| Angophora paludosa shrubby forest and woodland on sandstone or sands of the North Coast (NR101)                 | Forest Red Gum ( <i>E. tereticornis</i> ) | Red Mahogany ( <i>E. resinifera</i> ) | -                                            |
| Angophora robur shrubby forest and woodland on sandstones of the North Coast (NR102)                            | Orange gum ( <i>E. bancroftii</i> )       | -                                     | Tindal's Stringybark ( <i>E. tindaliae</i> ) |
| Black Bean-Weeping Lilly Pilly riparian rainforest of the North Coast (NR110)                                   | -                                         | -                                     | -                                            |
| Blackbutt - bloodwood dry heathy open forest on sandstones of the northern North Coast (NR115)                  | -                                         | Red mahogany ( <i>E. resinifera</i> ) | -                                            |
| Blackbutt-Tallowwood dry grassy open forest of the central parts                                                | Tallowwood                                | -                                     | -                                            |

| BioMetric vegetation types showing the dominant or associated tree species known to be food trees for the Koala       | Koala food tree species                                                                 |                                                   |                                                     |
|-----------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|---------------------------------------------------|-----------------------------------------------------|
|                                                                                                                       | Primary                                                                                 | Secondary                                         | Supplementary                                       |
| North Coast (NR119)                                                                                                   | ( <i>E. microcorys</i> )                                                                |                                                   |                                                     |
| Blackbutt grassy open forest of the lower Clarence Valley of the North Coast (NR125)                                  | Tallowwood<br>( <i>E. microcorys</i> )                                                  | Red mahogany<br>( <i>E. resinifera</i> )          | -                                                   |
| Brush Box - Tallowwood shrubby open forest of the northern ranges of the North Coast (NR140)                          | Tallowwood<br>( <i>E. microcorys</i> )                                                  |                                                   |                                                     |
| Coast Cypress Pine shrubby open forest of the North Coast Bioregion (NR148)                                           | -                                                                                       | -                                                 | -                                                   |
| Coastal floodplain sedgeland, rushlands, and forblands (NR149)                                                        | -                                                                                       | -                                                 | -                                                   |
| Coastal heath on sands of the North Coast (NR152)                                                                     | -                                                                                       | -                                                 | -                                                   |
| Flooded Gum - Tallowwood - Brush Box moist open forest of the coastal ranges of the North Coast (NR159)               | Tallowwood<br>( <i>E. microcorys</i> )                                                  | -                                                 | -                                                   |
| Forest Red Gum - Swamp Box of the Clarence Valley lowlands of the North Coast (NR161)                                 | Forest red gum<br>( <i>E. tereticornis</i> )                                            | -                                                 | -                                                   |
| Forest Red Gum grassy open forest of the coastal ranges of the North Coast (NR162)                                    | Forest red gum<br>( <i>E. tereticornis</i> )                                            |                                                   |                                                     |
| Grey Gum - Grey Ironbark open forest of the Clarence lowlands of the North Coast (NR173)                              | -                                                                                       | Small-fruited grey gum<br>( <i>E. propinqua</i> ) | -                                                   |
| Hoop Pine-Yellow Tulipwood dry rainforest of the North Coast (NR179)                                                  | -                                                                                       | -                                                 | -                                                   |
| Mangrove-Grey Mangrove low closed forest of the NSW Coastal Bioregions (NR182)                                        | -                                                                                       | -                                                 | -                                                   |
| Narrow-leaved Ironbark dry open forest of the North Coast (NR193)                                                     | Forest red gum<br>( <i>E. tereticornis</i> )                                            |                                                   |                                                     |
| Narrow-leaved Red Gum woodlands of the lowlands of the North Coast (NR197)                                            | Cabbage gum<br>( <i>E. amplifolia</i> )                                                 | Narrow-leaved red gum<br>( <i>E. seeana</i> )     | -                                                   |
| Needlebark Stringybark - Red Bloodwood heathy woodland on sandstones of the lower Clarence of the North Coast (NR200) | -                                                                                       | -                                                 | -                                                   |
| Orange Gum ( <i>Eucalyptus bancroftii</i> ) open forest of the North Coast (NR216)                                    | Orange gum<br>( <i>E. bancroftii</i> )                                                  | -                                                 | -                                                   |
| Paperbark swamp forest of the coastal lowlands of the North Coast (NR217)                                             | Swamp mahogany<br>( <i>E. robusta</i> )<br>Forest red gum<br>( <i>E. tereticornis</i> ) | -                                                 | -                                                   |
| Pink Bloodwood - Tallowwood moist open forest of the far northern ranges of the North Coast (NR219)                   | Tallowwood<br>( <i>E. microcorys</i> )                                                  | Small-fruited grey gum<br>( <i>E. propinqua</i> ) |                                                     |
| Red Mahogany open forest of the coastal lowlands of the North Coast (NR222)                                           | -                                                                                       | Red mahogany<br>( <i>E. resinifera</i> )          | -                                                   |
| Scribbly Gum - Needlebark Stringybark heathy open forest of coastal lowlands of the northern North Coast (NR227)      | -                                                                                       | -                                                 | -                                                   |
| Scribbly Gum – Red Bloodwood heathy open forest of the coastal lowlands of the North Coast (NR228)                    | -                                                                                       | -                                                 | -                                                   |
| Spotted Gum - Grey Box - Grey Ironbark dry open forest of the Clarence Valley lowlands of the North Coast (NR244)     | Forest red gum<br>( <i>E. tereticornis</i> )                                            | Grey box<br>( <i>E. moluccana</i> )               | Thin-leaved Stringybark<br>( <i>E. eugenoides</i> ) |
| Spotted Gum - Grey Ironbark - Pink Bloodwood open forest of the Clarence Valley lowlands of the North Coast (NR246)   | -                                                                                       | Small-fruited grey gum<br>( <i>E. propinqua</i> ) | -                                                   |
| Swamp Box swamp forest of the coastal lowlands of the North Coast (NR253)                                             | Swamp mahogany<br>( <i>E. robusta</i> )<br>Cabbage gum<br>( <i>E. amplifolia</i> )      | -                                                 | -                                                   |
| Swamp Mahogany swamp forest of the coastal lowlands of the North Coast (NR254)                                        | Swamp mahogany<br>( <i>E. robusta</i> )<br>Forest red gum<br>( <i>E. tereticornis</i> ) | Red mahogany ( <i>E. resinifera</i> )             | -                                                   |
| Swamp Oak swamp forest of the coastal lowlands of the North Coast (NR255)                                             | Forest red gum<br>( <i>E. tereticornis</i> )                                            | -                                                 | -                                                   |
| Tallowwood dry grassy forest of the far northern ranges of the                                                        | Tallowwood                                                                              | Small-fruited grey                                | -                                                   |

| BioMetric vegetation types showing the dominant or associated tree species known to be food trees for the Koala | Koala food tree species               |                                                                                            |               |
|-----------------------------------------------------------------------------------------------------------------|---------------------------------------|--------------------------------------------------------------------------------------------|---------------|
|                                                                                                                 | Primary                               | Secondary                                                                                  | Supplementary |
| North Coast (NR267)                                                                                             | ( <i>E.microcorys</i> )               | gum<br>( <i>E. propinqua</i> )                                                             |               |
| Tuckeroo-Riberry-Yellow Tulipwood littoral rainforest of the North Coast (NR273)                                | -                                     | -                                                                                          | -             |
| Turpentine moist open forest of the coastal hills and ranges of the North Coast (NR274)                         | Tallowwood<br>( <i>E.microcorys</i> ) | Red mahogany ( <i>E. resinifera</i> )<br>Small-fruited grey gum<br>( <i>E. propinqua</i> ) | -             |
| Wet heathland and shrubland of coastal lowlands of the North Coast (NR278)                                      | -                                     | -                                                                                          | -             |
| White Booyong-Fig subtropical rainforest of the North Coast (NR280)                                             | -                                     | -                                                                                          | -             |

Koalas exhibit strong feeding preferences between individual trees within a species. This variability creates a nutritional patchiness such that species-based assessments of habitat are likely to result in overestimates of the availability of high quality habitat (DSEWPaC 2013). In addition, many other unrelated factors (e.g. predation, disease, human impacts) could increase Koala mortality and thus explain low abundance of this species in its preferred habitat.

The list of tree species known to be important as food for the Koala is large and expanding as more information becomes available. Table 2-2 provides a list of Koala food trees from the Australian Koala Foundation (Mitchell 2012) for the local government areas Coffs Harbour, Grafton and Ballina.

**Table 2-2 Koala food tree species in Coffs Harbour, Clarence Valley and Ballina LGAs (source: Mitchell 2012)**

| LGA               | Scientific name and/or subspecies                                                                                           | Common name and ecology                                                                                                                              |
|-------------------|-----------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|
| Clarence Valley   | <i>E. amplifolia</i> ssp. <i>sessiliflora</i>                                                                               | Cabbage gum; by streams or in lower moister sites, in deeper loamy soils                                                                             |
|                   | <i>E. bancroftii</i>                                                                                                        | Orange Gum; infertile, sandy lowland sites                                                                                                           |
|                   | <i>E. biturbinata</i>                                                                                                       | Grey Gum; slopes on soils of medium fertility, annual rainfall>1000 mm                                                                               |
|                   | <i>E. crebra</i>                                                                                                            | Narrow-leaved red ironbark, Ironbark, Narrow-leaved ironbark; well-drained shallower or sandy/sandy clay soils of medium fertility, >550 mm rainfall |
|                   | <i>E. glaucina</i>                                                                                                          | Slaty Red Gum; deep, moderately fertile moist soils                                                                                                  |
|                   | <i>E. grandis</i>                                                                                                           | Flooded Gum, Rose Gum; moist, fertile, well-drained, deep, loamy soils of alluvial or volcanic origin, 725-3500 mm                                   |
|                   | <i>E. laevopinea</i>                                                                                                        | Silvertop stringybark; hills and eastern escarpments, medium to high fertility basalt soils in wetter areas                                          |
|                   | <i>E. melanophloia</i>                                                                                                      | Silver-leaved ironbark; moderately fertile silts, loams, sandy clays on foothills                                                                    |
|                   | <i>E. microcorys</i>                                                                                                        | Tallowwood; on slopes in deeper moderate to fertile soils, well-drained but moist                                                                    |
|                   | <i>E. moluccana</i>                                                                                                         | Coastal Grey Box, Grey box, Gum-topped box; loam soils of moderate to high fertility on coastal plains and ranges, tolerates saline soils            |
|                   | <i>E. obliqua</i>                                                                                                           | Messmate Stringybark; fertile acidic well-drained loams, > 600 mm rainfall, drought tolerant                                                         |
|                   | <i>E. planchoniana</i>                                                                                                      | Bastard Tallowwood, Needlebark stringybark; dry sclerophyll forest or woodland on sandy soils or coastal sand                                        |
|                   | <i>E. propinqua</i>                                                                                                         | Small-fruited Grey Gum; wet coastal forest on soils of low to medium fertility, drought and frost tolerant                                           |
|                   | <i>E. racemosa</i> ssp. <i>racemosa</i>                                                                                     | Scribbly Gum; shallow infertile sandy soil, coastal areas or over sandstone                                                                          |
|                   | <i>E. resinifera</i> ssp. <i>hemilampra</i>                                                                                 | Red mahogany; sandy or well drained fertile soils, drought and frost tolerant                                                                        |
| <i>E. robusta</i> | Swamp Mahogany; swampy, seasonally waterlogged soils, very moist fertile soils, heavy clay, sandy clay, alluvial sand soils |                                                                                                                                                      |



| LGA           | Scientific name and/or subspecies               | Common name and ecology                                                                                                                                                                  |
|---------------|-------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|               | <i>E. seeana</i>                                | Narrow-leaved Red Gum; poorly drained shallow soils, swampy sandy soils                                                                                                                  |
|               | <i>E. siderophloia</i>                          | Ironbark, Broken Back Ironbark; wet forest on soils of moderate fertility                                                                                                                |
|               | <i>E. tereticornis</i> ssp. <i>tereticornis</i> | Forest red gum, Blue gum, Red Iron-gum; alluvial soils, 600-2500 mm, tolerates salt-laden coastal winds, tolerates saline soils, medium-heavy clays, does not tolerate waterlogged soils |
|               | <i>E. tindaliae</i>                             | Tindal's Stringybark; poorer soils in high rainfall areas, often derived from granite                                                                                                    |
| Coffs Harbour | <i>E. bancroftii</i>                            | Orange Gum; infertile, sandy lowland sites                                                                                                                                               |
|               | <i>E. biturbinata</i>                           | Grey Gum; slopes on soils of medium fertility, annual rainfall >1000 mm                                                                                                                  |
|               | <i>E. crebra</i>                                | Narrow-leaved red ironbark, Ironbark, Narrow-leaved ironbark; well-drained shallower or sandy/sandy clay soils of medium fertility, >550 mm rainfall                                     |
|               | <i>E. globoidea</i>                             | White Stringybark; moist well drained soils in foothills                                                                                                                                 |
|               | <i>E. grandis</i>                               | Flooded Gum, Rose Gum; moist, fertile, well-drained, deep, loamy soils of alluvial or volcanic origin, 725-3500 mm                                                                       |
|               | <i>E. microcorys</i>                            | Tallowwood; on slopes in deeper moderate to fertile soils, well-drained but moist                                                                                                        |
|               | <i>E. moluccana</i>                             | Coastal Grey Box, Grey box, Gum-topped box; loam soils of moderate to high fertility on coastal plains and ranges, tolerates saline soils                                                |
|               | <i>E. planchoniana</i>                          | Bastard Tallowwood, Needlebark stringybark; dry sclerophyll forest or woodland on sandy soils or coastal sand                                                                            |
|               | <i>E. propinqua</i>                             | Small-fruited Grey Gum; wet coastal forest on soils of low to medium fertility, drought and frost tolerant                                                                               |
|               | <i>E. racemosa</i> ssp. <i>racemosa</i>         | Scribbly Gum; shallow infertile sandy soil, coastal areas or over sandstone                                                                                                              |
|               | <i>E. resinifera</i> ssp. <i>hemilampra</i>     | Red mahogany; sandy or well drained fertile soils, drought and frost tolerant                                                                                                            |
|               | <i>E. robusta</i>                               | Swamp Mahogany; swampy, seasonally waterlogged soils, very moist fertile soils, heavy clay, sandy clay, alluvial sand soils                                                              |
|               | <i>E. seeana</i>                                | Narrow-leaved Red Gum; poorly drained shallow soils, swampy sandy soils                                                                                                                  |
|               | <i>E. siderophloia</i> Ironbark,                | Broken Back Ironbark; wet forest on soils of moderate fertility                                                                                                                          |
|               | <i>E. tereticornis</i> ssp. <i>tereticornis</i> | Forest red gum, Blue gum, Red Iron-gum; alluvial soils, 600-2500 mm, tolerates salt-laden coastal winds, tolerates saline soils, medium-heavy clays, does not tolerate waterlogged soils |
|               | <i>E. tindaliae</i>                             | Tindal's Stringybark; poorer soils in high rainfall areas, often derived from granite                                                                                                    |
| Ballina       | <i>E. bancroftii</i>                            | Orange Gum; infertile, sandy lowland sites                                                                                                                                               |
|               | <i>E. grandis</i>                               | Flooded Gum, Rose Gum; moist, fertile, well-drained, deep, loamy soils of alluvial or volcanic origin, 725-3500 mm                                                                       |
|               | <i>E. microcorys</i>                            | Tallowwood; on slopes in deeper moderate to fertile soils, well-drained but moist                                                                                                        |
|               | <i>E. moluccana</i>                             | Coastal Grey Box, Grey box, Gum-topped box; loam soils of moderate to high fertility on coastal plains and ranges, tolerates saline soils                                                |
|               | <i>E. propinqua</i>                             | Small-fruited Grey Gum; wet coastal forest on soils of low to medium fertility, drought and frost tolerant                                                                               |
|               | <i>E. racemosa</i> ssp. <i>racemosa</i>         | Scribbly Gum; shallow infertile sandy soil, coastal areas or over sandstone                                                                                                              |
|               | <i>E. resinifera</i> ssp. <i>hemilampra</i>     | Red mahogany; sandy or well drained fertile soils, drought and frost tolerant                                                                                                            |
|               | <i>E. robusta</i>                               | Swamp Mahogany; swampy, seasonally waterlogged soils, very moist fertile soils, heavy clay, sandy clay, alluvial sand soils                                                              |
|               | <i>E. seeana</i>                                | Narrow-leaved Red Gum; poorly drained shallow soils, swampy sandy soils                                                                                                                  |
|               | <i>E. siderophloia</i>                          | Ironbark, Broken Back Ironbark; wet forest on soils of moderate fertility                                                                                                                |
|               | <i>E. tereticornis</i> ssp. <i>tereticornis</i> | Forest red gum, Blue gum, Red Iron-gum; alluvial soils, 600-2500 mm, tolerates salt-laden coastal winds, tolerates saline soils, medium-heavy clays, does not tolerate waterlogged soils |
|               | <i>E. tindaliae</i>                             | Tindal's Stringybark; poorer soils in high rainfall areas, often derived from granite                                                                                                    |

The Koala resides in a specific home-range, however the home-ranges of individual animals are not mutually exclusive, often overlapping extensively (Kavanagh *et al.* 2007). Individuals tend to use the same set of trees, but generally not at the same time, and social interactions are uncommon outside of the breeding season. Koalas tend to move relatively short distances under most conditions, changing trees only a few times each day (DSEWPaC 2013).

Home ranges for the Koala are variable depending on the location, with Koalas occurring in "poorer" habitats having larger home ranges than individuals established in higher quality habitats (DSEWPaC 2013). On average, male Koalas have larger home ranges than females (Kavanagh *et al.* 2007, Goldingay and Dobner 2014, de Oliveira *et al.* 2014). For example, at Bonville on the NSW North Coast, approximately 40 kilometres south of Woolgoolga, male home ranges were estimated at approximately 20 hectares and female home ranges were approximately 10 hectares (Lassau *et al.* 2008).

Recent genetic research identified major roads as a barrier to gene flow for Koalas (Lee *et al.* 2010). The project would fragment habitat links for Koalas seeking to access preferred habitats either side of the highway, particularly along Section 10 (between Bagotville and Wardell and the southern parts of Coolgardie) and Section 9 (between Broadwater National Park and Rileys Hill) of the project.

Koala movements are expected to be more frequent and extensive during the breeding season (September to February) with the peak dispersal period (July to August) due to expansion of home ranges and movement of juveniles away from natal areas (Lassau *et al.* 2008). Therefore, these periods would be likely to represent peaks in Koala movement, resulting in potentially greater incidence of road mortality, but also higher rates of usage of connectivity structures and thus higher detection rates.

## 2.2 Distribution of the Koala and its habitat

The distribution of potential habitat for the Koala throughout the footprint area of the Pacific Highway upgrade between Woolgoolga and Glenugie was assessed by means of vegetation assessments, identification of the presence of known Koala food trees, assessments of habitat connectivity, patch area and evidence of Koala presence using assessments of the presence of faecal pellets. The scat-search method of Phillips and Callaghan (2011), which involves inspection of the ground below 30 trees greater than 10 cm diameter at breast height within 0.1-0.2 ha plots, was used to identify Koala presence and relative use of different vegetation types. A total of 212 scat-search plots were sampled along the length of the Pacific Highway upgrade, and evidence of Koala presence was found at 16 of these plots.

Each vegetation polygon assessed was ranked from 0 (lowest) to 10 (highest) in terms of its habitat suitability for the Koala (based on the above criteria), and in terms of the likelihood of each vegetation type to contain preferred (primary and secondary) Koala food trees. The methodology was in accordance with the EPBC Act's Environmental Offset Policy (October 2012) and Offsets Assessment Guide. These assessments were undertaken for each of the eleven sections of the highway upgrade, the results of which, for Sections 1 and 2, are mapped in Figs 2-1a, and 2-2a. In addition, the locations of all NSW Wildlife Atlas records of the Koala are indicated on these maps.

### **2.2.1 Section 1: Woolgoolga to Halfway Creek**

Koala habitat quality (HQ) was scored in 181 vegetation polygons encompassing a total of 199.20 ha along the 17 km stretch of Section 1. The median HQ score was 7 (range 3-7; Biosis 2014), indicating that potential Koala habitat was widespread along this section of the highway upgrade (Fig. 2-1a). These relatively high scores may be due to the large continuous areas of State Forest and National Park near the highway footprint area, leading to higher weightings for patch size and connectivity. Figure 2-1a indicates that habitat suitable for the Koala is widespread along Section 1 of the highway upgrade. However, only few records of the Koala were obtained during vegetation assessments, faecal pellet searches, other surveys, and from the NSW Wildlife Atlas (EIS 2011, S/PIR 2013, Biosis 2014). A total of 30 scat-search plots were surveyed in Section 1 across nine vegetation types, but no Koala faecal pellets were observed. A small number of Koala faecal pellets were observed at one additional site in August 2012 during opportunistic searches near the Range Road Interchange (GeoLink 2012). Studies during the early 1990s also found that the Koala was very uncommon in the State Forests that adjoin Section 1 (and Section 2) of the highway (Kavanagh *et al.* 1995). Others have reported similar findings of low Koala population densities in these forests during the past decade (Brian Tolhurst, *personal communication November 2014*; previously Regional Forest Ecologist, Forestry Corporation of NSW). It was concluded that Koalas occur at very low population densities along Section 1 of the Pacific Highway Upgrade, despite the existence of potentially suitable habitat.

### **2.2.2 Section 2: Halfway Creek to Glenugie**

Sixty-four mapped vegetation polygons totalling 129.81 ha were assessed along the 15 km stretch of Section 2. The median Koala HQ score was 8 (range 5-9; Ecosure 2014), indicating that potential Koala habitat was widespread along this section of the highway upgrade (Fig. 2-2a). A total of 24 scat-search plots was surveyed in Section 2 across eight vegetation types, and Koala faecal pellets were observed at only one plot. This plot was located in vegetation type NR217 (Paperbark swamp forest of the coastal lowlands of the North Coast). Overall, vegetation floristics and condition were very good for Koalas, with good connectivity to State Forest, particularly at the northern end of the Section. However, while there were several records of the Koala in or near Section 2 of the project area, Koalas appear to occur at very low population densities in this area, and these findings were also supported by those of Kavanagh *et al.* (1995) and B. Tolhurst (*personal communication*). It was concluded that Koalas occur at very low population densities along Section 2 of the Pacific Highway Upgrade, despite the existence of potentially suitable habitat.

### **2.2.3 Section 3: Glenugie to Tyndale ....to be updated in subsequent revisions**

### **2.2.4 Section 4: Tyndale to Maclean... to be updated in subsequent revisions**

### **2.2.5 Section 5: Maclean to Iluka Road... to be updated in subsequent revisions**

### **2.2.6 Section 6: Iluka Road to Devils Pulpit upgrade... to be updated in subsequent revisions**

### **2.2.7 Section 7: Devils Pulpit upgrade to Trustums Hill.... to be updated in subsequent revisions**

**2.2.8 Section 8: Trustums Hill to Broadwater National Park to be updated in subsequent revisions**

**2.2.9 Section 9: Broadwater National Park to Richmond River to be updated in subsequent revisions**

**2.2.10 Section 10: Richmond River to Coolgardie Road to be updated in subsequent revisions**

**2.2.11 Section 11: Coolgardie Road to Ballina bypass to be updated in subsequent revisions**

**2.3 Important populations in the project area**

There are more than 14,600 recorded Koala sightings in the NSW Wildlife Atlas for the NSW North Coast Bioregion (data accessed 20 November 2014). These records are spread over all local government areas (LGA) in a wide range of topographies and vegetation types, including in conservation reserves, State forests and private land. The data indicate that Koalas do occur in all project sections of the highway upgrade area and in a range of habitats that will be impacted by the project. Field data collected during the EIS and subsequent PIR support this assertion. These documents report a total of 160 Koala habitat and faecal assessment plots, and a further 52 Koala faecal-pellet search plots (total 212) being undertaken. Koala faecal pellets were found at sixteen of these plots, only one of which occurred in Sections 1 and 2 (Table 2-3).

**Table 2-3 Locations where evidence of Koalas was reported from scat search surveys**

| Project section | No. of scat-search plots | No. of plots with scats | Location description                                                                                                                                                                                          | Distribution of koala records                                                                                                                              |
|-----------------|--------------------------|-------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1               | 30                       | 0                       | No records of Koala faecal pellets found in Section 1. (NB. One opportunistic record located in Section 1 near the Range Road intersection on the eastern side of the current Pacific Highway (GeoLink 2012). | Only one record from BioNet of the Koala along Section 1 (in Newfoundland State Forest). No evidence of a local population centred near the road corridor. |
| 2               | 24                       | 1                       | One plot with Koala faecal pellets in Section 2, located just south of Halfway Creek near Yuraygir State Recreation Area.                                                                                     | Only two records from BioNet of the Koala along Section 2 (both in Yuraygir SRA). No evidence of a local population centred near the road corridor.        |
| 3               | 64                       | 4                       | To be updated in subsequent revisions                                                                                                                                                                         | To be updated in subsequent revisions                                                                                                                      |
| 4               | 5                        | 0                       | To be updated in subsequent revisions                                                                                                                                                                         | To be updated in subsequent revisions                                                                                                                      |
| 5               | 2                        | 0                       | To be updated in subsequent revisions                                                                                                                                                                         | To be updated in subsequent revisions                                                                                                                      |
| 6               | 18                       | 0                       | To be updated in subsequent revisions                                                                                                                                                                         | To be updated in subsequent revisions                                                                                                                      |
| 7               | 32                       | 1                       | To be updated in subsequent revisions                                                                                                                                                                         | To be updated in subsequent revisions                                                                                                                      |
| 8               | 10                       | 0                       | To be updated in subsequent revisions                                                                                                                                                                         | To be updated in subsequent revisions                                                                                                                      |
| 9               | 9                        | 3                       | To be updated in subsequent revisions                                                                                                                                                                         | To be updated in subsequent revisions                                                                                                                      |
| 10              | 15                       | 7                       | To be updated in subsequent revisions                                                                                                                                                                         | To be updated in subsequent revisions                                                                                                                      |
| 11              | 3                        | 0                       | To be updated in subsequent revisions                                                                                                                                                                         | To be updated in subsequent revisions                                                                                                                      |

Based on data from the NSW Atlas of Wildlife (BioNet) for the NSW North Coast Bioregion, the results of Koala scat-search plots and the vegetation community mapping for the project, it is evident that Koalas could occur in all project sections and in a range of environments that would be impacted by the project. The areas with the greatest number of Koala records in relation to the project occur in the Richmond Valley LGA between Woodburn and Wardell (Sections 9 and 10 of the project) particularly around Wardell, Coolgardie and Bagotville (Section 10 of the project) and south of the Richmond River from Rileys Hill to Broadwater National Park (Section 9 of the project). These northern populations are considered 'important populations' according to the *Interim Koala referral advice for proponents* (DSEWPac 2012)

Other important Koala populations in the project area have been identified from Ashby, Iluka and Woombah (Clarence Valley Council 2010) to the east of the project, also the western regions of the Clarence Valley LGA (Clarence Valley Council 2010), northern regions of the Coffs Harbour LGA (Coffs Harbour City Council 1999) and to the west of Woodburn in the larger State Forests of the Richmond LGA (Australian Koala Foundation 2008). The project will not impact on these populations.

Sections 1 and 2 are not considered to support an important Koala population, although the species is present. The initial preferred route studies surveyed 16 scat search sites across Sections 1 and 2 (Ecotone 2007). An additional 32 scat search plots were conducted in Sections 1 and 2 for the EIS (2011) followed by an additional 32 plots surveyed in February 2013. This included plots specifically positioned along Range Road to the east of the project to assess presence of a Koala population. Scat searches were conducted at Range Road as reported in Geolink (2012) and involved a series of plots and random searches between plots. As a result of the accumulated survey effort for Koala across Woolgoolga to Wells Crossing (Sections 1 and 2) and including Range Road, Koala populations in these locations were considered to occur in low densities relative to the amount of habitat available in the locality. There were five records of Koalas within 10 kilometres either side of the project reported in the NSW Wildlife Atlas database between 1992 and 2006. Based on the Wildlife Atlas records and communication with local residents during field surveys, occasional road deaths do occur in the area. This is consistent with only two scats being found despite the level of survey effort.

## 2.4 Key threats

The key threats to Koala populations include:

- Loss of foraging, sheltering and breeding habitat.
- Habitat fragmentation and impacts on habitat connectivity (movement of individual Koalas to different populations and home-ranges allows important genetic exchange which is essential for Koala population viability).
- Vehicle strike (Koala injury or death).
- Domestic dog attacks (Koala injury or death).
- Increased prevalence of disease (increased susceptibility to disease due to stress caused by the above mentioned threats) (DEHP 2012 and DSEWPac 2013).

Drought and incidences of extreme heat are also known to cause very significant mortality, and post-drought recovery may be substantially impaired by a range of other threatening factors (Gordon *et al.* 1988, Seabrook *et al.* 20011, Lunney *et al.* 2012, TSSC 2012).

Koala injuries or death have been reported during the clearing phases of road projects from the removal of habitat trees and have been demonstrated from collisions with vehicles during the operation of these projects (AMBS 2011).

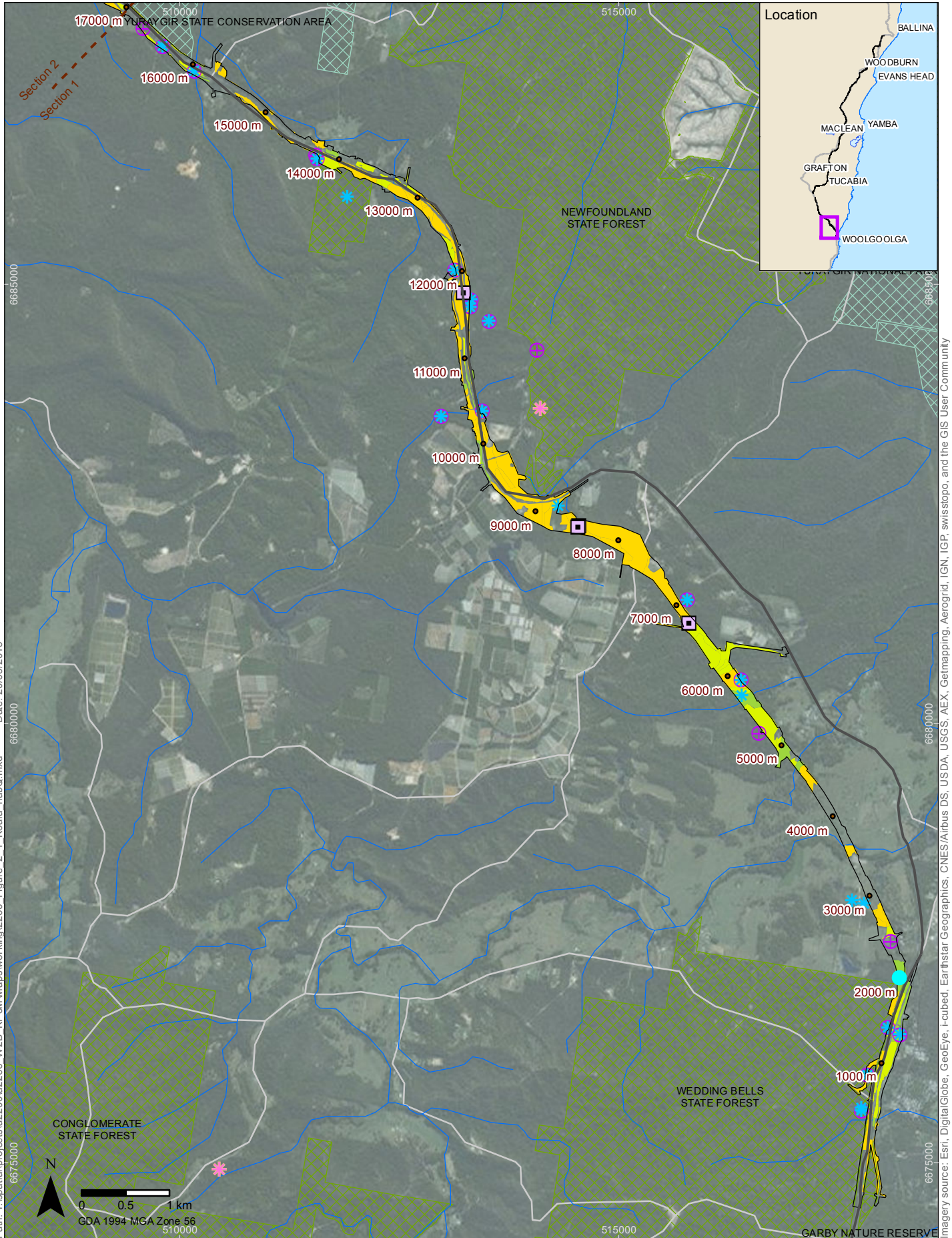
Mortality due to vehicle strike has the potential to significantly affect local Koala populations particularly where individual home-ranges abut or overlap the project corridor (AMBS 2011). These impacts are likely to be most significant in areas where the highway upgrade passes through high quality habitat for Koalas and those areas which are extensively forested. However, the presence of the proposed underpass structures and temporary and permanent fauna exclusion fencing will reduce this risk, including current road-kill events on the existing highway.

Crossing structures (underpasses and overpasses) have been shown to be effective for Koalas provided they are large enough, not too long, and are combined with fencing and revegetation (Taylor and Goldingay 2003, AMBS 2011, RMS unpublished data). However, research is lacking on the extent to which mitigation measures reduce the risk of local extinction, given the overall context of the major linear infrastructure (Taylor and Goldingay 2010, Van der Ree *et al.* 2011). Most Koalas killed by vehicle collisions on the highway are not the local roadside residents but appear to be sub-adults dispersing and perhaps old, weak animals displaced from their former home-ranges away from the highway (Dique *et al.* 2003a, AMBS 2011). Consequently the impact of road mortality may affect populations more widely.

In a radio-tracking study of Koalas on the Pacific Highway at Bonville (AMBS 2011) construction activities in two study areas led directly to only one known death, suggesting that the direct impacts of clearing and construction are relatively minor at a population scale (when appropriate mitigation strategies are in place). Construction activities (in particular habitat removal) indirectly affected individual Koalas, including the mortality of at least one animal through stress, the alteration of home-ranges and behaviour of others, and possibly mortality as a result of home-range adjustments (AMBS 2011).

Habitat restoration using plantings of Koala food trees has been shown to be very successful, with Koalas utilising young plantings within seven years, both as feeding and shelter habitat (Kavanagh and Stanton 2012).

Figure 2-1a Koala records, koala habitat quality and connectivity structures (section 1)

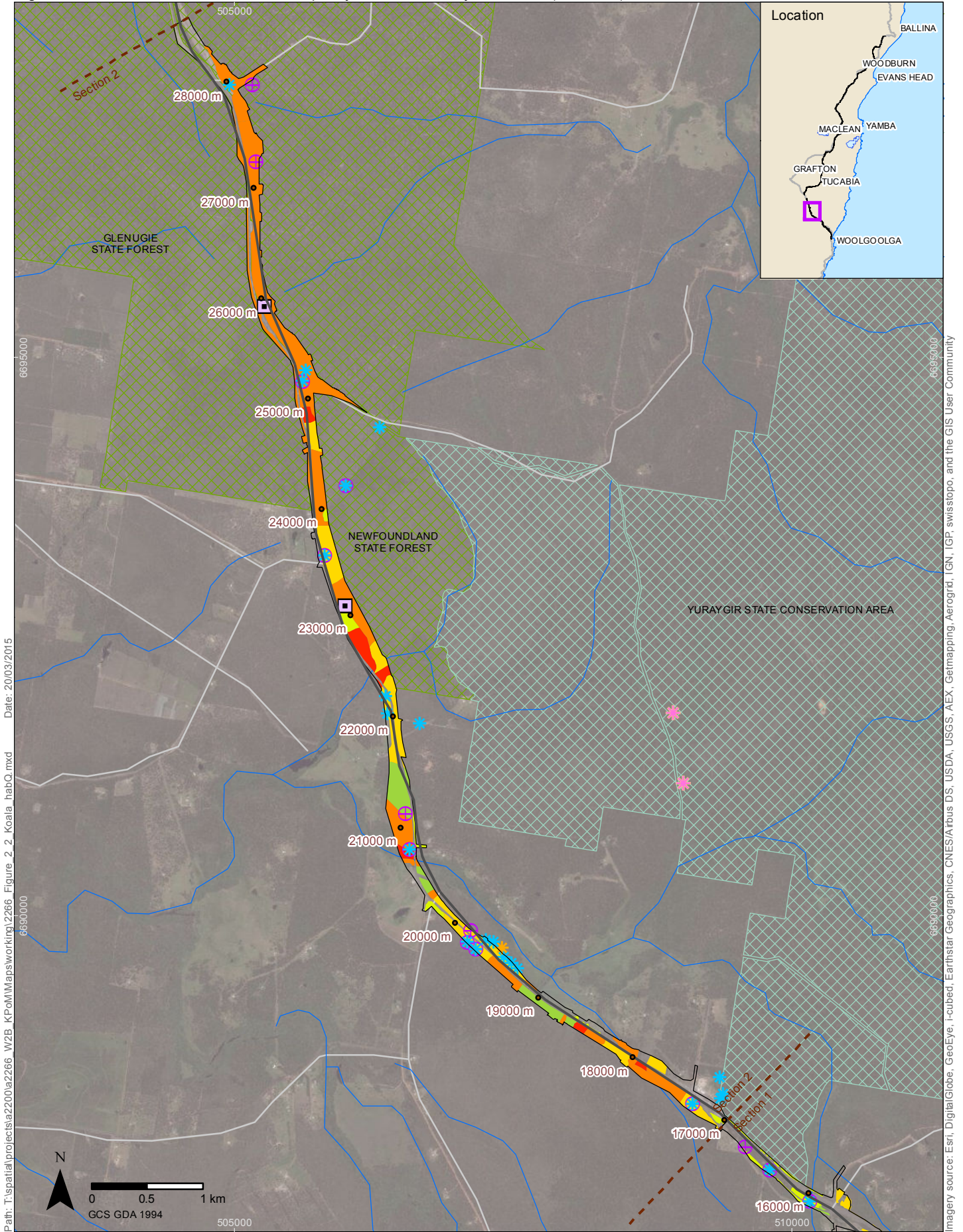


Path: T:\spatial\projects\12200\12266 W\2B KP\Map\Mapworking\2266 Figure 2\_1 Koala habQ.mxd Date: 20/03/2015

Imagery source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Geomapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

- Pacific Highway
- Project Boundary
- \* Koala Atlas sightings
- ⊕ Koala habitat assessment plots
- \* No scats
- Koala habitat quality values
  - 5
  - 6
  - 7
- Dedicated Underpass

Figure 2-2a Koala records, koala habitat quality and connectivity structures (section 2)



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Imagery source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

- Pacific Highway
- Project Boundary
- \* Koala Atlas sightings
- ⊕ Koala habitat assessment plots
- ★ Koala scat search plots
  - ★ Scats
  - ★ No scats
- Koala habitat quality values
  - 3
  - 5
  - 6
  - 7
  - 8
  - 9
- Fauna connectivity structures
  - Dedicated Underpass



## 3. Potential impacts and management approach

This chapter provides a brief overview of the potential impacts to Koala populations with reference to the more detailed impact assessment presented in the Section 4.3.2 (pp 298-300, 306 and 314-315) of the Biodiversity Working Paper (Roads and Maritime 2012) and Section 4.5.6 (pp 136-155) of the Supplementary Biodiversity Assessment (Roads and Maritime 2013). It also provides an overview of the effectiveness of mitigation measures proposed for this project which have been based on previous experience with Koalas on upgrade projects for the Pacific Highway.

### 3.1 Potential impacts associated with the project

The main project impacts to Koala populations within the project include:

- Loss of foraging, sheltering and breeding habitat (leading to a direct reduction in Koala population size).
- Habitat fragmentation and impacts on habitat connectivity (leading to disrupted movements of individual Koalas to different populations and areas of suitable habitat, thus reducing opportunities for genetic exchange and increasing the chances of predation or collision with motor vehicles, both of which are important factors affecting Koala population viability).

The Woolgoolga to Ballina project will directly impact 782 hectares of Koala habitat within the clearing footprint. This is based on a Koala Habitat Quality Score ranging from 2-10: 124.11 ha in Section 1 and 92.15 ha in Section 2 (Table 3-1). The Koala habitat score methodology was in accordance with the EPBC Act's Environmental Offset Policy (October 2012) and Offsets Assessment Guide (see part 2.2 of this Plan). The area of Koala habitat to be removed, as estimated using this method, is larger than the 557 ha and 375 ha originally estimated as 'habitat critical to the survival of the Koala' (DSEWPaC 2012) in the EIS and SPIR, respectively. This is because Roads and Maritime Services decided to take a more conservative approach to estimating the area of Koala habitat that would be removed as part of the Project. RMS assumed that all Biometric Vegetation Types that nominally contain Koala food tree species (see Table 2-1), regardless of their actual occurrence on the ground (as required under the definition of 'habitat critical to the survival of the Koala,' would be treated as requiring offsets under the EPBC Act Biodiversity Offsets Policy. The SPIR estimated that 375 ha of primary and secondary 'habitat critical to the survival of Koala' habitat would be cleared throughout the Project footprint. This figure was derived from 160 habitat assessment plots, each 0.1 ha in size and distributed throughout a similar number of vegetation polygons, in which absence of the required percentage composition (30% and 50%) of primary and secondary Koala food trees was interpreted as absence of primary and secondary Koala habitat within the entire vegetation polygon. This methodology was based on Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) (2012). *Interim Koala referral advice for proponents for proponent.*

All Biometric Vegetation Types nominally containing primary, secondary and supplementary Koala food tree species will be recognised as requiring offsets. Primary food tree species in these vegetation types include Swamp Mahogany (*Eucalyptus robusta*), Forest Red Gum (*E. tereticornis*), Tallowwood (*E. microcorys*), Cabbage Gum (*E. amplifolia*) and Orange Gum (*E. bancroftii*). Secondary food tree species are represented by Red Mahogany (*E. resinifera*), Small fruited Grey-Gum (*E. propinqua*), Grey Box (*E. moluccana*) and Narrow-leaved Red Gum (*E. seeana*). Supplementary tree species include the stringy-barks (*E. eugenoides* and *E. tindaliae*).

**Table 3-1 Area (ha) of each Biometric Vegetation Type proposed for clearing in relation to Koala habitat score ranking.**

| Biometric Vegetation Type                                        | Koala Habitat Quality Scores |   |             |   |              |              |              |   |   |    | Grand Total   |
|------------------------------------------------------------------|------------------------------|---|-------------|---|--------------|--------------|--------------|---|---|----|---------------|
|                                                                  | 0                            | 2 | 3           | 4 | 5            | 6            | 7            | 8 | 9 | 10 |               |
| <b>Section 1</b>                                                 |                              |   |             |   |              |              |              |   |   |    |               |
| Black Bean - Weeping Lilly Pilly Riparian Rainforest (NR110)     | 0.31                         |   |             |   |              |              |              |   |   |    | 0.31          |
| Blackbutt - Bloodwood Dry Heathy Open Forest (NR115)             | 0.20                         |   |             |   |              | 11.33        | 30.03        |   |   |    | 41.55         |
| Blackbutt Grassy Open Forest (NR125)                             | 0.01                         |   |             |   | 1.17         | 2.82         | 9.81         |   |   |    | 13.81         |
| Cleared                                                          | 72.86                        |   |             |   |              |              | 0.11         |   |   |    | 72.97         |
| Forest Red Gum - Swamp Box (NR161)                               |                              |   |             |   |              | 0.26         | 2.27         |   |   |    | 2.54          |
| Needlebark Stringybark - Red Bloodwood Heathy Woodland (NR200)   |                              |   |             |   |              |              | 13.82        |   |   |    | 13.82         |
| Paperbark Swamp Forest (NR217)                                   | 0.03                         |   |             |   | 7.88         | 3.01         | 1.18         |   |   |    | 12.09         |
| Spotted Gum - Grey Ironbark - Pink Bloodwood Open Forest (NR246) | 0.33                         |   |             |   | 0.99         | 3.58         | 12.94        |   |   |    | 17.83         |
| Swamp Box Swamp Forest (NR253)                                   |                              |   |             |   |              | 5.23         | 5.69         |   |   |    | 10.91         |
| Swamp Mahogany Swamp Forest (NR254)                              | 0.28                         |   | 0.60        |   | 1.49         | 5.77         | 4.26         |   |   |    | 12.40         |
| Swamp Oak Forest (NR255)                                         | 0.95                         |   |             |   |              |              |              |   |   |    | 0.95          |
| <b>Total Section 1</b>                                           | <b>74.97</b>                 |   | <b>0.60</b> |   | <b>11.52</b> | <b>32.00</b> | <b>80.11</b> |   |   |    | <b>199.20</b> |

**Section 2**

|                                                                |       |  |      |  |      |      |      |      |      |  |       |
|----------------------------------------------------------------|-------|--|------|--|------|------|------|------|------|--|-------|
| Black Bean - Weeping Lilly Pilly Riparian Rainforest (NR110)   |       |  | 0.00 |  |      |      |      |      |      |  | 0.00  |
| Blackbutt - Tallowwood Dry Grassy Open Forest (NR119)          |       |  |      |  |      | 0.26 | 0.24 |      |      |  | 0.50  |
| Blackbutt Grassy Open Forest (NR125)                           |       |  |      |  | 3.97 |      |      |      |      |  | 3.97  |
| Cleared                                                        | 37.66 |  |      |  |      |      |      |      |      |  | 37.66 |
| Narrow-Leaved Red Gum Woodlands (NR197)                        |       |  |      |  |      | 1.05 |      | 4.51 |      |  | 5.56  |
| Needlebark Stringybark - Red Bloodwood Heathy Woodland (NR200) |       |  |      |  |      | 1.61 | 0.63 |      |      |  | 2.24  |
| Orange Gum (Eucalyptus Bancroftii) Open Forest (NR216)         |       |  |      |  |      |      |      | 4.84 | 4.38 |  | 9.22  |

|                                                                  |              |  |             |  |             |             |              |              |             |  |               |
|------------------------------------------------------------------|--------------|--|-------------|--|-------------|-------------|--------------|--------------|-------------|--|---------------|
| Paperbark Swamp Forest (NR217)                                   |              |  |             |  | 3.34        |             |              |              |             |  | 3.34          |
| Scribbly Gum - Needlebark Stringybark Heathy Open Forest (NR227) |              |  |             |  |             |             | 6.35         |              |             |  | 6.35          |
| Scribbly Gum - Red Bloodwood Heathy Open Forest (NR228)          |              |  |             |  |             |             | 14.12        | 4.34         |             |  | 18.47         |
| Spotted Gum - Grey Box - Grey Ironbark Dry Open Forest (NR244)   |              |  |             |  |             |             |              | 8.61         |             |  | 8.61          |
| Spotted Gum - Grey Ironbark - Pink Bloodwood Open Forest (NR246) |              |  |             |  |             |             | 2.10         | 27.59        |             |  | 29.70         |
| Swamp Box Swamp Forest (NR253)                                   |              |  |             |  |             |             | 0.09         |              |             |  | 0.09          |
| Swamp Mahogany Swamp Forest (NR254)                              |              |  |             |  |             |             |              | 2.23         | 1.87        |  | 4.10          |
| <b>Total Section 2</b>                                           | <b>37.66</b> |  | <b>0.00</b> |  | <b>7.31</b> | <b>2.92</b> | <b>23.53</b> | <b>52.14</b> | <b>6.25</b> |  | <b>129.81</b> |

The species may also be indirectly impacted by fragmentation and the barrier effect of the highway. It has been identified that Koalas are regularly struck by cars where high-density populations occur in fragmented urban habitats (Canfield 1987, Dique *et al.* 2003b, Taylor and Goldingay 2010, DSEWPac 2013). Recent genetic research has identified that major roads can act as a barrier to gene flow for Koalas (Lee *et al.* 2010).

The project will fragment habitat links for Koalas seeking access to preferred habitats either side of the highway, and this is particularly of concern for the 'important populations' located between Bagotville and Wardell and the southern parts of Coolgardie (Section 10 of the project), and also between Broadwater National Park and Rileys Hill (Section 9 of the project) which will be the subject of further updates to this Koala Management Plan. However, any potential barrier effects of the highway upgrade within Section 1 and Section 2 are of less concern due to the very low population density of Koalas inhabiting these areas.

The impacts of the barrier effect and fragmentation have been considered via a focus on this species in the Connectivity Strategy for Sections 1 and 2 as required under NSW CoA D2.

Potential indirect impacts (unmitigated) would result from:

- Vehicle strike (Koala injury or death) during road construction and operation.
- Changes in Koala home-range distributions - although this is unlikely to be an issue for Section 1 and 2 due to low Koala population density.
- Reduced breeding success and safe dispersal due to fragmentation.
- Disease and stress.

### 3.2 Detailed design considerations

A number of factors were considered in identifying the key connectivity zones for Koalas and the types of crossing structures likely to be used by this species have been included in the detailed design of the Project. The factors considered in locating and sizing of connectivity structures included:

- Known and potential Koala habitat and connectivity areas.
- Consideration of local Koala population density
- Previous experience from monitoring programs which investigated the effectiveness of structures for Koalas. These experiences included the need to make underpasses as large as possible in profile, but as short as possible in total length (< 50 m).

### 3.3 Mitigation and monitoring

A number of measures to mitigate and monitor the impact of the project on Koalas during construction and operation for the entire project were suggested in the EIS (Biodiversity Working Paper, Roads and Maritime 2012). In general these measures related to:

- Installation of dedicated and combined connectivity structures, including overpasses and underpasses, in combination with strategic revegetation and exclusion fencing.
- Development of a Koala Fencing Strategy.
- Provision of Koala fauna exclusion fencing, including fencing of escape points and strategic areas of preferred vegetation.
- Additional targeted Koala surveys as part of a comprehensive monitoring program.
- Pre-clearing surveys to identify Koalas within the construction corridor.
- Identification of exclusion zones and fencing to prevent damage to native vegetation and Koala habitat.
- Siting of ancillary facilities to avoid impacts to known and potential Koala habitat.
- Implementation of a dog policy to ensure that no domestic dogs are brought onto the site.
- Induction and training of construction staff to make them aware of Koala habitat requirements, clearing extents and no-go areas.

- A licensed wildlife carer/ecologist would be present on site during all vegetation clearing.

### **3.4 Effectiveness of mitigation measures**

A summary of the proposed Koala-specific mitigation measures for the entire Pacific Highway upgrade, and evaluation of their effectiveness based on past experience with other highway upgrades, is described in Table 3-2.

**Table 3-2 Mitigation measures and evaluation of their effectiveness**

| Issue                                                                 | Mitigation measure                                                                                                                                                                                                                                                  | History of success                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Effectiveness rating                                              |
|-----------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|
| Impact to Koala habitat outside the construction zone.                | <p>Identification of exclusion zones and limits of clearing.</p> <p>Revegetation of lands adjacent to the corridor post construction.</p>                                                                                                                           | <p>A standard procedure has been developed by Roads and Maritime and documented in the Biodiversity Guidelines for Construction (RTA 2011). The guidelines were developed in consultation with the NSW Office of Environment and Heritage (OEH), NSW Department of Primary Industries (DPI) (Fisheries), biodiversity specialists and Roads and Maritime staff including project managers, construction personnel and designers. Consultation was facilitated through a number of workshops carried out in 2009. These procedures have been developed using knowledge gained from a long history of upgrades on the Pacific highway and other road projects in NSW.</p> <p>Temporary fencing around important fauna habitats (exclusion zones) has been used by Roads and Maritime on multiple highway upgrades including the Pacific Highway and Hume Highway for the past 20 years. It has become a standard procedure as part of the Construction Environment Management Plan (CEMP) and is inspected during construction. When combined with standard training of contractors it has become a highly effective measure at avoiding impacts to important habitats adjacent to construction areas.</p> <p>Landscape designs are a standard procedure used on all upgrades and have developed over the last three decades to include the use of locally indigenous plant species and a targeted approach to revegetation where required. This includes the provision of specific keystone species for fauna including koala feed trees. It is particularly useful at crossing zones, to encourage fauna use of underpass and overpass structures.</p> | High                                                              |
| Potential impacts to Koalas within the project during clearing works. | <p>Pre-clearing and clearing procedures.</p> <p>Installation of temporary barrier fencing during construction including placement of escape points</p> <p>Koala relocation protocol.</p> <p>Managing Koala construction vehicle collisions during construction.</p> | <p>Guide 1: Pre-clearing procedures of the Roads and Maritime Biodiversity Guidelines (RTA 2011) outline the process to be followed prior to clearing works. The objective of this guide is to provide guidance for the pre-clearing process that would be conducted before any clearing takes place to minimise the impact on native flora and fauna. If fauna is within the identified limits of clearing an ecologist would capture and/or remove the fauna that have the potential to be disturbed, injured or killed as a result of clearing activities. Guide 8: Fauna handling would be followed for the capture and release of fauna.</p> <p>Specifically for the Koalas refer to Section 5.3.6 in this plan for a description of the Koala relocation protocol.</p> <p>The use of ecologists and licensed wildlife carers has been used on Pacific Highway projects over the last 10 years to successfully capture and relocate fauna. Temporary exclusion fencing has also been used on all Pacific Highway upgrade over the last 10 years to exclude fauna from the construction works along the highway upgrade.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Moderate – High. Monitor success and implement corrective actions |
| Domestic dogs brought on site by contractor could lead to dog attack  | CEMP to document dog policy.                                                                                                                                                                                                                                        | A prohibition of dog's policy is implemented as a standard procedure part of the CEMP process and has been used on multiple upgrades on the Pacific Highway including the Bonville and Kempsey upgrade where koalas were important issues. This policy has ensured that no domestic dogs are brought onto the site by construction contractors and is monitored throughout the construction period with consequences for contractors who bring dogs to the site.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | High                                                              |
| Potential impact to Koala habitat when siting ancillary facilities.   | Locate ancillary facilities and access roads in disturbed and cleared areas.                                                                                                                                                                                        | <p>Roads and Maritime <i>Stockpile Site Management Procedures</i> (RTA 2011).</p> <p>The siting of temporary construction related infrastructure is to be sited where possible within existing cleared or disturbed areas. This approach can substantially reduce the overall area of impact to vegetation and fauna habitat, while also reducing the area required to be rehabilitated at the end of construction.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | High                                                              |

WOOLGOOLGA TO BALLINA | PACIFIC HIGHWAY UPGRADE: SECTION 1 – SECTION 2

|                                                                                                     |                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                          |
|-----------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|
| <p>Disruption to Koala movements and gene flow.</p> <p>Koala vehicle collisions on the highway.</p> | <p>Fauna crossing structures – underpasses, including refuge poles and furniture</p> <p>Fauna crossing structures – overpasses (land bridges), including refuge poles.</p> <p>Installation of permanent fauna exclusion fencing.</p> <p>Maintenance of fauna exclusion fencing.</p> | <p>Targeted crossing structures for Koalas have been used on multiple projects in Australia with high level of success. Roads and Maritime undertook monitoring of the vegetated median and rope bridge for the Bonville underpass in 2010 (SES 2010). This monitoring found that the underpasses were being used by Koalas, but only rarely during the first few years of the project (AMBS 2011).</p> <p>A review of the usage of fauna passage structures was undertaken for Roads and Maritime in 2009 (Roads and Maritime 2009). This report found that Koalas have been recorded in fauna tunnels and box culverts. Specifically this study found that:</p> <ul style="list-style-type: none"> <li>• Koalas were using box culverts within the Yelgun to Chinderah and Brunswick Heads sections.</li> <li>• Within the Yelgun to Chinderah section the purpose-built fauna tunnel in the Taree section was also being used.</li> <li>• The culverts successful in attracting Koalas were united by their close proximity to quality vegetation.</li> <li>• The Koala may require time to acclimatise to the presence of the road and the underpass structures (AMBS 2011). Alternatively, it may be necessary for vegetation to regenerate before a Koala is comfortable moving over land.</li> <li>• Koalas were recorded in culverts with and without internal poles and logs. Although the sample sizes were too small to comment on whether culverts with poles were more successful than those without.</li> </ul> <p>Permanent fauna exclusion fencing has been used on multiple sections of the Pacific Highway to exclude fauna and direct to crossing points. An investigation of the impact of roads on Koalas was undertaken in 2011 for Roads and Maritime (AMBS 2011). Some of the findings from the study include that:</p> <ul style="list-style-type: none"> <li>• Most Koalas killed by vehicle collisions on the highway are not the local roadside residents but appear to be sub-adults dispersing and perhaps old, weak animals displaced from their former home-ranges away from the highway. Consequently the impact of road-kill affects a wider section of the population.</li> <li>• The genetic variation in roadside Koalas in the Yelgun to Chinderah and Bonville study areas prior to the upgrades was relatively high and had apparently not been impacted by the long existence of the Pacific Highway</li> <li>• Construction activities in the two study areas directly led to only one known death, suggesting that the direct impacts of clearing and construction are relatively minor at a population scale (when appropriate mitigation strategies are in place).</li> <li>• ‘Floppy-top’ fauna exclusion fencing can be very effective at reducing the rate of road-killed Koalas, but gaps and other weaknesses (including side-roads) have to be eliminated, and fences that end at the forest edge are likely to be not as effective as those that extend beyond the forest.</li> <li>• Underpasses (both constructed culverts and ‘natural’ underpasses such as gullies) can work in providing safe dispersal routes for Koalas to cross the highway. Other studies have recorded Koalas using underpasses in NSW including at the Brunswick Heads bypass, Bulahdelah to Coolongolook section of the Pacific Highway, Taree section of the Pacific Highway upgrade and a culvert near Brunswick Heads (Taylor and Goldingay 2003).</li> <li>• Recommended that clearing activities be undertaken outside the Koala breeding and dispersal period during future road constructions.</li> <li>• Other sources of mortality (e.g. <i>Chlamydia</i>) can be much higher in roadside Koalas than road mortality</li> </ul> <p>Roads and Maritime routinely conducts maintenance on exclusion fencing along the Pacific Highway both as a standard procedure and in response to a breach in the fence or the discovery of significant numbers of fauna road kills.</p> | <p>Moderate – High, monitor success and implement corrective actions</p> |
|-----------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|

|                                                                                           |                                                                  |                                                                                                                                                                                                      |      |
|-------------------------------------------------------------------------------------------|------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
| Increased noise and dust during construction impacting on Koala movements and behaviours. | Dust and noise managed in accordance with procedures in the CEMP | Roads and Maritime have developed standard procedures for water quality management on construction sites as part of the CEMP process with a long history of success as reported in auditing reports. | High |
|-------------------------------------------------------------------------------------------|------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|



### 3.5 Relevance to Section 1 and Section 2

The low density populations of Koalas living within Sections 1 and 2 are likely to suffer a reduced level of impact by the Project, compared to other Sections where this species is more abundant. Accordingly, the management response by RMS will differ between Sections.

### 3.6 Adaptive management approach

This management plan adopts an adaptive management approach based on the identification of specific goals for management, implementation of management actions, followed by monitoring of the performance of these measures against the goals and identified thresholds. As a final step, the monitoring will evaluate the effectiveness of the management measures using identified thresholds for performance and implementing corrective actions to improve mitigation where required.

To ensure the success of this approach the management goals presented in the plan were based on the following SMART principles:

- **S**pecific.
- **M**easurable.
- **A**chievable.
- **R**esults-based.
- **T**ime-based.

Details of the proposed Koala monitoring program for the entire project are described in Chapter 7 and include:

- Changes in Koala activity and population density in proximity to the upgrade and to the east and west of the road corridor using methodology which includes a Before-After-Control-Impact (BACI) approach.
- The use of crossing zones and crossing structures during the project pre-construction, construction and operational phases.
- The effectiveness of roadside fencing in excluding Koalas from the road corridor and in directing Koalas to crossing zones.
- The success and utilisation by Koalas of habitat revegetation.

Monitoring procedures for Koalas in Sections 1 and 2 of the highway upgrade are limited to assessments of the effectiveness of the road crossing structures provided, the effectiveness of fauna fencing associated with the frequency and distribution of Koala road kills, and the use of restored habitat by Koalas.

## 4. Pre-construction management measures

### 4.1 Potential impacts during pre-construction phase

- Location of infrastructure within ancillary facility sites, including heavy vehicle access, may impact on Koala habitat, movements, and foraging behaviour.

### 4.2 Main goals for management

- Koala fencing strategy completed prior to the commencement of construction (note: does not include “floppy top” fencing in Section 1 and Section 2).
- No impact to Koala habitat outside designated clearing areas and the project boundary.
- No Koala deaths from contractor domestic dogs on the project.

### 4.3 Management measures

Details on the site specific mitigation measures for Koalas to be implemented during the pre-construction phase are detailed in the following section and summarised in Table 4-1 along with performance thresholds and corrective actions.

#### 4.3.1 Fauna fencing

Fauna fencing type and location has been completed as part of the detailed design for Section 1 and Section 2 and is detailed in the Connectivity Strategy for these sections. “Floppy top” Koala fencing is not proposed for use in Section 1 and Section 2 because of the low population density of animals. Instead, a modified rabbit-proof fence will be installed that can be retro-fitted with smooth metal sheeting if any Koala deaths or injuries are recorded. These assessments have been undertaken following consultation with biodiversity specialists in EPA/OEH. The Connectivity Strategy provides detail on fence types and specific locations for fencing, as well as placement of escape points (for instances where fauna become trapped in the road corridor). However, recent research presented at Australian Network of Ecology and Transportation 2014 conference found that these escape points were being used by a variety of fauna groups to access the highway rather than escape from it (Taylor and Goldingay 2014). Further consultation with EPA (December 2014) recommended that “fauna drop downs” rather than “escape poles” be used in Sections 1 and 2, due to the low number of Koala records. The EPA specified that these drop downs be designed with 1200 mm clearance down the front, and that drop downs be placed close to entry nodes and less frequently (at notional 500 m intervals) further away from entry roads. The EPA acknowledged that escape are a vital design feature of four-lane highways, and that further research is required to improve the efficiency of designs. The current Connectivity Strategy for Section 1 and 2 includes 1200 mm escape drop downs at all dedicated and combined fauna crossing culverts. The Section 2 re-use area will also include fauna drop down structures to allow for fauna to access the underpasses rather than going back across the northbound carriageway.

Details of the fauna fencing locations for Section 1 and Section 2 are shown in the Connectivity Strategy (2014).

#### 4.3.2 Commence baseline surveys

No baseline surveys for Koala population size and distribution are proposed for Section 1 and Section 2 because of the low population density of animals in these locations.

Baseline Koala surveys will focus on important Koala populations identified in Sections 9 and 10 of the Project.

### 4.3.3 Pre-clearing surveys

Although Section 1 and Section 2 have low density koala populations, pre-clearing surveys would be conducted prior to the commencement of vegetation clearing works to identify Koalas within the construction corridor. The pre-clearing process targets all fauna habitat and is a requirement of the CEMP. Searches for signs of Koala activity and Koala presence will form a part of this process. The results of the pre-clearing process will inform planning and procedures for the staged habitat removal process and are documented as part of the FFMP.

Pre-clearing surveys include a 2-staged process for habitat trees and any trees that contain fauna. If a Koala is found, clearing will stop and the area left for 24hrs to allow the Koala to relocate. If the Koala is still present after 24hrs, the Koala will be trapped and relocated. A Koala spotter will also be present during clearing operations.

### 4.3.4 Identify exclusion zones

An exclusion zone is a designated 'no-go' area that is clearly identified and appropriately fenced to prevent damage to native vegetation and fauna habitat. This procedure is documented in the CEMP and conducted along the entire construction corridor for all threatened species and endangered ecological communities.

Habitat exclusion zones and limits of clearing will include consideration of Koala habitat. Habitat exclusion zones will be marked out during the on-ground survey of the road corridor and the commencement of construction to ensure that these activities, including vehicles and machinery, do not intrude or remove protected and roadside vegetation in Koala habitat areas.

The identification of exclusion zones may be staged with a priority for early works sites and then remaining areas of the construction corridor. Survey personnel will be inducted to ensure they do not encroach outside the limits of clearing.

### 4.3.5 Identify sensitive ancillary areas and access roads

The siting of ancillary areas including stockpiles and construction infrastructure is planned to be located within cleared areas and disturbed vegetation. This will occur across all ancillary sites for each stage of the project and will be documented in the CEMP. The procedure will avoid direct and indirect impacts to Koala habitat.

### 4.3.6 Dog policy

The CEMP includes a policy that no domestic dogs are to be brought onto the site during pre-construction and construction activities. All project personnel will be inducted as part of the CEMP.

## 4.4 Performance thresholds and corrective actions

Table 4-1 summarises the pre-construction environmental planning measures for Koalas that will be completed prior to the commencement of construction.

**Table 4-1. Mitigation measures, performance measures and corrective actions - pre-construction**

| Main goals for mitigation                                                                       | Proposed mitigation measure                                                                                                                                                  | Monitoring/timing frequency                                                                                                                                                                                                        | Performance thresholds                                                                                        | Corrective actions if deviation from performance thresholds                                                                                                 |
|-------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Fencing identified as part of Connectivity Strategy completed prior to construction commencing. | Detail location of temporary and permanent fencing, encourage use of crossing points and direct Koalas from the road corridor.                                               | Connectivity Strategy to be completed prior to construction commencing.                                                                                                                                                            | Connectivity Strategy and associated fencing locations signed off as complete at end of design.               | Delay construction until Connectivity Strategy has been completed.                                                                                          |
| No impact to Koala habitat outside designated clearing areas and the project boundary.          | Identification and appropriate fencing/marketing of exclusion zones.                                                                                                         | Identify clearing limits prior to clearing works. Inspection prior to clearing report in the CEMP to be signed off                                                                                                                 | Exclusion fencing signed off at start of clearing                                                             | Do not commence clearing, hold-off work and complete.                                                                                                       |
| No impact to Koala habitat outside designated clearing areas and the project boundary.          | Ancillary facilities and access roads to be planned and sited within cleared or disturbed areas within the project boundary and in accordance with NSW CoA B73, B74 and B75. | Ongoing during construction phase. Detailed plans to be prepared showing the proposed location of construction related infrastructure prior to commencement of clearing and construction activities during the construction phase. | Ancillary facility plans ensure there is no impact on primary or secondary koala habitat and vegetated areas. | Amend locations until all known and potential Koala habitat that is not scheduled for removal is avoided.                                                   |
| No Koala deaths from contractor's domestic dogs on the project.                                 | CEMP to document policy that prohibits dogs being brought onto the construction site.                                                                                        | Ongoing during construction.                                                                                                                                                                                                       | No domestic dogs found on site belonging to construction personnel.                                           | Any breach of the policy to be reported to Roads and Maritime and ER, with contractors warned that further breaches would require removed from the project. |

## 5. Construction management measures

### 5.1 Potential impacts during construction

- Impacts during clearing of vegetation.
- Koalas entering the construction corridor and becoming trapped in the corridor.
- Koala vehicle collisions with construction traffic.
- Disturbance and degradation to adjoining Koala habitat.
- Dust and noise impacting on movements and habitat use.

### 5.2 Main goals for management

- No injuries to Koalas during clearing of vegetation.
- No injuries to Koalas during construction as a result of Koala/construction vehicle collisions.
- No damage to Koala habitat within exclusion zones during construction.
- Dust and noise managed in accordance with the CEMP.
- Replanting of Koala habitat adjacent to the road corridor completed as per landscape design.

### 5.3 Management measures

#### 5.3.1 Construction work method statements

Construction Work Method Statements would be prepared for specific activities to ensure sound environmental practices are implemented and to minimise the risk of high risk environmental incidents or system failures.

Construction Work Method Statements would be prepared to address all construction Koala management requirements during construction in consultation with relevant agencies, the Roads and Maritime and the relevant project environmental manager prior to the commencement of project activities considered to present risk to the Koala. Construction Work Method Statements would be prepared to ensure that all Koala management measures are implemented.

#### 5.3.2 Construction induction and training

Induction training would be conducted for all contractors and project staff working in areas of known and potential Koala habitat and distribution in the project area. This training would identify areas of Koala habitat, crossing zones and key threats to the species. The importance of following the clearing and rehabilitation protocols would be made clear to all project personnel.

### 5.3.3 Temporary Koala exclusion fencing

Temporary exclusion fencing will not be installed around exclusion zones and potential Koala habitat outside of the clearing footprint in Section 1 and section 2 because of the expected low likelihood of Koalas entering the highway upgrade footprint during construction activities.

### 5.3.4 Permanent fauna exclusion fencing

Permanent fauna exclusion fencing will be installed at locations along the carriageway identified from the Connectivity Strategy (RMS 2014). However, Section 1 and Section 2 have relatively low koala population densities and, as such, typical floppy top fencing used for Koalas will not be applied to these sections. Instead, a modified rabbit proof fence has been developed which is minimum 1200 mm high mesh fence pegged into the ground and secured with concrete posts. In developing this fence design, extensive consultation was undertaken with biodiversity specialists from the EPA. If any Koala accidents or road kills occur during the operation of Section 1 and 2, this fence, or parts thereof, will be retro-fitted with smooth metal sheeting as an additional deterrent to Koalas.

### 5.3.5 Pre-clearing and clearing procedures

Pre-clearing and clearing procedures will be outlined in the CEMP and FFMP, and will be undertaken in accordance with *Biodiversity Guidelines: Protecting and managing biodiversity on RTA Projects* (RTA 2011), in order to minimise impacts on flora and fauna.

Specifically for Koalas, clearing of trees will be undertaken in a way that ensures Koalas living in or near the clearing area have enough time to move out of the site without human intervention. In summary this involves:

- Staged clearing, i.e. sequential thinning or partial removal of trees in progressive stages, to allow Koalas to safely leave the clearing area and relocate to adjacent habitat.
- An ecologist will undertake surveys of the scheduled clearing area prior to vegetation clearing (i.e. early in the morning prior to the commencement of vegetation clearing activities) to identify trees in which a Koala is present and any adjacent trees with overlapping crowns.
- Suspension of clearing works for a minimum period of 48 hours if a Koala is found within a clearing area to allow the animal to move out of the construction site on its own volition.
- The direction of sequential clearing will be away from threatening processes or hostile environments, i.e. roads. The ecologist is responsible for verifying that sequential clearing has taken place.
- Each tree identified by the ecologist as being a risk to a Koala if felled, will not be felled, damaged or interfered with until the Koala has moved from the clearing site. The ecologist will physically move Koalas if necessary in accordance with *Biodiversity Guidelines: Protecting and managing biodiversity on RTA Projects* (RTA 2011).
- In the event that a Koala remains in the clearing site for more than 48 hours, it will be captured and translocated by a suitably qualified person to the nearest area of habitat identified as suitable for Koala release and where the individual is at no risk of further harm.

These procedures are informed by the sequential vegetation clearing and requirements for clearing Koala habitat trees in Queensland (EPA 2006). Clearing procedures will be outlined in the CEMP and FFMP, and will be undertaken in accordance with *Biodiversity Guidelines: Protecting and managing biodiversity on RTA Projects* (RTA 2011), in order to minimise impacts on flora and fauna in general.

Clearing procedures will also be informed by the Roads and Maritime unexpected finds procedures (RTA 2011) should a Koala be encountered in the construction corridor at any time during construction.

### 5.3.6 Koala relocation protocol

An ecologist will be present on site prior to and during all vegetation clearing to allow Koalas to safely leave the clearing site and relocate to adjacent habitat without human intervention. In the event that a Koala does not move on its own volition after a period of two nights, it will be trapped. The 'corflute method' would be used for trapping Koalas. This typically involves the use of a plastic guard, or similar material (approximately 100 centimetres tall) and, optionally, a cage trap arrangement placed in the fence near the base of the target tree, as shown in Photo 1 (AMBS 2011).



**Photo 1** Trap designed to capture koalas (source AMBS 2011)

Once captured, the Koala's health will be assessed and details recorded of age, sex, weight, body measurements, and presence of pouch or back young (for females). All healthy animals will be ear tagged, micro-chipped (using a PIT tag) and relocated into adjacent habitat identified for Koala release. Release points will be not more than 100 metres away provided that suitable habitat is present. If an injured Koala is captured, it will be transported to an experienced wildlife veterinarian for treatment. Details of veterinarians will be provided in the FFMP. The NSW Code of Practice for Injured, Sick and Orphaned Koalas (OEH, 2011) (refer to Appendix C) will be followed for trapping and relocating Koalas and dealing with any injured Koalas encountered during the clearing procedure.

Direct interactions with Koalas must only be conducted by a suitably qualified and experienced ecologist who holds the necessary capture and handling permits issued by the OEH, or other licensed wildlife carers.

Areas where Koalas have been captured will be recorded for consideration of inclusion as a monitoring site within the monitoring program discussed in Chapter 7.

### 5.3.7 Managing construction vehicle collisions with Koalas

A licensed wildlife carer/ecologist will be present on site during all vegetation clearing and habitat removal activities to redirect Koalas that may be encountered during clearing activities.

Following the clearing works and throughout the remainder of the construction period, any observations of Koalas in the construction corridor will also follow the unexpected threatened species find procedure (RTA 2011).

All construction vehicles will be required to comply with the speed limits set out in the CEMP and to remain within the designated construction corridor. The speed limit within the construction zone will range from 10 km/hr – 60 km/hr, depending on construction activities and construction machinery. Speed limits will be reduced to 80 km/hr on the existing Pacific Highway and 40 km/hr on local access roads.

Given the likely increased traffic on local roads during the construction period, Koala awareness signs will be erected on local roads in potential road kill areas to make motorists aware of the potential for Koalas to cross the road and the need to restrain dogs, particularly between the hours of 6 pm and 6 am when Koalas are most active. Koala awareness signs will also to be constructed along the highway upgrade at locations in close proximity to the fauna crossing zones. Signage locations will be identified in the Koala Fencing Strategy.

### 5.3.8 Fauna crossing structures

A number of dedicated and combined fauna/drainage connectivity structures for Section 1 and Section 2 are included in the Connectivity Strategy (RMS 2014) to maintain existing levels of landscape connectivity for all fauna, including the Koala and has been developed in close consultation with EPA/OEH and DPI Fisheries. Fauna connectivity structures that are targeted to Koalas, or which may be used by Koalas, are summarised in Table 5-1 below. The locations of these fauna connectivity structures are indicated by the chainages in Table 5-1, and are displayed on maps in Figures 1-1 and 1-2 of the Final Connectivity Strategy (April 2015). It should be noted that many additional under-road structures designed primarily for drainage will also be built in each Section of the highway upgrade and a number of these could also be used by Koalas. The primary fauna connectivity structures in Section 1 and Section 2 include:

- Seven bridges with fauna passage beneath, including dry ground retained along river banks
- Thirty combined drainage / fauna passage culverts in wet areas

Twelve dedicated fauna underpasses in dry sclerophyll forest and swamp forest. The dimensions of underpasses that have been shown to facilitate Koala movements (Taylor and Goldingay 2003, AMBS 2011) include:

- Box culvert of three metres height (H) x three metres width (W) – especially for four or greater lane carriageways.
- Box culvert of 2.4 metres (H) x 2.4 metres (W) – as a minimum for a single or dual carriageway (this size may include Koala furniture).
- Preferably, all dedicated underpasses to be less than 50 m in total length.

Fauna furniture will be placed within targeted Koala underpasses, including hard wood horizontal and vertical logs within and outside the culvert to provide a dry passage for Koalas whilst also providing refuge from predators. Previous Koala monitoring on the Pacific Highway in north-east NSW (AMBS 2011) demonstrated that log furniture in underpasses was used by a Koala but not by most. This suggests that furniture may facilitate the use of the underpass by some individual Koalas.

Fauna furniture installed at the targeted Koala underpasses will be finalised in the detailed design and adhere to the connectivity guidelines in the EIS which include:

- Horizontal logs placed as high off the ground as possible for Koalas to avoid predators with a minimum space of 600 millimetres between the top of the horizontal log and the structure's roof.
- Horizontal logs supported by vertical logs at regular intervals (approximately every 2-3 metres) along the underpass for Koalas to ascend or descend the Koala furniture as required.
- Logs greater than 200 millimetres in diameter.
- Koala furniture extends beyond the underpass into Koala habitat.
- Where fauna furniture is placed inside a culvert, it is to be constructed on the left or right side of the culvert (not in the middle), to minimise incidence of flooding.

Strategic planting of Koala habitat adjacent to targeted connectivity structures will also be undertaken post-construction, or beforehand if practicable, to improve and maintain connectivity.



Fauna exclusion fencing will be constructed to funnel Koalas to the fauna crossing structures and will be designed with a return at the end to encourage Koalas to move back into habitat and not directly onto the highway. Additional features will be incorporated into the fauna exclusion fencing design, such as fauna drop downs.

The monitoring program described in Chapter 7 of this plan will focus on monitoring the effectiveness of crossing structures and exclusion fencing for Koalas. This includes monitoring performance of structures and implementing corrective actions where required.

**Table 5-1 Fauna connectivity structures as detailed in the Connectivity Strategy**

| Project section | Chainage (m) | Connectivity structure (Cell No x wxhxl*) | Functionality     | Comments                |
|-----------------|--------------|-------------------------------------------|-------------------|-------------------------|
| 1               | 2000         | 3 x 3 x 3 x 45 m                          | Combined culvert  |                         |
| 1               | 3600         | 62 m long                                 | Bridge            | Corindi Creek           |
| 1               | 4150         | 300 m long                                | Bridge            | Corindi Floodplain      |
| 1               | 4750         | 74 m long                                 | Bridge            | Cassons Creek           |
| 1               | 5660         | 3 x 3.6 x 1.5 x 25 m                      | Combined culvert  | Redbank Creek           |
| 1               | 5660         | 4 x 3.3 x 1.5 x 35 m                      | Combined culvert  | Redbank Creek           |
| 1               | 6170         | 64 m long                                 | Bridge            | Corindi Creek tributary |
| 1               | 6890         | 1 x 3 x 2.7 x 45 m                        | Dedicated culvert |                         |
| 1               | 7280         | 1 x 3 x 3 x 80 m                          | Combined culvert  |                         |
| 1               | 8470         | 1 x 3 x 3 x 51 m                          | Dedicated culvert |                         |
| 1               | 8800         | 1 x 3 x 3 x 50 m                          | Dedicated culvert |                         |
| 1               | 10340        | 2 x 2.1 x 0.9 x 69 m                      | Combined culvert  |                         |
| 1               | 10750        | 2 x 3 x 3 x 62 m                          | Combined culvert  | Dundoo Creek            |
| 1               | 11710        | 1 x 3 x 3 x 57 m                          | Dedicated culvert |                         |
| 1               | 12420        | 1 x 3 x 3 x 52 m                          | Dedicated culvert |                         |
| 1               | 12880        | 1 x 3 x 3 x 54 m                          | Combined culvert  |                         |
| 1               | 13310        | 2 x 3.6 x 3.3 x 27 m                      | Combined culvert  |                         |
| 1               | 13310        | 2 x 3.6 x 3.3 x 66 m                      | Combined culvert  |                         |
| 1               | 13800        | 1 x 3 x 3 x 49 m                          | Combined culvert  |                         |
| 1               | 14280        | 1 x 3 x 3 x 71 m                          | Combined culvert  |                         |
| 2               | 17710        | 1 x 3 x 2.4 x 57 m                        | Dedicated culvert |                         |
| 2               | 18120        | 2 x 2.7 x 2.1 x 79 m                      | Combined culvert  |                         |
| 2               | 19180        | 1 x 3 x 3 x 59 m                          | Combined culvert  |                         |
| 2               | 19880        | 1 x 3 x 3 x 54 m                          | Dedicated culvert |                         |
| 2               | 20650        | 4 x 3.6 x 2.7 x 64 m                      | Combined culvert  |                         |
| 2               | 20780        | 57 m long                                 | Bridge            | Halfway Creek           |
| 2               | 20880        | 1 x 3 x 3 x 66 m                          | Combined culvert  |                         |
| 2               | 21290        | 1 x 3 x 3 x 47 m                          | Combined culvert  |                         |
| 2               | 22400        | 78 m long                                 | Bridge            | Wells Crossing          |
| 2               | 23130        | 1 x 3 x 3 x 22 m                          | Dedicated culvert |                         |
| 2               | 23131        | 1 x 3 x 3 x 22 m                          | Dedicated culvert |                         |
| 2               | 23750        | 1 x 3 x 2.7 x 43 m                        | Dedicated culvert |                         |
| 2               | 24570        | 1 x 3 x 3 x 42 m                          | Combined culvert  |                         |

| Project section | Chainage (m) | Connectivity structure (Cell No x wxhx*) | Functionality      | Comments                     |
|-----------------|--------------|------------------------------------------|--------------------|------------------------------|
| 2               | 25850        | 1 x 3 x 3 x 45 m                         | Dedicated culvert  |                              |
| 2               | 27420        | 1 x 3.6 x 3 x 60 m                       | Combined culvert   |                              |
| 2               | 29300        | 1 x 2.4 x 2.4 x 25 m                     | Dedicated culvert  | Glenugie dedicated underpass |
| 2               | 29360        | 26 m plus existing                       | Bridge (Bebo Arch) | Glenugie Creek               |

NOTE:

1 - \* = width x height x length. Note lengths are indicative and there may be minor changes in length as part of detailed design.

### 5.3.9 Habitat revegetation

A landscape design has been prepared for Section 1 and Section 2 and includes the use of primary and secondary koala food trees in those areas that will not cause a road safety traffic hazard. Areas where specific revegetation is to occur include approaches to fauna connectivity structures and riparian corridors (within the project boundary), which would be directly applicable to Koalas. Methods for topsoiling, seeding and planting will be in accordance with the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA Projects* (RTA 2011).

The landscape design provides due consideration to the landscape requirements around crossing structures by ensuring that the height and density of vegetation does not obscure the structure and provides a clear line of sight, while also providing some cover from predators for fauna approaching and exiting the structure.

Revegetation using primary, secondary and supplementary Koala food trees has been shown to be effective in restoring habitat for Koalas (Kavanagh and Stanton 2012). Revegetation near crossing structures will commence immediately on completion of the construction activity or may commence earlier in the construction period if possible.

Details on monitoring the performance of the revegetation, as well as corrective actions to be implemented in instances of change from performance measures, are provided in Chapter 7.

### 5.3.10 Location of ancillary facility sites

Ancillary facility sites (i.e. temporary sites for construction related activities) have been located in cleared land or sites of low ecological value. Locations of plant and equipment will be placed in cleared parts of the site. This will avoid unnecessary clearing of Koala habitat, particularly at locations where Koala food trees and Koala activity have been identified (Roads and Maritime Services 2013).

### 5.3.11 Minimising dust and noise

Dust and noise impacts will be managed in accordance with the CEMP, including dust suppression measures and construction noise limit measures.

## 5.4 Performance thresholds and corrective actions

Table 5-1 summarises the operational environmental planning measures for Koalas and corrective actions if the measure deviates from the performance criteria.

**Table 5-2 Performance indicators and corrective actions – construction**

| Main goals for management                                                                      | Management measure                                                                                                                                                                                                                 | Monitoring/timing frequency                                                                                                                                                      | Performance thresholds                                                                       | Corrective actions if performance threshold reached                                                                                                                                                                                                                                                  |
|------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| No injuries to Koalas during clearing of vegetation.                                           | <ul style="list-style-type: none"> <li>Documented procedures for clearing and relocating.</li> <li>Project ecologist to evaluate situation and approach on each occasion.</li> </ul>                                               | <ul style="list-style-type: none"> <li>Monitored daily during the clearing works.</li> <li>Outcome of clearing procedure reported in ER as per the CEMP requirements.</li> </ul> | Any injury to an individual Koala during clearing works.                                     | <p>Stop clearing works and consult with Koala specialists and/or NPWS.</p> <p>Update procedure for emergency management if a Koala is encountered and convey changes to construction staff via induction and toolbox talks.</p> <p>Consider erection of temporary exclusion fencing if required.</p> |
| No injuries to Koalas during construction as a result of Koala construction vehicle collisions | <ul style="list-style-type: none"> <li>All vehicles to stay within the construction corridor. No vehicles to enter exclusion zones.</li> <li>Compliance with construction vehicles speed limits designated in the CEMP.</li> </ul> | <ul style="list-style-type: none"> <li>Reporting of any incidents as, and if, they occur</li> <li>Monthly fauna incident log to be maintained as per FFMP.</li> </ul>            | Any injury to an individual Koala during construction activities.                            | <p>Stop construction activities and review traffic control procedures.</p> <p>Consider erection of temporary fencing if required. Update strategy and speed limit as required and convey changes to construction staff via induction and toolbox talks.</p>                                          |
| No damage to Koala habitat within exclusion zones.                                             | <ul style="list-style-type: none"> <li>All vehicles to stay within the construction corridor. No vehicles or machinery to enter exclusion zones.</li> </ul>                                                                        | <ul style="list-style-type: none"> <li>Monthly inspection of protection zones as part of FFMP.</li> </ul>                                                                        | Any breaches in protection of Koala habitat within exclusion zones.                          | Supplementary revegetation of disturbed habitat and monitor recovery for period of 12 months.                                                                                                                                                                                                        |
| Dust and noise managed in accordance with the CEMP.                                            | Implement relevant dust and noise procedures from the CEMP.                                                                                                                                                                        | Measures to be undertaken in response to weather and construction conditions.                                                                                                    | Dust and noise control measures within acceptable standards as defined in the CEMP..         | Increase the frequency of dust and noise measures as appropriate and implement procedures to avoid unnecessary dust and noise events during construction.                                                                                                                                            |
| Water quality and weeds managed in accordance with the CEMP.                                   | Implement relevant water quality and weed management procedures from the CEMP.                                                                                                                                                     | Measures to be undertaken in response to storm events and construction conditions.                                                                                               | Water quality and weed control measures within acceptable standards as defined in the CEMP.. | Implement additional procedures to control stream siltation, and undertake weed spraying in problem areas during construction.                                                                                                                                                                       |

|                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                         |                                                                                                                                                          |                                                 |
|--------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------|
| <p>Replanting of Koala habitat adjacent to the road corridor completed as per the landscape design</p> | <ul style="list-style-type: none"> <li>● In situations where no fencing is present, and revegetation is required, roadside plantings to avoid Koala food trees to prevent Koalas being attracted to road edges.</li> <li>● Landscape plantings at fauna crossing zones to use Koala habitat trees to encourage use of the crossing zones by the Koala.</li> <li>● Revegetation in areas disturbed during construction to be restored to the original habitat type at each location. Focus at potential habitat locations</li> </ul> | <p>Final audit of Landscape design.</p> | <p>Compliance of landscape plan at end of construction with regard to koala plantings (refer Chapter 7 for further details on performance criteria).</p> | <p>Complete plantings where gaps identified</p> |
|--------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------|

## 6. Operational management measures

### 6.1 Potential impacts during operational phase

- Degradation of exclusion fencing leading to Koala vehicle collisions and road deaths or Koalas becoming trapped within the road corridor.
- Degradation of Koala revegetation areas.
- Wild dogs targeting Koalas at designated crossing zones.
- Koalas not using designated crossing structures where recorded in adjacent habitat.

### 6.2 Main goals for management

- No Koala deaths or injuries associated with road operations (i.e. vehicular collisions) within the upgrade area after a five year period following commencement of the operational phase.
- Evidence of completed crossings by Koalas at targeted fauna crossing structures. Less than 30% mortality of planted Koala feed trees in Koala habitat revegetation areas on Roads and Maritime owned land for a period of five years post-construction.

### 6.3 Management measures

#### 6.3.1 Maintenance of fauna exclusion fencing and fauna crossings

The Roads and Maritime Services will maintain fauna crossing structures and exclusion fencing as part of the standard maintenance requirements for perpetuity as required. A small vehicle access track adjacent to the fence would facilitate rapid inspection and repair. Fauna fencing will be inspected every six months and maintained as required.

Maintenance of fauna fencing will also be conducted in response to observations and reports of any Koala injuries or road kills in the vicinity of exclusion fencing and structures. The work to be commissioned will include repair of any breaches in the exclusion fence, the slashing of overgrown vegetation that breaches the fence or occurs within 3 m of the fence, and the removal of large debris or vegetation from culverts.

#### 6.3.2 Maintenance of revegetation

Inspection, monitoring and maintenance of revegetated areas will be specified in the landscape design. The recommended monitoring and maintenance schedule for the revegetated Koala habitat areas in the first year is outlined in **Table 6-1**.

**Table 6-1 Monitoring and maintenance schedule first year for planted trees/shrubs**

| Monitoring                        | Timing       | Maintenance                                                                                                                                                              |
|-----------------------------------|--------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Site preparation                  | Commencement | Weeds and grasses controlled within 2 metres of planting locations.                                                                                                      |
| Watering weekly                   | First month  | No plants wilting or with dried foliage.                                                                                                                                 |
| Monitoring weeds and plant health | 3 months     | Weeds not smothering plants, plants healthy with active growth, replanting required if plant survival not achieving minimum 70% survival using performance quadrant plot |
| Weed control                      | 3 months     | Weeds and grass controlled within 2 metres of planting locations, all plants mulched and fertilised.                                                                     |
| Monitoring weeds and plant health | 6 months     | Weeds not smothering plants, plants healthy with active growth, replanting required if plant survival not achieving minimum 70%                                          |

| Monitoring                        | Timing    | Maintenance                                                                                                                                                              |
|-----------------------------------|-----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                   |           | survival using performance quadrant plot                                                                                                                                 |
| Weed control                      | 6 months  | Weeds and grass controlled within 2 metres of planting locations,                                                                                                        |
| Monitoring weeds and plant health | 9 months  | Weeds not smothering plants, plants healthy with active growth, replanting required if plant survival not at required percentage.                                        |
| Weed control                      | 9 months  | Weeds and grass controlled within 2 metres of planting locations, all plants mulched                                                                                     |
| Monitoring weeds and plant health | 12 months | Weeds not smothering plants, plants healthy with active growth, replanting required if plant survival not achieving minimum 70% survival using performance quadrant plot |
| Weed control                      | 12 months | Weeds and grass controlled within 2 metres of planting locations, all plants mulched                                                                                     |

### 6.3.3 Predator control

Predatory animals (i.e. wild dogs) have the potential to exploit the channelling function of the fauna exclusion fence by hunting near the entrance to the underpass or overpass (Harris *et al.* 2010). Monitoring of predatory animal activity will be conducted as part of the crossing structure monitoring program (refer to Chapter 7). Where monitoring indicates that predators are a threat to Koala movement through the crossing structures, Roads and Maritime Services will engage with the North Coast Local Land Services, NSW National Parks and Wildlife Service (Grafton), and Rural Lands Protection Board (North East) and adjacent landowners to identify and implement strategies to reduce this predation risk.

### 6.3.4 Monitor effectiveness of crossing structure

Monitoring of the targeted Koala connectivity structures (and associated exclusion fencing) will be undertaken to assess their effectiveness to facilitate movement of Koalas across the highway upgrade. Chapter 7 outlines the process that would be used to undertake this monitoring.

## 6.4 Performance thresholds and corrective actions

Table 6-1 summarises the operational environmental planning measures for Koalas and corrective actions if the measure deviates from the performance criteria.

**Table 6-2 Performance indicators and corrective actions – operation**

| Main goal                                                                                                                                       | Mitigation / control measure                                                                                                                                                                                                                                                                                                                                                 | Monitoring/timing frequency                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Performance thresholds                                                                                                                  | Corrective actions if deviation from performance criteria                                                                                                                                                                                                                                                                                                                            |
|-------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| No Koala deaths or injuries from collisions with vehicles travelling along the new road or associated intersections with minor or feeder roads. | <p>Construction of temporary and permanent fencing in selected locations to encourage the use of designated crossing points and to direct Koalas away from the road corridor.</p> <p>Periodic monitoring and maintenance of exclusion fencing for the life-time of the project.</p> <p>Slashing weeds near fences and repair breaches in fence or replace broken fences.</p> | <p>Reporting of any incidents as, and if, they occur.</p> <p>Conduct Koala mortality surveys as per Chapter 7<br/>The program will include inspections of the fence and structures as part of the standard maintenance requirements at the site for the life-time of the project.</p> <p>Monitoring will also be conducted in response to observations and reports of Koala road kills within 100 metres of exclusion fencing and Koala crossing structures. Monitoring will be conducted for five years initially and the need for further monitoring will be reviewed at the end of this period.</p> | Any injury to an individual Koala from car strikes during operational years 1-5.                                                        | <p>Locate and repair faulty exclusion fence within 3 days of Koala death being reported.</p> <p>Review Koala mitigation measures if any Koala has been killed or injured as a result of car strike.</p> <p>Retrofit exclusion fencing, or part there-of, with additional measures to deter koalas</p> <p>Consider erection of exclusion fencing in areas where none is provided.</p> |
| Maintain habitat revegetation areas.                                                                                                            | Regular monitoring and reporting on revegetation works and keeping Log Book of Maintenance                                                                                                                                                                                                                                                                                   | <p>Monitor and report on revegetation works at month three, month nine and month twelve following initial establishment of revegetation area. A Log Book of Maintenance shall be prepared. The log book shall report on:</p> <ul style="list-style-type: none"> <li>• Date of maintenance actions</li> <li>• Results from performance quadrants</li> <li>• Summary of visual inspection</li> <li>• Further soil test information</li> <li>• Any instructions by RMS and response actions from contractor</li> </ul>                                                                                    | <p>Less than 30% mortality of trees at revegetation sites determined from performance quadrants</p> <p>Weed infestations controlled</p> | <p>Review planting regime and methods, and re-plant areas where significant tree mortalities have occurred.</p> <p>Increase maintenance reporting period until revegetation success rate is achieved.</p> <p>Remove and replace dead trees</p>                                                                                                                                       |
| No Koala deaths or injuries from wild dog attacks in vicinity of crossing structures in years 1-5.                                              | Conduct ongoing monitoring at crossing zones as per methods in Chapter 7.                                                                                                                                                                                                                                                                                                    | Monitor predator presence and predator related Koala kills as part of ongoing crossing structure monitoring program.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Any injury to an individual Koala near crossing zones that are attributed to predator attack (as per methods in Chapter 7).             | Engage with stakeholders involved with predator control to identify and implement actions to minimise attacks.                                                                                                                                                                                                                                                                       |

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|                                                        |                                                               |                                                                                                                                                                                                                               |                                                                                                                |                                                                                                                                                                                                                                                                                                                                               |
|--------------------------------------------------------|---------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>Koalas not using designated crossing structures</p> | <p>Monitoring of crossing structures: refer to Chapter 7.</p> | <p>As outlined in Chapter 7<br/>Undertake monitoring until such time as the use and effectiveness of mitigation measures can be demonstrated to have been achieved over a minimum of three successive monitoring periods.</p> | <p>Evidence of successful crossings by Koalas at some of the designated crossing structures within 3 years</p> | <p>Review and update the monitoring methods, including whether Koalas are present in adjacent habitat.</p> <p>Check exclusion fencing for damage and rectify</p> <p>Improve habitat condition and connectivity adjacent to crossing structures</p> <p>Consider whether Koala translocation is warranted within isolated areas of habitat.</p> |
|--------------------------------------------------------|---------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|



## 7. Monitoring program

Monitoring will be undertaken to determine the effectiveness of mitigation measures implemented in Section 1 and Section 2 of the Pacific Highway Upgrade. The monitoring program will be refined if new records of Koala populations are located in the vicinity of the project.

### 7.1 Objectives

Monitoring will provide reliable information such that sound conclusions can be drawn in relation to management of the species.

The monitoring objectives for Section 1 and Section 2 of the Pacific Highway Upgrade project include:

- Evaluate the success of mitigation measures against the performance indicators and corrective actions presented in Table 7-2.
- Assess the effectiveness of the fauna crossing structures and fauna exclusion fencing to facilitate movement of Koalas across the upgraded highway. Note that Sections 1 and 2 will not employ Koala “floppy top” exclusion fencing, unless Koala deaths or injuries are observed. However, modified “rabbit-proof” fencing will be installed along the length of Sections 1 and 2 to exclude Koalas and a range of other species.

The monitoring program may be subject to refinement as a result of the performance of the aforementioned monitoring objectives and assessment against the performance indicators and corrective actions presented in Table 7-2. In order to fulfil these objectives, a number of ecological variables will be monitored, with each variable discussed below.

### 7.2 Koala population monitoring

There is a growing appreciation that the ecological impacts of major linear infrastructure need to be assessed at the landscape scale (Taylor and Goldingay 2010, Van der Ree *et al.* 2011). Many studies (mostly international) have reported the use and effectiveness of wildlife crossing structures (road underpasses and overpasses) and the prevalence of wildlife road mortalities, concluding that most dedicated crossing structures increase the permeability of roads by allowing individual animals to cross more safely (Van der Ree *et al.* 2007, Taylor and Goldingay 2010). However, most studies have been unable to conclude whether “use” of a structure by an individual animal necessarily equated to conservation gain. The important unanswered question is: “Are populations declining in size due to road effects, even though we observe them using the crossing structures?”

The areas with the greatest number of Koala records in relation to the project occur around Wardell, Coolgardie and Bagotville (Section 10) and south of the Richmond River from Rileys Hill to Broadwater National Park (Section 9), both of which are considered to be ‘important populations’ (see 2.3) which could be adversely affected by the Pacific Highway upgrade. In contrast, the low density populations of the Koala occurring in or near Section 1 and Section 2 of the Upgrade are too sparse to warrant the intensive sampling that would be required to document the broader landscape effects of the Pacific Highway. Instead, population monitoring efforts will be focused in later Stages and in other Sections where the Koala is more abundant.

### 7.3 Koala activity and fauna crossing structures

Monitoring of the targeted Koala connectivity structures (underpasses and associated exclusion fencing) will be undertaken to assess their effectiveness in facilitating the movement of Koalas across the highway upgrade.

### 7.3.1 Selection of monitoring locations

Monitoring locations have been pre-selected and include targeted connectivity structures that have been designed for use by the Koala (i.e. dedicated culverts). Motion sensor cameras will be installed at each end of the Koala dedicated underpass structures listed in Table 7-1 to determine whether Koalas are prepared to undertake complete crossings of these structures.

Table 7-1 Fauna connectivity structures targeted for the Koala as detailed in the Connectivity Strategy

| Project section | Chainage (m) | Connectivity structure (Cell No x wxhxl*) | Functionality     | Comments                     |
|-----------------|--------------|-------------------------------------------|-------------------|------------------------------|
| 1               | 6890         | 1 x 3 x 2.7 x 45 m                        | Dedicated culvert |                              |
| 1               | 8470         | 1 x 3 x 3 x 51 m                          | Dedicated culvert |                              |
| 1               | 8800         | 1 x 3 x 3 x 50 m                          | Dedicated culvert |                              |
| 1               | 11710        | 1 x 3 x 3 x 57 m                          | Dedicated culvert |                              |
| 1               | 12420        | 1 x 3 x 3 x 52 m                          | Dedicated culvert |                              |
| 2               | 17710        | 1 x 3 x 2.4 x 57 m                        | Dedicated culvert |                              |
| 2               | 19880        | 1 x 3 x 3 x 54 m                          | Dedicated culvert |                              |
| 2               | 23130        | 1 x 3 x 3 x 22 m                          | Dedicated culvert |                              |
| 2               | 23131        | 1 x 3 x 3 x 22 m                          | Dedicated culvert |                              |
| 2               | 23750        | 1 x 3 x 2.7 x 43 m                        | Dedicated culvert |                              |
| 2               | 25850        | 1 x 3 x 3 x 45 m                          | Dedicated culvert |                              |
| 2               | 29300        | 1 x 2.4 x 2.4 x 25 m                      | Dedicated culvert | Glenugie dedicated underpass |

Koala faecal pellet searches and searches for Koala scratches on trees will be conducted in adjacent habitat (within 100 m) to the above connectivity structures and during the period that the underpass structures are being monitored. The purpose of these searches is to determine whether there is any evidence of Koala presence near the connectivity structures at the time they are being monitored.

### 7.3.2 Methods, timing, intensity and duration

Monitoring of underpasses will be undertaken using the following techniques:

- Two motion-detecting cameras with infrared flash will be installed either side of the underpasses, facing inwards, and positioned to capture Koala movements on the ground and on fauna furniture. Cameras will operate continuously for at least three months during the monitoring periods (spring/summer). These monitoring periods are scheduled to occur each year for the first three years following completion of the project, after which the need for further monitoring will be reviewed (Table 8-1). The performance of each dedicated Koala crossing structure will be determined by evidence of one or more completed crossings during these monitoring periods (Table 7-2). A standardised camera set up will be used to allow comparison with subsequent monitoring events. Cameras will not be installed in combined underpasses (only dedicated), as these are at risk of flooding.
- Faecal pellet and tree-scratch searches within 100 m of each end of dedicated crossing structures, and faecal pellet searches within each dedicated crossing structure, will be undertaken when installing and checking camera batteries (once per month during the monitoring periods). Scat samples will be sent to an appropriately qualified/experienced specialist for identification if necessary. Predator scats will be analysed for Koala hair.
- Exclusion fence monitoring: Survey of the Koala exclusion fence for 250 metres either side of the structure to identify and report any breaches and report maintenance requirements.

The timing of surveys will be selected to coincide with the breeding season and likely juvenile dispersal period of the Koala (September to February and July to August). Koala movements are expected to be more frequent and extensive during the breeding season and dispersal periods due to expansion of home ranges and movement of juveniles away from natal areas. Therefore, these periods are likely to represent peaks in fauna movement, resulting in higher rates of usage of connectivity structures and thus higher detection rates.

Fauna crossing structure monitoring will commence six months after installation of connectivity structures (i.e. Veage and Jones 2007). Monitoring will be undertaken annually (in Spring/Summer). Control sites will be re-surveyed at each monitoring event until structures are proven to be effective in line with the adaptive management approach.

Additional monitoring may be required in the event that monitoring data suggests an underpass is ineffective in facilitating Koala movement and modification/treatments are required to improve the structural integrity and functionality of the structure.

### 7.3.3 Performance indicators and criteria

The objectives of the fauna crossing structures are to provide a safe passage for the movement of wildlife, including Koalas, across the highway and to minimise wildlife mortality due to vehicle strike, specifically to maintain local and regional wildlife corridors, home-ranges and genetic exchange between populations.

Performance of the underpass structures and associated fauna fencing will be measured by achievement of the following possible outcomes:

- Evidence of completed crossings by Koalas at targeted fauna crossing structures.
- No Koala deaths or injuries due to vehicle strikes in the vicinity of fauna crossing structures.
- No breaches in fauna exclusion fencing or encroachment of shrub or canopy vegetation within three metres of fauna exclusion fencing.

To measure and provide for success in achieving the aforementioned objectives, performance indicators and corrective actions have been set and are provided in Table 7-2.

## 7.4 Road mortality monitoring

### 7.4.1 Selection of monitoring locations

Monitoring of Koala mortalities will be undertaken along the project, including in Sections 1 and 2, with particular focus at targeted fauna connectivity structures.

Koala deaths or injuries will be reported as, and if, they occur along the length of the highway upgrade. The GPS location of each road kill specimen will be recorded and assessed in relation to the closest fauna crossing structure and/or fauna exclusion fence to evaluate their effectiveness.

### 7.4.2 Methods, timing, intensity and duration

Road mortality monitoring will occur twice per year for a period of five years (between July-August and October-November) in the operational stage of the program. The method will involve walking transects along the road edge (500 metres in length) along both sides of each dedicated fauna crossing structure and upgraded highway. At other times of the year, any Koala deaths or injuries along the length of the highway upgrade will be reported as, and if, they occur.

A Project Road Mortality Register will be established which would allow for construction personnel to report any Koala road mortalities identified during project works.

### 7.4.3 Performance indicators and criteria

Performance of the fauna connectivity structures in preventing Koala road mortalities will be measured by achievement of a zero or reduced rate from existing rate of Koala vehicle strikes.

To measure and provide for success in achieving the aforementioned objectives, performance indicators and corrective actions have been set and are provided in Table 7-2.

## 7.5 Evaluation, project review and reporting

Detailed monitoring reports will be prepared outlining the methods and results of the monitoring program.

### 7.5.1 Responsibility

The contractor(s) employed to undertake the various aspects of monitoring for the project will be responsible for the evaluation of the monitoring information collected. Monitoring of Koala use of fauna crossing structures and evidence of Koala presence nearby at the time of monitoring, together with habitat revegetation measures, will be undertaken separately for the project, and the success of these mitigation measures will be considered in the evaluation of impacts on the Koala. The responsibility for identifying appropriate triggers to undertake corrective actions, if needed, will be shared between RMS and its ecologists, with RMS having the prime responsibility for enforcing any necessary changes as required by this Plan (Table 8-1),

### 7.5.2 Timing

A brief annual report will be prepared by the contractor(s) for each project for distribution to the Roads and Maritime, DP&E, EPA and DoE and document the methods and results from each monitoring period.

A final report would be prepared at the conclusion of the monitoring period. This report will incorporate all the results of the monitoring and recommend any additional measures (if deemed necessary) to facilitate the long term survival of the Koala population in the locality.

## 7.6 Corrective actions

The Koala monitoring program to be undertaken in Section 1 and Section 2 will focus on the use of mitigation structures, the success of any habitat restoration and its use by Koalas, and the incidence of Koala injuries and roadkill during the project. Further monitoring/assessment will be undertaken if a decline of Koala population numbers is identified as being attributable to the construction and operation of the project. The monitoring / assessment to determine the cause of the decline and/or remedial actions will be commenced as necessary, taking into account potential causes such as dry seasons, population fluctuations and other natural variation, hence the need to establish unmitigated control sites. Any contingency measures to be implemented will be agreed to by the relevant regulatory authorities EPA and DoE) prior to being commenced. The corrective actions and responsibilities are listed in Table 7-2.

Observations of Koala presence using faecal pellet-search and tree-scratch searches within 100 m in adjacent habitat during the time of monitoring fauna crossing structures will be used in assessments of the effectiveness of these structures. If during the operational phase Koalas are found to be unable or unwilling to use designated crossing structures, and Koalas are known to be present in the vicinity of these structures, provisional options will be developed that could be implemented if research and/or monitoring identify that additional or alternative measures are required.

Depending on the outcome of the monitoring of crossing structures, the following options will be considered in consultation with EPA:

- Maintenance of the existing connectivity measures.
- Modify design of existing measures where feasible and reasonable.
- Consider additional offset measures to improve connectivity elsewhere.

**Table 7-2 Performance indicators and corrective actions**

| Performance monitoring              | Performance indicator                                                                                                                               | Corrective actions                                                                                                                                                                                                                                                                                                                                                                                                                               | Responsibility                                                                                                                                                                                                         |
|-------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Road mortality monitoring.          | Any injury to an individual Koala as a result of vehicle strike.                                                                                    | Examine fencing for breach or obstruction within 3 days of report and repair.<br>Retrofit exclusion fencing, or part there-of, with additional measures to deter koalas                                                                                                                                                                                                                                                                          | Roads and Maritime maintenance responsible for repairing exclusion fencing                                                                                                                                             |
| Fauna crossing structure monitoring | Evidence of completed crossings by Koalas at targeted fauna crossing structures<br><br>Evidence of high visitation/usage rates by exotic predators. | Review monitoring methods, consider increasing frequency, intensity and duration, to ensure individuals are identified.<br><br>Check fauna furniture associated with underpass for damage and rectify. Investigate habitat adjoining the underpass. Consider improving habitat condition and connectivity.<br><br>Check general area, including the underpass itself, for the presence of predators. Seek advice and implement predator control. | Roads and Maritime responsible for engaging suitably qualified ecologists to undertake the monitoring and suitably qualified contractors for the maintenance and engaging with regional stakeholders for pest control. |
| Fauna exclusion fencing monitoring  | No breaches in fauna exclusion fencing.                                                                                                             | Check fauna exclusion fencing and fauna crossing structures for damage/blockage and rectify.                                                                                                                                                                                                                                                                                                                                                     | Roads and Maritime maintenance responsible for repairing exclusion fencing                                                                                                                                             |
| Habitat revegetation monitoring     | Less than 30% mortality of planted Koala feed trees.                                                                                                | Undertake revegetation maintenance, i.e. replanting, replacing, fertiliser treatment, erosion control, weed control.                                                                                                                                                                                                                                                                                                                             | Roads and Maritime responsible for engaging suitably qualified ecologists to undertake the monitoring and suitably qualified contractors for the maintenance of revegetation.                                          |

# 8. Summary table and implementation schedule

Table 8-1 provides an overall summary of the actions proposed in the above plan. It also identifies the persons responsible for the actions and the estimated timing of the project.

*The program schedule will be updated following a review of the approval and project timelines.*

**Table 8-1 Summary table and implementation schedule of management plan**

| No.                                   | Task                                                | Responsibility                             | Pre-construction | Construction | Operations |        |        |        |        |
|---------------------------------------|-----------------------------------------------------|--------------------------------------------|------------------|--------------|------------|--------|--------|--------|--------|
|                                       |                                                     |                                            |                  |              | Year 1     | Year 2 | Year 3 | Year 4 | Year 5 |
| <b>1. Pre-construction management</b> |                                                     |                                            |                  |              |            |        |        |        |        |
| 1.1                                   | Baseline Koala surveys                              | Contractor's ecologist                     | X                |              |            |        |        |        |        |
| 1.2                                   | Preparation of Koala fencing strategy               | Contractor's ecologist                     | X                |              |            |        |        |        |        |
| 1.3                                   | Pre-clearing surveys                                | Contractor's ecologist                     | X                |              |            |        |        |        |        |
| 1.4                                   | Identify sensitive ancillary areas and access roads | Contractor and Roads and Maritime          | X                |              |            |        |        |        |        |
| 1.5                                   | Dog policy                                          | Contractor and Roads and Maritime          | X                |              |            |        |        |        |        |
| <b>2. Construction management</b>     |                                                     |                                            |                  |              |            |        |        |        |        |
| 2.1                                   | Construction method statements                      | Contractor                                 |                  | X            |            |        |        |        |        |
| 2.2                                   | Construction induction and training                 | Contractor                                 |                  | X            |            |        |        |        |        |
| 2.3                                   | Permanent fauna exclusion fencing                   | Contractor                                 |                  | X            |            |        |        |        |        |
| 2.4                                   | Pre-clearing and clearing procedures                | Contractor                                 |                  | X            |            |        |        |        |        |
| 2.7                                   | Managing Koala / vehicle collisions                 | Contractor's ecologist                     |                  | X            |            |        |        |        |        |
| 2.8                                   | Koala relocation protocol                           | Contractor's ecologist                     |                  | X            |            |        |        |        |        |
| 2.9                                   | Location of ancillary facilities                    | Contractor's ecologist, Roads and Maritime |                  | X            |            |        |        |        |        |
| 2.10                                  | Fauna crossing structures                           | Roads and Maritime                         |                  | X            |            |        |        |        |        |
| 2.11                                  | Fauna crossing structures                           | Roads and Maritime                         |                  | X            |            |        |        |        |        |
| 2.13                                  | Habitat revegetation                                | Roads and Maritime                         |                  | X            |            |        |        |        |        |
| <b>3. Operational management</b>      |                                                     |                                            |                  |              |            |        |        |        |        |

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| No.                          | Task                                                                                    | Responsibility                | Pre-construction | Construction | Operations |        |        |                                 |                                 |
|------------------------------|-----------------------------------------------------------------------------------------|-------------------------------|------------------|--------------|------------|--------|--------|---------------------------------|---------------------------------|
|                              |                                                                                         |                               |                  |              | Year 1     | Year 2 | Year 3 | Year 4                          | Year 5                          |
| 3.1                          | Maintenance of fauna exclusion fencing and fauna crossing structures (ongoing)          | Roads and Maritime            |                  |              | X          | X      | X      | X                               | X                               |
| 3.2                          | Maintenance of revegetation ongoing until revegetation criteria achieved                | Roads and Maritime            |                  |              | X          | X      | X      | X                               | X                               |
| 3.3                          | Predator control* dependant on monitoring findings/evidence of predator action on koala | Roads and Maritime            |                  |              | X          | X      | X      | TBC following year three review | TBC following year three review |
| <b>4. Monitoring program</b> |                                                                                         |                               |                  |              |            |        |        |                                 |                                 |
| 4.1                          | Selection of monitoring locations                                                       | Ecologist                     | X                |              |            |        |        |                                 |                                 |
| 4.2                          | Fauna crossing structure and exclusion fencing monitoring                               | Ecologist, Roads and Maritime |                  |              | X          | X      | X      | TBC following year three review | TBC following year three review |
| 4.3                          | Road mortality monitoring                                                               | Ecologist, Roads and Maritime |                  |              | X          | X      | X      | X                               | X                               |
| 4.4                          | Evaluation, project review and reporting                                                | Ecologist, Roads and Maritime | X                | X            | X          | X      | X      | TBC following year three review | TBC following year three review |



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# **Appendix A – Expert review: Associate Professor Robert Close CV**

### **Qualifications**

Ph.D., Macquarie University, 1977

B.Sc. (Hons), University of Adelaide, 1972

### **Employment History**

1996 – present University of Western Sydney – Associate Professor, School of Biomedical and Health Sciences

1994 – 1996 University of Western Sydney – Senior Lecturer, School of Business and Technology

### **Professional Experience**

My principal field of interest is marsupial biology which includes cytogenetics, formation of new species, hybridisation of existing species, fertility of hybrids, and ecology. My original Ph D research was on the cytogenetics of bandicoots which led to post-doctoral studies of the taxonomy and distribution of this group of marsupials. My main area of research then became rock wallabies (*Petrogale*) and I have been studying this group since 1976. Since that time, my colleagues and I dramatically changed the taxonomy of the group including the naming of four new species and the discovery of three of them. We also plotted, for the first time, the distributions of many of the species. The research showed that there was some hybridisation occurring at the borders between some of the distributions.

I have conducted a study of koalas in the Campbelltown region since 1990 that has included supervision of graduated PhD student, Steven Ward on his ecological study of koalas in Sydney's South and graduated MSc student Grace Hey for her study of identifying individual koalas from their faecal DNA. We now have 120 animals in the region with individually coloured ear-tags including 8 radio-tracked females. The Campbelltown study has largely been ecological and genetic but has become a community-associated research program, with feedback from the community leading to increased sightings of koalas. I am on 24h call via a pager, the number for which is posted on koala road signs which Campbelltown Council has erected in the LGA. Since October 1995, we have published a weekly column in the Macarthur Advertiser principally describing our koala research, which is important in maintaining the community interaction on which the project depends. The project has developed a momentum that is time consuming and on-going but rewarding in terms of interaction with the University and the community, as well as providing long-term family data for koalas that include four generations of koalas.

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## Appendix B - Expert review: Comments and recommendations, and responses by Roads and Maritime Services

The following table summarises the recommendations of the independent expert reviewer and identifies how each of the recommendations have been addressed. Recommendations have been addressed in one of three ways:

- Adopted - plan updated.
- Adopted - plan to be updated prior to implementation.
- To be reviewed - recommendation to be reviewed further by Roads and Maritime prior to implementation.

**Table. Summary of recommendations from the expert review and how addressed in this plan**

| ID No. | Comment / Recommendation                                                                                                                                                                                                                 | How recommendations have been addressed                             |
|--------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------|
| KMP1   | Reconsider which sections of the Upgrade require focus.<br>Would like to see a map on which all the various koala sightings are marked as well as the inclusion of vegetation maps so that potential dispersal routes can be visualised. | Adopted- plan updated. See figures 2.1a, 2.2a,                      |
| KMP2   | Reconsider suitability of methods for gathering base-line data.<br>It will be very difficult to monitor changes, particularly in low density areas for Koalas using the SAT technique                                                    | Adopted- plan to be updated, See section 7. monitoring program      |
| KMP3   | Reconsider methods for monitoring road kill data (more frequent)                                                                                                                                                                         | Adopted- plan updated. See section 7.4 Road Kill Monitoring         |
| KMP4   | Reconsider methods of catching and treating koalas located in the clearing areas<br>Ear tagging of captured / relocated individuals is extremely worthwhile                                                                              | Adopted – plan updated. See section 5.3.6 Koala Relocation Protocol |
| KMP5   | Captured koalas should go to the vet rather than the vet goes to the koala.                                                                                                                                                              | Adopted- plan updated. See section 5.3.6 Koala Relocation Protocol  |
| KMP6   | Examine side-road fencing                                                                                                                                                                                                                | Adopted – plan updated. See section 7.6                             |
| KMP7   | Consider the approaches to the crossing structure                                                                                                                                                                                        | Adopted- plan updated. See section 5.3.9 habitat revegetation.      |

AM Consulting Ref: 1300892

23 September 2013



## *Expert Review of Koala Management Plan*

**Author: Associate Professor Robert Close**

### **A) Relevant experience**

After 15 year's study of mainly bandicoots and rock-wallabies, I began a study of the Campbelltown koala population because it was close to home and I could see it would be an excellent vehicle for under-graduate teaching. Twenty four years later the field study is approaching its end. However, much remains to publish. The study, because it was a low density one (1/10 ha), required community assistance to locate animals for capture, ear-tagging and monitoring. We have received over 2000 community sightings (including many ear-tagged animals), ear-tagged 140, and radio-tracked 30, most of which survived >10 years.

Because of this experience, I was asked in 1999 to join the AMBS team (now Australian Museum Consulting) to conduct research on the effects of the construction of the Pacific Highway upgrades at Yelgun-Chinderah and at Bonville on the respective local koala populations. I stayed with the projects until 2011 (only 2 years with Y2C, the remainder of the time Bonville) when I was one of the authors of the final report (AMBS 2011).

Relevant publications:

- R. L. Close. 1993. Campbelltown's koalas: what is their future? *National Parks Journal* 37: 22-5.
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## **B) Recommendations:**

- 1) Reconsider which sections of the Upgrade require focus.
- 2) Reconsider suitability of methods for gathering base-line data.
- 3) Reconsider methods for monitoring roadkill data.
- 4) Reconsider methods of catching and treating koalas located in the clearing areas.
- 5) Captured koalas should go to the vet rather than the vet goes to the koalas.
- 5) Examine side-road fencing.
- 6) Consider the approaches to the crossing structure.

Rationale for recommendations:

1 & 2) Currently Road Sections 9 and 10 are considered the most suitable areas for focusing crossing structures. This is based on the number of sightings and the number of active sites found during the base-line studies. However, the population densities may be high in Section 9 because dispersal from the area is restricted by the rivers, the sea and the Pacific Highway. I would have liked to see the priorities set by vegetation and potential for dispersing koalas to move without restriction throughout the region. As the MP suggests, koalas are likely to occur all along the 155 km Upgrade in varying densities. Assessing densities of koalas is a very difficult task particularly at lower densities. The method advocated in the MP is the SAT which is a useful technique for detecting presence/ absence and common/uncommon categories; but is not so good for detecting changes unless they are gross. So Section 10 would be a high priority because the highway is the only restriction to movement from the coast to the higher western areas. In sections 7 and 8, likewise, dispersants from the west are only restricted by the highway from moving to and from the coastal forests and the ranges. Sections 3 & 4 are restricted by clearing and the river, while Sections 1 & 2 would receive dispersants from a large area if they could cross the highway. I

would like to see a map on which all the various koala sightings are marked and a vegetation map so that the potential dispersal routes can be visualised.

3) The method of monitoring the effectiveness of the structures from hopefully the absence of roadkills would be more effective if the inspections were more frequent. Ideally the 155 km of highway should be inspected regularly for all species. This could be started now and is the sort of project that a student might take on.

4) At present only the koala trap has been suggested as a means of capturing koalas that are in the clearing zone. However, the trap is only suitable where there are no interlocking branches and the terrain is flat. The method requires regular checks through the night and sometimes the koala will stay aloft for more than one night. It is useful, therefore, to have an extendable pole and flag on hand in case the koala is low in the tree. Catching requires some experience.

5) If an animal is captured it should be placed in a large bag (we use a jute bag from Fodder stores). A check-list should be prepared (clean eyes, clean fur around the cloaca, condition noted {muscle bulge, coat ashy grey rather than brown}, pouch checked, head measured, weight recorded). If in doubt about health, take the animal to the nearest consenting vet. Insert unique combination of ear-tags in koala's ears.

6) Side-roads joining the main highway are a major hazard which can funnel koalas onto the highway. It appears that koalas may choose to follow tracks (Lassau et al 2008 and unpublished observations), perhaps because it's easier to walk and gives better visibility. Short of having a gate across, little can be done except to fence the side-road in conjunction with permanent fencing on the adjacent highway. Alternatively, it might help to remove vegetation from around the road entrance so that the koalas are not attracted.

7) It may help direct the koalas to the structure by having a path leading to it. This path could be maintained by the passage of the camera monitors

**C) General notes:** The Woolgoolga – Ballina Upgrade (WBU) crosses 155 km of largely coastal country and in doing so separates on its eastern side a large area of forest that includes both Primary and Secondary habitat (WBU koala management plan (WBUKMP or MP). There are two eastern segments: from Woolgoolga to the Clarence River estuary and then from that estuary to the Richmond River estuary at Ballina. Koala Atlas records and recent scat searches show that koalas occur on both sides of the proposed upgrade at regular intervals with the exception of the eastern section from Pillar Valley to Tyndale. That section is largely comprised of Yuraygir National Park. Dispersal in and out of this Park is limited by clearing and the Clarence River which form a western barrier. Why that park has not recorded a sighting is perplexing. However at very low densities, say 1/50 ha, koalas are difficult to detect. Although the number of sightings recorded near the path of the Upgrade is low and might be dispersing males rather than breeding females, it is likely that there will be patches of breeding animals along the route just as there are for the Yelgun-Chinderah Upgrade (AMBS 2011). To avoid genetic stagnation of koalas in the two eastern sections, and to ensure the safety of dispersing animals crossing the road in both directions then functional structures to allow passage must be built. Given the threat of rapid climate change steps should be taken to maximise dispersal amongst as many forest types as possible.

**D) Review background information** to the project including the EIA and associated Biodiversity Working Paper. These reports were extensive and thorough

**E) Agencies' comments:** I only commented where there were unresolved differences between the agencies and RMS or where I could contribute to the topic. Section numbers at the start of each query refers to Version RO1 of the MP. The following section should be read in conjunction with the full set of "Agency Comments".

1) Queries re size of underpasses. Clearly the bigger and more, the better for all terrestrial and arboreal animals. RMS response adequate.

2) Query regarding revegetation. RMS responded that properties were still being purchased and decisions were still being made.

3) Comment on priority. I agree that the Bandjalung-Woombah-Ashby link is an important one because there is no river boundary to prevent dispersal from coastal forest to ranges.

4) Request for various maps. RMS gave a vague response to agency. I felt that the koala distribution maps could have incorporated more of the available data. I would have liked to see a vegetation map.

5) Sect 1.1.3. Agency requests expansion of aims. I think they are appropriate.

6) Sect 2.3. Agency want lists of preferred trees for each population. I think that this request is unreasonable. The current list is highly likely to include the main browse trees for each area. A map of vegetation types would have been useful.

7) Sect 2.4.2. Agency wants more info on koala distribution from local sources. RMS responded with a long list of local groups that supplied data. Why then was the map so limited?

8) Sect 2.5. Agency wanted discussion of impacts of side-roads and genetic barriers. Lassau et al (2008) showed more roadkills near entry of side-roads at Bonville. It seems that roaming koalas will use such tracks presumably because it's easier to walk on. Lee et al (2010) showed that highways can be a barrier. However in Lee's situation, the road was some distance from breeding females, few animals are seen in the area and the adjacent vegetation included few known food trees. Even if young male dispersants successfully crossed the road they may never manage to breed. Whereas at Bonville, residents occasionally cross the highway and there is a good supply of young dispersants, some of which would cross safely.

The agency also requested comments on secondary effects of disturbances such as the effects of clearing on road kill. RMS made no response. Some of these effects are potentially serious for the resident koalas (e.g. fertility, disease, fighting). However data from Bonville indicate that koalas are relatively resilient and home-ranges are established soon after the disturbance is reduced.

9) Sect 3.3.2. Agency requested details on choosing fences. RMS responded with plan details of "The koala fencing strategy" (sect 4.3.1).

10) Sect 3.4.3 Agency suggested that escape methods be constructed every 250 m. RMS didn't respond but I suspect that that spacing would be adequate for drop-downs.

11) Sect 3.4.4. Agency asks whether ecologist must be present all day. RMS didn't respond but an ecologist should be present if a koala is in a vulnerable position and looks "uncomfortable". Such animals are likely to descend and move, possibly to a more dangerous position. The ecologist should have proven success in handling koalas (and humans). A project running near to and simultaneously with the AMBS Bonville project generated criticism when local conservationists believed that the welfare of the koalas was being treated as secondary to their scientific value.

12) Sect 3.4.8 The EPA is rightfully very concerned about the distribution, number and size of connectivity structures. RMS referred to the EIS strategy. However, the more crossings the more likely it is that animals will cross successfully. I suspect that the high chance of coming to grief on the road itself overrides the disadvantages of having hydrological structures. That said, purpose-designed structures should be constructed where possible particularly in the critical northern sections of the Upgrade. Furthermore, approach areas to hydrological culverts should be modified by suitable plantings to improve their connectivity quality. See also Recommendation 7.

13) Table 3.1 (5.1 in Plan), generated much discussion about siting of bridges and culverts. The EPA and RMS were largely in agreement over this important issue.

14) Sect 3.4.9. Agency wanted more details on revegetation which was felt to be a very vital issue. The RMS response was vague and I believe necessarily so. Revegetation can be used to re-establish the size and function of an original block of habitat or to develop a corridor to lead koalas to a safe crossing. These 2 uses require different strategies and every site will have its own different features. Such decisions require site by site analysis.

15) Sect 4.1 p.15 Population monitoring discussed. It will be very difficult to monitor changes, particularly in low density areas where there are few base-line data.

16) Sect 4.2.1 Monitoring contd. EPA believes design of monitoring systems requires expert statistical input. As mentioned in 15) above and in the General Introduction, rigorous statistical analysis is often difficult because of low numbers and the variation in the usage of different habitats by koalas. Statistical analysis of road kills was possible at Bonville where the number of dispersing animals was high, whereas at sites in the Yelgun to Chinderah, few data were available.

17) Sect 4.2.2 p.16 Monitoring contd. Agencies concerned about methods of surveying. RMS response vague. See Recommendations.

18) Sect 4.2.3 p.16 Objectives. EPA believes two surveys are insufficient to provide base-line data to measure declines in activity levels. See 15) & 16) above. EPA believes that "density is a robust measure". I believe that changes could be detected where the initial densities are high e.g. 1 per ha, but become increasingly less reliable as densities decrease e.g. < 1/10 ha. I also believe that it is possible that resident koalas whose home-ranges about the fencing could maintain activity levels while dispersing koalas were being killed on the road. Declines in road-kill rates and camera evidence are the most effective measures of success and the easiest to measure. See recommendations.

19) Sect 4.4.3 (Table 7.2) Comments by EPA on Success of Plan. Note: the monitored, resident population may decline as a result of the disturbance then return or be replaced. There also may be a build-up of dispersing animals outside the fence.

20) Sect 4.7 Commitments of Plan: Natural variation in population numbers. Hard to detect given the variation in density measurements. RMS commits to review and consider moving or adding structures, also commits to investigate adjacent habitat and consider improving the habitat quality. Both are big commitments.

21) Sect 3.4.8 (5.3.6 table 5.1) Seeks details of structures, monitoring to demonstrate their success. Table 5.1 is comprehensive.

22) Sect 4.4.1 (7.2) DoP wants criteria for Pilot study selection, timeframes, objectives. RMS responds (see sect 7.2) which indicates preselection but with potential for change.

**F) Prepare a written review statement** on the MP which will provide feedback on the following questions:

- a) Is the design of the monitoring project appropriate? See E points 15-19 above. The road-kill method (sect 7.4) could be more valuable if a daily check of each section were undertaken; perhaps commuting volunteers or students could be recruited. Such a system could begin immediately and would deliver much valuable data.
- b) Is the frequency and timing of monitoring adequate? See a) above. At present, I doubt whether many data would be collected. Corpses that remain on the road don't last long.
- c) Is the MP clear on selection criteria for monitoring sites? For koala activities and crossing structures the sites are pre-selected but apparently still flexible depending on base-line studies. This flexibility is wise. For monitoring road mortalities the MP is vague; for revegetation the MP relies on the project Landscape design (not yet seen).
- d) Are appropriate goals being set? Yes, but zero roadkills is unlikely because koalas can still enter the road space at the edges of the fencing.
- e) Are the mitigation and management actions sufficiently targeted? Yes fencing, crossing structures and revegetation are all suitable for koalas.
- f) Objectives, performance measures, corrective actions and thresholds and corrective actions in accordance with SMART principles? These are appropriate.
- g) Do the management measure objectives, performance indicators and thresholds and corrective actions link sufficiently to allow effective implementation?
- h) Has the MP provided sufficient evidence where the proposed mitigation has previously been effective? The MP referred to the two similar projects that I am familiar with (Bonville and Yelgun to Chinderah) but did not discuss in any detail any of the several RMS sites where fencing and crossing structures or translocation have been used.
- i) Does the MP describe and discuss contingencies should the proposed measures be ineffective? Yes, see E 20 above.
- j) If we can't demonstrate mitigation proposed will be effective, can we demonstrate that corrective actions will be effective? That would require a calculated guess for many cases.
- k) Where there is no known research /evidence of the effectiveness of the specific measure proposed – have relevant alternative contingencies been committed to?
- l) Have indirect impacts been addressed in the MP, as relevant? Yes



k) Are qualifications and experience of authors in subject field relevant? There appears to be no specific experience with major highways but they are otherwise well equipped for the project.

# Appendix C – Agency reviews: Comments and requirements, and responses by Roads and Maritime Services

Department of the Environment review of Koala Management Plan: Sections 1 and 2

February 2015

| Requirements of the Conditions | Comment:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Response by RMS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
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| General:                       | <p>Currently, this Plan is intended to cover Sections 1 and 2 of the proposal only. However, as a lot of the content covers the remainder of the action, there is contradicting information between what is proposed for the broader proposal, and what is proposed specifically for sections 1 and 2. This makes the plan difficult to comply with and implement. For example, Table 5.1 refers to temporary fence monitoring to be undertaken, when it is stated in the plan that no temporary fencing will be installed for sections 1 and 2. The same problem occurs for references to population monitoring, which based on this plan is not proposed for sections 1 and 2. Another example is where section 7.1 refers to the objective of determining the extent to which the highway creates a barrier for the koala, while the plan currently does not provide any mechanism to meet this objective in sections 1 and 2. Furthermore, it is unclear where reference is made to the project, whether this means the whole upgrade or the projects in section 1 and 2.</p> <p>The Department recommends that the format be addressed to amend this as we understand that approval of this plan would be sought prior to it being updated to address the remaining sections.</p> | <p>The format and content of the report has been addressed throughout to clarify that this plan is referring principally to highway upgrades along Section 1 and Section 2. In a number of areas, where it was considered useful to include a broader context, reference has been given to the entire project.</p> <p>Table 5-1 (re-labelled as 5-2) has been revised to deal with temporary fencing. Table 7-1 has been revised to deal with monitoring objectives of Section 1 and section 2.</p> |
| General                        | The Department notes and concurs with the EPAs comments on the Plan.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Noted refer to responses below.                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| General                        | Key sections of the document, and mitigation measures proposed within, are currently worded as recommendations. The Department recommends that this wording be strengthened to clear commitments by RMS.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Word such as “would” have been replaced by “will”, etc. throughout the document.                                                                                                                                                                                                                                                                                                                                                                                                                    |
| General                        | There seems to be confusion in the plan between performance thresholds and triggers for corrective actions. Performance thresholds are thresholds that are trying to be met and for which deviation from these thresholds would result in corrective actions being implemented (as is written                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | The column headings for “Performance thresholds” in Tables 4-1, 5-2 and 6-2                                                                                                                                                                                                                                                                                                                                                                                                                         |

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|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | <p>in the headings of tables within the document).</p> <p>On the other hand triggers for corrective actions are negative outcomes which would trigger corrective actions. Currently the majority of the actions/statements under the performance measures heading are actually triggers for corrective actions. Therefore, as currently written, deviation from these measures, which would trigger corrective actions, would in effect result in corrective actions being implemented when the desired outcome is being achieved. The actions under the heading or the terminology used in the heading needs to be amended to address this inconsistency.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <p>have been altered. The language used to describe performance thresholds has been changed to remove inconsistencies in terminology.</p> <p>Alterations to language have also been inserted in 7-2 under “performance indicator”.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <p>D9 (a) demonstration that adequate surveys have been undertaken to assess the impacts of the SSI with reference to the Mitigation Framework developed under condition D1, including baseline data collected from surveys, undertaken by a suitably qualified and experienced ecologist on threatened species and ecological communities within all habitat areas to be cleared of vegetation for the SSI, that are likely to contain these species and that are likely to be adversely impacted by the SSI (as determined by a suitably qualified expert). The data shall address the densities,</p> | <p>Currently, no reference is made to the Mitigation Framework in the Plan. While there is a brief reference to additional surveys undertaken, further information is required to demonstrate the adequacy of these surveys, as required by this condition (noting the expert comment that SAT surveys are not sufficient to determine population density). Furthermore, the baseline data from the surveys and the detail of the location and methodology of the surveys needs to be provided.</p> <p>Currently, the plan appears to still rely heavily of NSW Wildlife Atlas records, and not on evidence based on surveys undertaken. This may be as a result of the plan being updated in parts for section 1 and 2, but not in other parts (see general comment above). Further information, including the details of surveys undertaken should be included as a part of this plan.</p> <p>The data provided for sections 1 and 2 does not address all the requirements of the condition (distribution and movement patterns). The Department notes that the low density of koalas in this area may is likely to be the reason for this and requests that this be clarified.</p> | <p>New reference to the Biodiversity Mitigation Framework has been inserted in part 1.2.</p> <p>The population density of Koalas in Section 1 and Section 2 is considered to be too low using any survey method to achieve cost-effective and accurate assessments of Koala density. This is the reason why baseline surveys are not being undertaken in Section 1 and Section 2, because such low population densities will be difficult to monitor and any changes that may occur cannot be determined statistically from the data that would be collected.</p> <p>Additional information about Koala surveys undertaken, and the results of these surveys in Section 1 and Section 2, has been presented in part 2.2 of this Plan.</p> <p>The low density of</p> |

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| <p>distribution, habitat use and movement patterns of these species;</p> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <p>Koalas in Section 1 and Section 2 is the reason why detailed studies of Koala distribution and movement patterns have not been undertaken in these Sections.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <p>(b) identification of potential impacts on each species;</p>          | <p>The Department recommends that this plan needs to contain all the detailed impact assessment for the koala for sections 1 and 2, including the amount of habitat to be cleared (for example, this is required on page 25)</p> <p>The Department also notes that reference is made to the interim EPBC Act guidelines for the species and not the current guidelines, a draft of which was made available for public comment in late 2013. These are available at <a href="http://www.environment.gov.au/biodiversity/threatened/publications/epbc-act-referral-guidelines-vulnerable-koala">http://www.environment.gov.au/biodiversity/threatened/publications/epbc-act-referral-guidelines-vulnerable-koala</a> . Please confirm that these guidelines have been considered in determining the quantum of habitat critical to the survival of the species likely to be impacted by the action.</p> <p>Page 41, 6.1 impacts from operation phase – please add road kill as an impact. This is currently presented as a result of degradation of fauna fencing only, when it can easily occur in unfenced areas or areas where there are gaps in the fence, or where inappropriate fencing is used.</p> | <p>The total amount of Koala habitat that is to be cleared for the entire Project has been amended upwards to 782 ha. This is indicated in part 3.1 of this Plan.</p> <p>A Table showing the breakdown by Sections (including Section 1 and Section2) is presented in Table 3-1.</p> <p>The new (2014) guidelines were consulted, but were not considered to change the results of the now, more conservative, estimates of Koala habitat that will be removed (782 ha across the entire Project). The EPBC Biodiversity Offset Policy, in conjunction with the nominal tree species composition of NSW Biometric Vegetation Types, were used as the basis for calculating areas of habitat critical for the survival of the Koala (see part 3.1 of this Plan).</p> <p>Amendments have been made to Table 6-1 (re-labelled 6-2) to include Koala deaths and injuries as a possible impact.</p> |

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| <p>(c) details of and demonstrated effectiveness of the proposed avoidance and mitigation and management measures to be implemented for each threatened species including measures to at least maintain habitat values of habitat areas compared to baseline data and maintain connectivity for the relevant species;</p> | <p>Specific measures, as proposed for section 1 and 2, based on surveys undertaken in these areas are required. For example, please provide further information regarding the locations proposed for revegetation and the location of proposed fencing. Reference to a fencing strategy is made on page 31, however the strategy is currently not included. Please attach the strategy to the plan or provide a reference as to which plan the document is attached to, and a discussion of the key outcomes to be addressed in the strategy.</p> <p>Insufficient baseline data is currently presented to meet this requirement. A discussion is also required as to how habitat values will be at least maintained.</p> <p>In section 4.3.3, it is stated that the results of pre-clearance surveys would inform procedures for staged clearing. Please provide further information about how this would occur.</p> <p>Please identify the basis for selecting exclusion zones and their proposed locations.</p> <p>Location of ancillary facilities page 39 – please define ‘low ecological value’.</p> | <p>Strategic plantings will be undertaken adjacent to connectivity structures to improve connectivity. Plantings will be endemic species which will include Koala food trees. The fencing strategy is included in the connectivity strategy for Sections 1 and 2 please refer to this document.</p> <p>As above, no baseline surveys undertaken because of low densities and expert review comment.</p> <p>A new paragraph has been inserted into part 4.3.3.to state: Pre-clearing surveys include a 2-staged process for habitat trees and any trees that contain fauna. If a Koala is found, clearing will stop and the area left for 24hrs to allow the Koala to relocate. If the Koala is still present after 24hrs, the Koala will be trapped and relocated. A Koala spotter will also be present during clearing operations.</p> <p>Exclusion zones are those that include Biometric Vegetation Types containing Koala food tree species that are located outside the construction footprint.</p> |
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|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | <p>A suitably qualified ecologist will use his/her professional judgement to identify land as being of 'low ecological value' based on a site inspection and ecological assessment report,</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <p>(d) an adaptive monitoring program to assess the use of the mitigation measures identified in conditions B10 and D2. The monitoring program shall nominate appropriate and justified monitoring periods, performance parameters and criteria against which effectiveness of the mitigation measures will be measured and include operational road kill and fauna crossing surveys to assess the use of fauna crossings and exclusion fencing implemented as part of the SSI;</p> | <p>D2 connectivity strategy – The Department notes that the location of the proposed crossings can only be confirmed once the strategy has been approved and that these must be informed by the further survey undertaken since the EIS/PIR (e.g. page 37). This is currently not addressed in the plan.</p> <p>Further justification of the monitoring periods proposed is required to address the requirement of this condition. For example, in Table 5.1 a monthly inspection of fencing is proposed, and in section 7.4.2 biannual road kill monitoring is proposed. Further justification is required to demonstrate that this is sufficient.</p> <p>Section 5.3.4 – please provide further detail as to the retrofitting of fencing, specifically how the location and extent would be determined, and what amount of koala road kill, over what period of time would need to occur to trigger this corrective action.</p> | <p>No further surveys have been undertaken for Koalas in Section 1 and 2 for reasons explained above.. The connectivity strategy identifies connectivity structures that will facilitate the movement of fauna including the Koala. The connectivity strategy has been closely developed in consultation with EPA</p> <p>Table 5-2 (previously 5-1) refers to daily inspections for Koala deaths and injuries during the clearing phase, and monthly inspections immediately after clearing.</p> <p>Part 7.4.2 refers to bi-annual road-kill monitoring during the operational phase of the Project.</p> <p>The timing of monitoring of effectiveness of mitigation structures is set to co-incide with periods of peak movements of Koalas (dispersal of sub-adults and movement of adults during the breeding</p> |

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| <p>(e) monitoring methodology for threatened flora and fauna adjacent to the SSI footprint,</p>                                                                                                                  | <p>The Department notes that population monitoring is not proposed based on the density of koalas in sections 1 and 2. The plan needs to be updated to include the survey data that supports this statement. Once these are included and this is demonstrated, the Department would agree with the proposal to remove population monitoring requirements for these sections.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | <p>Additional information about Koala surveys undertaken, and the results of these surveys in Section 1 and Section 2, has been presented in part 2.2 of this Plan.</p>                                                                                                                                                                                                                                                                                                                     |
| <p>(f) goals and performance indicators to measure the success of mitigation measures, which shall be specific, measurable, achievable, realistic and timely (SMART), and be compared against baseline data;</p> | <p>Goals and performance indicators do not currently meet this requirement and need to be updated to be more specific, measurable, achievable, realistic and timely (see for example table 5.1, 6.1 and 7.2 and the specific examples below).</p> <p>Section 6.2 page 41 – main goals for management are defined as: zero or reduce rate of reported koala deaths - For this goal to be achievable, baseline data needs to be provided against which it will be measured; Targeted crossing found to be “used by koalas” – this should be further defined i.e. Koalas are found to be making a full crossing; “Successful” revegetation also should be defined and can only be achieved when the vegetation is self sustaining, not for a period of five years post construction</p> <p>Table 5.1 Exclusion zones: The Department suggests adding performance thresholds of damage to vegetation within exclusion zones, not just vehicle breaches; for the proposed replanting of koala habitat outlined in this table, the thresholds need to include survival rates to be achieved and within what timeframes they will be achieved.</p> <p>Table 7.2 – in the vicinity needs to be further defined to clarify what distance this is referring to</p> | <p>Goals and performance indicators have been revised to better reflect SMART criteria.</p> <p>Goal re-defined to clarify as “No Koala deaths or injuries” (baseline data unnecessary).</p> <p>Goal re-defined as “Evidence of completed crossings by Koalas at targeted fauna crossing structures</p> <p>Goal re-defined as “Less than 30% mortality of planted Koala feed trees in Koala habitat revegetation areas on Roads and Maritime owned land for a period of five years post-</p> |

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|                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                           | <p>construction” is a reasonable metric to assume re-vegetated area will continue to survive and become self sustaining. (self-sustaining, i.e. additional evidence of flowering/ seeding/ germination, is unrealistic).</p> <p>Exclusion zones are normally defined as the boundary of the approved clearing footprint. These areas will be marked with temporary flagging tape or temporary fencing. Any breaches by vehicles or equipment will be reported.</p> <p>Performance thresholds for tree planting of habitat for Koalas will be set at less than 30% mortality of planted trees.</p> <p>The term “vicinity” has been deleted and the performance indicator revised.</p> |
| <p>(g) methodology for the ongoing monitoring of road kill, the species densities, distribution, habitat use and movement patterns, and the use of fauna crossings during construction and operation of the SSI, including the proposed timing, and duration of that monitoring;</p> | <p>7.4.1 Please amend incorrect references to sections of the proposal in this section.</p> <p>7.4.2 please provide further justification of the frequency of the proposed monitoring</p> | <p>Edits made as required.</p> <p>Ad-hoc observations of Koala deaths or injuries may occur, and will be reported, at any time throughout the project, However, more formal monitoring, involving searching on foot for any evidence of road-killed animals, will be confined to two sampling periods per year.</p>                                                                                                                                                                                                                                                                                                                                                                  |



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|                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | This constraint is applied because it is necessary to restrict traffic flows along the highway to enable this monitoring work to be done.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| (h) provision for the assessment of monitoring data to identify changes to habitat usage and whether this can be attributed to the SSI;                                                                                                                   | n/a based on low density of individuals                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Not applicable within Section 1 and Section 2 because of the very low population density of Koalas that occur in this area.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| (i) details of contingency measures that would be implemented in the event of changes to habitat usage patterns, entities, distribution, and movement patterns attributable to the construction or operation of the SSI, based on adequate baseline data; | <p>No baseline data is currently presented to address this requirement</p> <p>The Department recommends that the corrective actions in this table be strengthened. For example:</p> <ul style="list-style-type: none"> <li>• Retrofitting of rabbit proof fence with smooth metal sheeting is proposed on page 34 – further information is required regarding what level of road kill would trigger this action, and the location and extent of fencing that would be installed, and a clear commitment to implement this action if required.</li> <li>• Table 5.1 Proposes a corrective action to review Koala measures if more than one Koala is reported as killed (or injured) as a result of road strike – please clarify over which period this would be measured.</li> <li>• Table 5.1 Retrofitting of fencing is proposed as a corrective action – within what timeframe would this occur from when a koala road strike is reported?</li> <li>• The Department requests that a corrective action be included that ensures that for sections 1 and 2, where temporary exclusion fencing is not proposed, that it be installed should koalas be recorded, injured or killed in the clearing footprint</li> <li>• Section 6.3.1 Fencing monitoring– how often will this occur? How will it be undertaken? In what timeframe would fencing be repaired once a breach is reported?</li> <li>• Table 5.1 The Department recommends that “adding additional exclusion fencing in unfenced areas” is added as a corrective action; identify and <i>implement</i> actions is added to the corrective action proposed for mortality from dog attacks.</li> </ul> | <p>Not applicable within Section 1 and Section 2 because of the very low population density of Koalas that occur in this area.</p> <p>Clear commitment has been made to consider the need to retro-fit fencing to provide further deterrence to Koalas.</p> <p>Table 5-2 refers only to the construction period, however, this corrective action applies for up to five years during the operational period (Table 6-2).</p> <p>Action to locate and repair a faulty exclusion fence (if present) will be undertaken within 3 days of Koala death being reported. Retro-fitting, if required, will be undertaken in consultation with suitably qualified</p> |

|                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                   |
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|                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                      | <p>ecologists.</p> <p>Corrective actions will include the provision of exclusion fencing where there is none if Koala deaths or injuries are recorded.</p> <p>Periodic monitoring and maintenance of exclusion fencing will be undertaken for the life-time of the project.</p> <p>Edits made to Table 6-2 regarding exclusion fencing and corrective actions for mortality from dog attacks.</p> |
| <p>(j) mechanisms for the monitoring, review and amendment of these plans;</p>                                                                                                                                                                                                                                                                                                   | <p>Requirement met</p>                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                   |
| <p>(k) provision for ongoing monitoring during operation of the SSI (for operation/ongoing impacts) until such time as the use and effectiveness of mitigation measures can be demonstrated to have been achieved over a minimum of three successive monitoring periods, unless otherwise agreed by the Secretary in consultation with the OEH, DPI (Fisheries) and DoE; and</p> | <p>The commitment to undertake monitoring until such time as the use and effectiveness of mitigation measures can be demonstrated to have been achieved over a minimum of three successive monitoring periods for the monitoring proposed for mitigation measures must be included in this plan. (for example road kill monitoring in table 6.1)</p> | <p>This commitment is stated in Table 6-2.</p>                                                                                                                                                                                                                                                                                                                                                    |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
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| <p>(l) provision for annual reporting of monitoring results to the Secretary and the OEH, DPI (Fisheries) and DoE, or as otherwise agreed by those agencies.</p>                                                                                                                                                                                                                                                                                                    | <p>Requirement met</p>                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <p>In developing the Plans, the Applicant shall demonstrate to the satisfaction of the Secretary and DoE, how the public authorities and expert reviewer recommendations provided for each draft plan in the documents listed in condition A2(c) have been addressed, including detailed justification of any variance from the recommendations of the expert reviewer of the management plans, including analysis of potential risk to the threatened species.</p> | <p>The Department notes the expert's comment that the SAT technique is recommended as being unsuitable to determine population densities. Please discuss how this has been addressed.</p> | <p>The key thing to note is that the SAT technique is not designed to provide a measure of Koala population density. The SAT technique is an <b>"indirect"</b> method which can provide estimates of relative use by Koalas of different areas or vegetation types. Other <b>"direct"</b> survey methods are required to estimate Koala population density. These direct survey methods are not effective or cost-efficient when Koala population densities are very low, as in the case of Section 1 and Section 2.</p> |

**NSW Environmental Protection Authority review of Koala Management Plan: Sections 1 and 2  
December 2014**

| Comment:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Response by RMS                                                              |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------|
| <p>Section 4.3.1 - EPA recommends using fauna drop downs rather than escape poles in sections 1 &amp; 2 due to the low number of koala records. Drop downs need to be designed with 1200mm clearance down the front. Place drop downs close to entry nodes and less frequently further away from entry roads, arbitrarily every 500m. The EPA welcomes the opportunity to consider alternative escape mechanism designs. The EPA believes escape mechanisms are a vital design feature of 4 lane highways however further research and experiment is necessary to improve the efficacy of designs.</p> | <p>New text has been inserted in part 4.3.1 to reflect this requirement.</p> |
| <p>Sections 5.3.4 – EPA supports the decision not to provide temporary koala exclusion fencing during construction and operation. However as discussed in this section and in Table 6-1 any koala road accidents/ kill should trigger analysis of potential koala movement areas and the subsequent need for retrofitted metal sheeting.</p>                                                                                                                                                                                                                                                           | <p>The Table has been updated to reflect this requirement.</p>               |
| <p>Section 5.3.8 - EPA recommends that all koala furniture is a minimum of 200mm diameter. Also the EPA would prefer the installation of horizontal logs rather than planks.</p>                                                                                                                                                                                                                                                                                                                                                                                                                       | <p>New text has been inserted in part 5.3.8 to reflect this requirement.</p> |

**NSW Department of Planning and Environment review of Koala Management Plan: Sections 1 and 2**

**January 2015**

| Comment:                                                                                                                                                                                                                    | Response by RMS                                                                                                                                                         |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>The plan needs to more clearly demonstrate what surveys have been undertaken for W2G (condition D8(a)). Some detail is required on each of the key points in D8(a) (eg. density, habitat use and movement patterns).</p> | <p>Additional information about Koala surveys undertaken, and the results of these surveys in Section 1 and Section 2, has been presented in part 2.2 of this Plan.</p> |
| <p>For D8(a), it is also necessary to link to the Mitigation Framework. Could you let me know the status of the framework for W2G?</p>                                                                                      | <p>New reference to the Biodiversity Mitigation Framework has been inserted in part 1.2.</p>                                                                            |
| <p>Information about how the expert review comments have been reviewed and incorporated into the plan should also be provided.</p>                                                                                          | <p>Provided in Appendix B of this Plan.</p>                                                                                                                             |

**Department of the Environment review of Koala Management Plan: Sections 1 and 2**

**Additional comments - April 2015**

| Condition No | Condition requirement                                                                | Section/ Page Reference of the document/Plan | Department Comment<br>Date – 14/4/2015                                                                                                                                                        | RMS Response<br>Date – 28/4/2015                                                                                                                                                                                                                                                                                          |
|--------------|--------------------------------------------------------------------------------------|----------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 8            | Develop a koala management plan as per NSW condition 8 and 9 for each relevant stage | This plan                                    | This plan has been prepared to address mainly section 1 and section 2 of the project which is from Woolgoolga to Halfway Creek                                                                |                                                                                                                                                                                                                                                                                                                           |
| General      |                                                                                      | Table 3-1 and page 17                        | <p><b>Response required</b><br/>The figures provided for total clearing of vegetation within sections 1 and 2 (section 3.1) do not appear to correspond with those provided in Table 3-1.</p> | Table 3-1 displays the correct information, following merging of the vegetation polygons used by different consultants and constraining analysis to the areas proposed for clearing as part of the highway upgrade footprint. The text on p. 17 has been updated to correspond to the information presented in Table 3-1. |
| 8            | Plan must minimise impacts to Koala to the satisfaction of the Minister              | Sections 4, 5 & 6                            | See below.                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                           |
|              | Management – pre construction                                                        | Section 1.3                                  | <p><b>Response required</b><br/>Tables 4-1 should include a column on responsibility/responsibly party</p>                                                                                    | Table 8-1 lists the responsible parties for each stage of the Koala Management Plan, including pre-                                                                                                                                                                                                                       |

|  |                         |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
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|  |                         |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | construction works.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|  | Management-construction | Section 5<br><br>Section 5.3.7 | <p>clearing procedures, relocation protocol are discussed satisfactorily.</p> <p><b>Response required</b><br/>Please ensure that this plan designates the speed limit for construction vehicles within the construction corridor, as this plan will need to be implemented by the Contractor as part of the CEMP for sections 1 &amp; 2.</p> <p>The expert review raised the issue of side roads joining the main highway as a major hazard which can funnel koalas on to the highway and suggested fencing side roads in conjunction with permanent fencing on the adjacent highway or removing vegetation from around the road entrance. It would appear that the applicability or otherwise of this recommendation, and if applicable appropriate mitigation measures to sections 1 and 2 have not been included.</p> | <p>The designated speed limit will vary between different construction activities and construction machinery. The Traffic Management Plan will identify speed limits for each construction activity. The speed limit within the construction zone will range from approximately 10km/hr – 60km/hr.</p> <p>Speed limits will be reduced to 80km/hr on the existing Pacific Highway and 40km/hr on local access roads.</p> <p>Koala floppy top fencing is not proposed on Section 1 and 2 because of the low population densities. For instances where fauna become trapped in the road corridor the connectivity strategy for Section 1 and 2 includes escape drop downs to allow fauna to exit the construction corridor.</p> <p>The issue of side roads funnelling koalas onto the highway will be further considered for the populations referred to in MCoA D9. RMS is currently looking into solutions to resolve this issue (e.g. Koala “roller grids”). RMS is also required to meet MCoA D9 (d) (vii) “provide passage for Koalas under or over the existing highway and service roads or local roads (servicing over 100 vehicles per day)”.</p> |

|  |                         |           |                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
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|  | Management construction | Table 5-2 | <p><b>Response required</b><br/>                 It is unclear why the measure provided under main goal for management (performance objective) and the performance threshold (trigger) is the same. If there are no injuries to a Koala this should not trigger corrective action. The trigger should be any injury to a koala individual.</p> <p>Please include a column on responsible party for monitoring and taking corrective action.</p> | <p>Performance measures in Table 5-2 amended to:<br/>                 “Any injury to an individual Koala during clearing works”.<br/>                 Also:<br/>                 “Any injury to an individual Koala during construction activities”.</p> <p>Table 8-1 lists the responsible parties for each stage of the Koala Management Plan, including construction activities.</p>                                                                                                                                                                                                                                                                                                                                                                            |
|  | Management construction |           | <p><b>Response required</b><br/>                 Should include weed management and water quality management in table 5-2</p> <p>Please confirm that general fauna fence (F1) referred to in Table 54 of the connectivity strategy provides for Koalas as described in section 5.3.4 of the Koala Management plan.</p>                                                                                                                          | <p>Table 5-2 amended to include references to weed management and water quality management</p> <p>Section 1 and Section 2 have relatively low koala population densities and, as such, typical floppy top fencing used for Koalas will not be applied to these sections. Instead, a modified rabbit proof fence has been developed which is minimum 1200 mm high mesh fence pegged into the ground and secured with concrete posts. Although this fence is not targeting Koalas, it will act as a barrier for koalas. In developing this fence design, extensive consultation was undertaken with biodiversity specialists from the EPA. If Koala accidents or road kills occur during the operation of Section 1 and 2, this fence, or parts thereof, will be</p> |



|           |                                                 |                                                     |                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                     |
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|           |                                                 |                                                     |                                                                                                                                                                                                                                                                                                                                                                            | retro-fitted with smooth metal sheeting as an additional deterrent to Koalas.                                                                                                                                                                                                                       |
|           | Management – Operation                          | Section 6.3<br><br>Table 6.3.2                      | <b>Response required</b><br>Frequency of maintenance inspections of fauna exclusion fencing will need to be specified.<br><br>Table 6.3.2 needs to include a column on responsible party.                                                                                                                                                                                  | Section 6.3.1 has been amended to indicate that fauna exclusion fencing will be inspected and maintained every six months, or in response to any Koala injuries or death.<br>Table 8-1 lists the responsible parties for each stage of the Koala Management Plan, including maintenance activities. |
|           | Responsibilities for implementation of the plan | Section 1.3, Chapter 8                              | Construction contractor and ecologist engaged will be responsible during construction phase.<br><br>RMS will be responsible for operational phase.<br><br>Please see comments above for inclusion in to the relevant Tables<br><br><b>Response required</b><br>It is important to delineate responsibilities as per previous comments given the split of responsibilities. | Table 8-1 lists the responsible parties for each stage of the Koala Management Plan.                                                                                                                                                                                                                |
| NSW D8(a) | Demonstration of adequate surveys               | Sections 2.2, 2.2.1, 2.2.2 and figures 2.1 a & 2,2a | The level of surveys undertaken for sections 1 & 2 appears reasonable.                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                     |
|           |                                                 | 5.3.8 & Table 5-1                                   | Table 5-1 provides a list of key Koala connectivity structures and their locations for sections 1 & 2 and                                                                                                                                                                                                                                                                  | Table 5-1 has been updated to include the relevant information provided in Table 5 of the Final Connectivity                                                                                                                                                                                        |

|           |                                                                                                                                                                            |           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
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|           |                                                                                                                                                                            |           | includes 6 bridges and 18 culverts. These have been developed in consultation with NSW EPA/OEH and DPI (Fisheries). This will need to be updated with the information provided in the Connectivity strategy (final connectivity structures).                                                                                                                                                                                                                                                                                                                                                                                  | Strategy (April 2015).<br>One additional bridge (64 m) over a tributary of Corindi Creek at chainage 6170 has been included in Table 5-1. Additional changes to the text of the Plan have been made in part 5.3.8.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| NSW D8(d) | Monitoring program to assess the use of mitigation measures- include monitoring periods, performance parameters and criteria against which effectiveness will be measured. | Section 7 | <p><b>Response required</b></p> <p>Please confirm if Table 7-1 indicates locations of under passes where motion cameras will be located on either end of each culvert.</p> <p>Section 7.3.2 states motion detection cameras will operate continuously during the monitoring period (spring/summer). Please specify the monitoring duration. Duration is given as until structures are proven to be effective. This will need to be defined in terms of how many successful crossings over what period of time. Ideally x number of years following the construction of structures and following operation of the highway.</p> | <p>Text has been added in part 7.3.1 to clarify that: "Motion sensor cameras will be installed at each end of the Koala dedicated underpass structures listed in Table 7-1 to determine whether Koalas are prepared to undertake complete crossings of these structures".</p> <p>Additional text also includes: "Koala faecal pellet searches and searches for Koala scratches on trees will be conducted in adjacent habitat (within 100 m) to the above connectivity structures and during the period that the underpass structures are being monitored. The purpose of these searches is to determine whether there is any evidence of Koala presence near the connectivity structures at the time they are being monitored."</p> <p>Section 7.3.2 has been amended to read "Cameras will operate continuously for at least three months during the monitoring periods</p> |

|           |                                                                                                                                                              |           |                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                               |
|-----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|           |                                                                                                                                                              |           |                                                                                                                                                                                                                                                 | (spring/summer). These monitoring periods are scheduled to occur each year for the first three years following completion of the project, after which the need for further monitoring will be reviewed (Table 8-1). The performance of each dedicated Koala crossing structure will be determined by evidence of one or more completed crossings during these monitoring periods (Table 7-2). |
| NSW D8(e) | Monitoring methodology                                                                                                                                       | Section 7 | Motion cameras, remote cameras, digital photography, SAT assessment are proposed.<br><b>Response required</b><br>For SAT and remote camera monitoring of adjacent habitat – please provide a definition in terms of distance for adjacent areas | Text in 7.3.2 has been amended to clarify distance (100 m) and timing (monthly) over which Koala faecal pellet searches and Koala tree-scratch searches will be undertaken either side of dedicated fauna crossing structures that are being monitored with remote cameras.                                                                                                                   |
| NSW D8(f) | Goals and performance indicators                                                                                                                             |           | See previous comment under condition 8                                                                                                                                                                                                          | Amendments made to performance indicators in Tables 6-1 and 7-2.                                                                                                                                                                                                                                                                                                                              |
| D8(g)     | Methodology for ongoing monitoring of road kill, species densities, distribution, habitat use and movement and use of fauna crossings<br>Timing and duration | 7.3.2     | See previous comment under D8(d)                                                                                                                                                                                                                | Amendments made within part 7.3.2 to clarify monitoring methodology. Further information in Tables 7-2 and 8-1. Scat-search and tree-scratch searches will be undertaken within 100 m in habitat adjacent to each dedicated crossing structure. Methodology is clarified in 7.3.2. The purpose of these                                                                                       |

|       |                                                                                                                                                   |               |                                                                                                    |                                                                                                                                                                                                                                                                                                                                   |
|-------|---------------------------------------------------------------------------------------------------------------------------------------------------|---------------|----------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|       | of monitoring                                                                                                                                     |               |                                                                                                    | search plots is to identify whether Koalas have recently been in proximity to the dedicated fauna crossing structures which are being monitored.                                                                                                                                                                                  |
| D8(h) | Provision for assessment of monitoring data to identify changes attributable to the project                                                       | 7.3.2, 7.6    | No comment                                                                                         |                                                                                                                                                                                                                                                                                                                                   |
| D8(i) | Details of contingency measures in the event of changes to habitat usage patterns, distribution and movement patterns attributable to the project | 7.6           |                                                                                                    | Text amended in 7.6 to read “Observations of Koala presence using faecal pellet-search and tree-scratch track searches within 100 m in adjacent habitat during the time of monitoring fauna crossing structures will be used in assessments of the effectiveness of these structures.”                                            |
| D8(j) | Mechanism for monitoring, review, and amendment of the plans                                                                                      | 7.5           | Not addressed under section 7.5                                                                    | 7.5 amended to include the following new text: “The responsibility for identifying appropriate triggers to undertake corrective actions, if needed, will be shared between RMS and its consulting ecologists, with RMS having the prime responsibility for enforcing any necessary changes as required by this Plan (Table 8-1).” |
| D8(k) | Provision for ongoing monitoring during operation until the                                                                                       | 7.3.1 & 7.4.2 | Has not been satisfactorily addressed under section 7.3.1 or section 7.4.2. se comment under D8(d) | Table 8-1 outlines the implementation schedule for monitoring activities in this Plan. Text has been amended in 7.3.1                                                                                                                                                                                                             |

WOOLGOOLGA TO BALLINA | PACIFIC HIGHWAY UPGRADE: SECTION 1 – SECTION 2

|       |                                                 |     |            |                                    |
|-------|-------------------------------------------------|-----|------------|------------------------------------|
|       | success of mitigation measures are demonstrated |     |            | and 7.4.2 to clarify these issues. |
| D8(l) | Annual reporting of monitoring results          | 7.5 | No comment |                                    |



## **Appendix D – NSW Code of Practice for Injured, Sick or Orphaned Koalas**



Office of  
Environment  
& Heritage

# Code of Practice for Injured, Sick and Orphaned Koalas





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## Preface

The Code of Practice for Injured, Sick and Orphaned Koalas (the Code) is intended for anyone authorised by the Office of Environment and Heritage (OEH) to rehabilitate and release koalas (*Phascolarctos cinereus*). It has been developed to protect the welfare of koalas in care and for the conservation of wild koala populations. The Code contains both standards and guidelines for the care of koalas and is designed to be read in conjunction with the *Code of Practice for Injured, Sick and Orphaned Protected Fauna* (OEH 2011).

Koalas are listed as vulnerable under the *Threatened Species Conservation Act 1995*. The koala population in the Pittwater Local Government Area and in the Hawks Nest and Tea Gardens areas are listed as endangered.

Both the *NSW Recovery Plan for the Koala* (DECC 2008) and the *National Koala Conservation and Management Strategy 2009–2014* (Australian Government 2009) have high welfare standards for koalas in care as a key objective. The Code is intended to contribute to this objective.

Compliance with the Code does not remove the need to abide by the requirements of the *Prevention of Cruelty to Animals Act 1979* and any other laws and regulations, for example, the *Local Government Act 1993*.

Compliance with the standards in the Code is a condition of licences issued (under Section 120 of the *National Parks and Wildlife Act 1974* (NPW Act)), to rehabilitate and release sick, injured and orphaned protected fauna. Failure to comply with a licence condition is an offence under the Section 133 of the NPW Act and may result in a Penalty Infringement Notice being issued or the commencement of a prosecution.

The Code has been prepared by OEH in consultation with Friends of the Koala, Koalas In Care, Native Animal Trust Fund, WIRES, Hunter Koala Preservation Society and the Koala Preservation Society NSW. It is also supported by the NSW Animal Welfare Advisory Council within the Department of Primary Industries.

The Code is neither a complete manual on animal husbandry, nor a static document. It will be revised as necessary to take into account new knowledge of animal physiology and behaviour, technological advances, developments in standards of animal welfare and changing community attitudes and expectations about the humane treatment of koalas. OEH will consult with licence holders regarding potential changes to the Code and give written notice when the Code is superseded.



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# 1. Introduction

This Code sets the standards for the care and housing of koalas that are incapable of fending for themselves in their natural habitat. It comprises both enforceable provisions and guidelines. Enforceable provisions are identified by the word 'standards' and these **must** be followed.

## 2. Interpretations and definitions

### 2.1. Interpretations

#### Objectives

Objectives are the intended outcome(s) for each section of the Code.

#### Standards

Standards describe the mandatory specific actions needed to achieve acceptable animal welfare levels. These are the minimum standards that must be met. They are identified in the text by the heading 'Standards' and use the word 'must'.

#### Guidelines

Guidelines describe the agreed best practice, following consideration of scientific information and accumulated experience. They also reflect society's values and expectations regarding the care of animals. A guideline usually indicates a higher level of care than the minimum standard, except where the standard is best practice.

Guidelines will be particularly appropriate where it is desirable to promote or encourage better care for animals than is provided by the minimum standards. Guidelines are also appropriate where it is difficult to determine an assessable standard. Guidelines are identified in the text by the heading 'Guidelines' and use the word 'should'.

#### Notes

Where appropriate, notes describe practical procedures to achieve the minimum standards and guidelines. They may also refer to relevant legislation.

### 2.2. Definitions

In this Code:

- **Fauna rehabilitator** means someone who is either authorised by a fauna rehabilitation group or zoological park or is individually licensed by OEH to rehabilitate and release protected fauna.
- **Fauna rehabilitation** means the temporary care of injured, sick or orphaned fauna with the aim of successfully releasing it back into its natural habitat.
- **Fauna rehabilitation group** means an incorporated group that is licensed by OEH to rehabilitate and release protected fauna.

- **Park** means a national park, historic site, state conservation area, regional park, nature reserve, karst conservation reserve or Aboriginal area, or any land acquired by the Minister under Part 11 of the NPW Act.

### **3. Case assessment**

Refer to Section 4 of the *Code of Practice for Injured, Sick and Orphaned Protected Fauna* (OEH 2011).

### **4. Rescue**

#### **Objective**

To conduct a koala rescue so as to minimise further stress and injury to the animal.

#### **4.1. Standards**

- 4.1.1 Prior to a rescue attempt, the rescuer must assess the risks to the koala from environmental hazards and from capture.
- 4.1.2. Rescuers must employ the correct rescue equipment for the condition and location of the koala and be trained in its use.
- 4.1.3. The following methods must not be used to capture a koala:
  - noosing with a rope that tightens
  - shaking the tree
  - cutting the tree down.
- 4.1.4. The rescue attempt must be suspended if the koala is exhibiting signs of stress (e.g. crying or panting).
- 4.1.5. If the koala is a suspected orphan, the surrounding area must be searched for the mother. If the mother is found and is healthy, attempts must be made to reunite it with its young.
- 4.1.6. If the koala is an injured female with signs of having a pouch young (e.g. swollen teat), the surrounding area must be searched for the young.
- 4.1.7. Rescuers must not move a healthy, independent koala unless it is at immediate risk of injury (e.g. on a road). Such relocations will involve moving the koala a safe distance from the hazard and placing it in a climbable tree.
- 4.1.8. If multiple koalas are rescued (e.g. on a fire ground), the containers the koalas are placed in must be labelled with the capture location.

#### **4.2. Guidelines**

- 4.2.1. The rescue of a koala should not be attempted unless at least two trained personnel are involved.
- 4.2.2. If the koala has not been captured after being pursued for 10 minutes, the rescue attempt should be suspended to allow the koala to recover.

- 4.2.3. Rescuers should take steps to protect the koala from additional stressors such as onlookers, loud noises, other animals and extremes of temperature during rescue.
- 4.2.4. A koala should be picked up from behind using a towel or blanket and held firmly by the wrists/forearms.

## Notes

A canvas bag, blanket or towel is suitable for catching a koala on the ground.

A long pole with flagging at one end is suitable for encouraging a koala that is close to the ground to move down.

A hoop net is suitable for catching a koala in a difficult location.

A ground trap is suitable for a koala that is too high to flag

Covering a koala's eyes with a towel, blanket or bag will often assist with calming it down.

Researchers are responsible for the welfare of the koalas covered by their animal research authority. It may be useful for researchers to establish a relationship with local rehabilitation groups should such an animal require rescue.

## 5. Transport

### Objective

To minimise further stress and injury to a koala during transport. This section applies to all movement of the koala including from the point-of-rescue to a veterinary surgery and between rehabilitation facilities.

### 5.1. Standards

- 5.1.1. The transport method and container size must be appropriate for the size and condition of the koala. For example:
- an orphaned pouch young requires an artificial pouch that is secured within a container (e.g. cage, box or basket). Artificial heat (e.g. a hot water bottle) may also be required
  - an adult or sub-adult requires a padded container.
- 5.1.2. The container must be designed, set-up and secured to prevent injuries to the koala. Hessian sacks must not be used as the koala's claws can become entangled and threads can be inhaled.
- 5.1.3. The container must be designed to prevent the koala from escaping.
- 5.1.4. The koala must be placed upright in the container.
- 5.1.5. The container must be kept at a temperature which is appropriate for the age and condition of the koala. For example:
- a range of 20–25°C is appropriate for an adult in most circumstances
  - a range of 28–32°C is appropriate for an unfurred pouch young.



- 5.1.6. The container must be ventilated so air can circulate around the koala.
- 5.1.7. The container must minimise light, noise and vibrations and prevent contact with young children and pets.
- 5.1.8. The koala must not be transported in the back of uncovered utility vehicles, car boots that are separate from the main cabin or on the rescuer's lap.
- 5.1.9. The container must be constructed from material that can be easily cleaned and disinfected.

## **5.2. Guidelines**

- 5.2.1. A container used for transporting an adult or sub-adult koala should contain something for the koala to hold on to (e.g. a rolled up towel).
- 5.2.2. An adult koala should be transported with fresh eucalyptus leaves to assist with calming it.
- 5.2.3. Koala transport should be the sole purpose of the trip and undertaken in the shortest possible time.

## **6. Euthanasia**

### **6.1. When to euthanase**

#### **Objective**

To end a koala's life in situations where death is imminent, or recovery is impossible, or the likelihood of successful reintegration into the wild population is remote, or the animal poses an unacceptable health risk to wild animals.

#### **6.1.1. Standards**

- 6.1.1.1. A koala must be euthanased without exception when:
  - death is imminent or highly likely regardless of the treatment provided, or
  - it is suffering from chronic, un-relievable pain or distress, or
  - it is carrying (or suspected to be carrying) an incurable disease that may pose a health risk to wild animals, or
  - it is permanently unable to consume leaf unaided due to an injured jaw or missing/worn teeth.
- 6.1.1.2. A koala must be euthanased (unless OEH has granted permission to hold it in permanent care) when:
  - there is no suitable release location, or
  - its ability to reproduce is lost due to an injury, disease or procedure, or
  - it is permanently incapable of climbing trees due to a missing or injured claws, digits, limb, pelvis or back bone, or

- it is permanently vision-impaired, hearing-impaired, or anosmic (can't smell) such that it is unable to survive in its natural habitat, or
- its ability to handle branches is permanently impaired due to a missing or injured digits, or
- its advanced age renders it unable to survive in its natural habitat.

In certain exceptional circumstances, OEH may grant permission to hold such animals in permanent care. See the *Rehabilitation of Protected Fauna Policy* (DECCW 2010) for details.

## Notes

A koala with a late-stage Chlamydia infection is extremely difficult to cure and poses a health risk to wild koalas.

The age of a koala can be determined through examining pre-molar and molar wear using a tooth-wear chart. For an example see Figure 8.4 in Vogelnest and Woods (2008).

## 6.2. How to euthanase

Refer to Section 7.2 of the *Code of Practice for Injured, Sick and Orphaned Protected Fauna*, (OEH2011).

## 6.3. Disposal of carcasses and animal waste

### Objective

To dispose of waste so that the risks of disease transmission are minimised.

### 6.3.1. Standards

- 6.3.1.1. Carcasses and organic waste suspected of disease contamination or that have been exposed to chemicals (e.g. barbiturates) must either be incinerated or buried at a depth that will prevent scavengers from reaching them.
- 6.3.1.2. A koala that has died from disease or chemical means (e.g. barbiturate overdose) must not be fed to other fauna.

### 6.3.2. Guidelines

- 6.3.2.1. A deceased koala should undergo a necropsy if the cause of death is uncertain.

## 7. Care procedures

### 7.1. Monitoring

#### Objective

To check the health of a koala undergoing rehabilitation so that issues can be promptly identified and managed. The type and frequency of monitoring will vary with the type of injury or illness and required treatment.

### **7.1.1. Standards**

- 7.1.1.1. A dependent koala (i.e. pouch young) or a koala in intensive care must be monitored repeatedly during the day and weighed at least twice per week.
- 7.1.1.2. An independent juvenile koala or a koala in intermediate care must be monitored at least once per day and weighed at least once per week.
- 7.1.1.3. A koala being prepared for release must be monitored at least every few days to determine if it is physically and behaviourally ready for release (See Section 11 Suitability for Release).
- 7.1.1.4. Rehabilitators must regularly monitor the temperature within an enclosure that contains thermal support, to ensure that temperatures, appropriate to the animals' condition, are maintained (e.g. blankets, hot water bottles and electric heat mats).

### **7.1.2. Guidelines**

- 7.1.2.1. On admission, a koala should be checked for:
  - bleeding, puncture wounds or matted wet-looking fur
  - bone fractures
  - rapid breathing or elevated heart rate
  - dilated pupils or erratic eye movements
  - enlarged lymph nodes
  - pale or blue mucous membranes
  - cold extremities
  - ticks
  - discharge from the eyes, nostrils, mouth or cloaca
  - odd smells.
- 7.1.2.2. Monitoring a koala should entail:
  - manually assessing body condition and demeanour
  - checking for signs of injury, disease and parasites
  - assessing hydration using the 'pinch test'
  - determining how much leaf has been consumed
  - noting the quantity and quality of scats and urine
  - looking for indications of activity.

## **7.2. Controlling disease transmission between animals**

Refer to Section 8.2 of the *Code of Practice for Injured, Sick and Orphaned Protected Fauna* (OEH2011).

## **8. Husbandry**

### **8.1. Food and water**

#### **Objectives**

To ensure that the koala has a feeding and watering regime that encourages rapid recovery, supports growth if it is a juvenile and assists with the maintenance of foraging behaviour necessary for survival in the wild.

#### **8.1.1. Standards**

- 8.1.1.1. Clean, fresh drinking water must be available at all times and changed daily, except in the case of dependent young (See Section 9.1.1.7).
- 8.1.1.2. Water containers must be designed and positioned so as to avoid spillage and contamination and must be appropriate for the size, age and mobility of the koala.
- 8.1.1.3. Fresh leaves must be available for the koala to eat at all times and replaced daily, except in the case of dependent young. Leaves may be harvested every few days and stored prior to use.
- 8.1.1.4. Stored leaves must not be accessible to pets, pests and wild animals and must be protected from contamination and nutritional and moisture loss (i.e. stored in containers of fresh water for a maximum of three days).
- 8.1.1.5. Leaves from at least two different eucalyptus species must be offered to the koala each day. At least one of these species must be a preferred eucalyptus species sourced from the area in which the koala was found.
- 8.1.1.6. Branches must be placed in holders that contain clean water. The water must be emptied and re-filled as necessary to keep the leaf hydrated.
- 9.1.1.7. A hand-reared koala must be fed a milk formula that is appropriate for its stage of development.

#### **8.1.2. Guidelines**

- 8.1.2.1. Leaves from non-eucalyptus food trees that are sourced from the area in which the koala was found should be offered as a supplement.
- 8.1.2.2. Milk supplements should be offered to an adult koala in the intensive and intermediate care stages.
- 8.1.2.3. Contaminant-free dirt and bark should be offered to a koala in the intermediate and pre-release stages.
- 8.1.2.4. The choice of eucalyptus species offered to a koala should be varied every few days.
- 8.1.2.5. Leaves should be sprayed with water before being offered to a koala.
- 8.1.2.6. Both young and mature leaves should be offered to a koala.
- 8.1.2.7. Leaves should not be collected from the side of a major road as they are likely to be contaminated.

- 8.1.2.8. Leaves should not be dragged across the ground as they may become contaminated.
- 8.1.2.9. If multiple koalas are kept within the same enclosure, branches should be placed in different locations so that all koalas can feed simultaneously.

## **8.2. Hygiene**

Refer to Section 9.2 of the *Code of Practice for Injured, Sick and Orphaned Protected Fauna* (OEH2011).

# **9. Housing**

## **9.1. General requirements**

Refer to Section 10 of the *Code of Practice for Injured, Sick and Orphaned Protected Fauna* (OEH2011).

## **9.2. Intensive care housing**

### **Objectives**

To reduce activity for a short period of time in order to facilitate frequent monitoring, treatment, feeding and re-hydration. It is suitable for severely injured or diseased adults and orphaned pouch young.

### **9.2.1. Standards**

- 9.2.1.1. Intensive care housing must provide sufficient space for the koala to sit upright and to stretch its body and limbs, but not enough space to crawl around.
- 9.2.1.2. Intensive care housing must contain a prop for the koala to hold on to (e.g. a shortened branch with a fork for an adult and a stuffed toy for a juvenile).
- 9.2.1.3. Intensive care housing must provide a constant temperature appropriate to the age and nature of the illness or injury.
- 9.2.1.4. The temperature in intensive care housing must be regularly monitored using a thermometer and electrical heat sources must be regulated by a thermostat.
- 9.2.1.5. A koala in intensive care housing must experience a light-dark cycle that replicates outside conditions.
- 9.2.1.6. Intensive care housing must be designed and/or positioned so that visual and auditory stimuli are reduced (e.g. by covering the animal with a towel and placing it in a quiet room).
- 9.2.1.7. Intensive care housing must be adequately ventilated without allowing excessive drafts.
- 9.2.1.8. Substrate used in intensive care housing must be replaced daily.

## **9.2.2. Guidelines**

- 9.2.2.1. Intensive care enclosures should have floor dimensions of at least 0.7 m long by 0.7 m wide.

## **9.3. Intermediate care housing**

### **Objectives**

To provide a mobile koala with enough space to allow some physical activity while enabling it to be readily caught for monitoring or treatment.

### **9.3.1. Standards**

- 9.3.1.1. Intermediate care housing must provide sufficient space for the koala to move about freely whilst being conveniently sized for capture.
- 9.3.1.2. Intermediate care housing must contain at least one branch with a fork and one horizontal pole.
- 9.3.1.3. A koala in intermediate care housing must experience a light-dark cycle that replicates outside conditions. This may be achieved by using a well-lit room or constructing an enclosure in a sheltered area outside.

### **9.3.2. Guidelines**

- 9.3.2.1. Intermediate care enclosures should have floor dimensions of at least 2 m long by 1 m wide.

## **9.4. Pre-release housing**

### **Objectives**

To give the koala the opportunity to regain its physical condition, acclimatise to current weather conditions and practise natural behaviour. At this stage of rehabilitation, interactions between the koala and humans will be greatly reduced.

### **9.4.1. Standards**

- 9.4.1.1. Pre-release housing must provide sufficient space for the koala to move about freely, express a range of natural behaviours and withdraw from undue conflict with co-housed koalas.
- 9.4.1.2. Pre-release housing must provide areas where the koala can gain exposure to prevailing weather conditions and locations where it can shelter.
- 9.4.1.3. Pre-release housing must contain habitat that enables the koala to perform a range of natural behaviour. A koala requires at least two tree forks to allow climbing.
- 9.4.1.4. Pre-release housing must be designed and/or positioned so that exposure to humans is kept to the minimum required for monitoring, feeding and cleaning.

## **9.4.2. Guidelines**

- 9.4.2.1. Pre-release enclosures should have floor dimensions of at least 4 m long by 3 m wide and provide at least 3 metres of usable vertical space.
- 9.4.2.2. Pre-release enclosures should contain a variety of natural branches oriented both vertically and horizontally. Branches should have different thicknesses and textures.
- 9.4.2.3. Leaves should be positioned in such a way as to encourage exercise.
- 9.4.2.4. Pre-release enclosure walls should be smooth, at least 1.5 m high and at least 2 m from the nearest branch to prevent escape.

## **10. Suitability for release**

### **Objectives**

To ensure that the koala is physically fit and possesses the appropriate survival skills prior to its release. Preparations for a koala's release will start at the time of rescue and continue throughout the rehabilitation process.

### **10.1. Standards**

- 10.1.1. A koala must not be released until it is physically ready. This status has been achieved when:
  - it has recovered from any injury and/or disease (e.g. climbs normally)
  - its weight is within the appropriate range for that age (koalas are normally independent at 18 months of age weighing 3.5–4 kg)
  - its body score is 3 (fair) or better as determined by scapula, cranial and limb musculature examination
  - it has appropriate fitness levels as determined by observation
  - its pelage is adequate for survival in its natural habitat (i.e. fur covering the entire body)
  - it has acclimatised to prevailing climatic conditions.
- 10.1.2. A koala must not be released until it is behaviourally ready. This status has been achieved when:
  - it can recognise and consume eucalyptus leaves unaided
  - it can recognise and successfully avoid predators (including pets)
  - it is not attracted to humans (i.e. not humanised) or to sights, sounds or smells that are specific to captivity (i.e. not imprinted)
  - it can climb effectively.
- 10.1.3. A koala's readiness for release must be confirmed by either a veterinarian or experienced fauna rehabilitator.

# 11. Release considerations

## 11.1. Timing of release

### Objectives

To ensure that a koala is released as soon as it is ready and at a time that minimises stress and maximises their chances of survival in their natural habitat.

#### 11.1.1. Standards

- 11.1.1.1. Once a koala is deemed ready for release, it must be released as soon as conditions are suitable (see 11.1.1.2).
- 11.1.1.2. A koala must be released when weather conditions encourage high activity levels. Release during extremes of temperature and storms must be avoided.

## 11.2. Release site selection

### Objectives

To ensure that the wild koala population and natural environment are not negatively impacted by the release of the koala. The welfare of the rehabilitated koala after release is a secondary consideration.

#### 11.2.1. Standards

- 11.2.1.1. If the exact location where the koala was found is known and it is a suitable environment for release, it must be released there.

A suitable environment for release is one that:

- contains appropriate habitat and an adequate number of food trees
- is occupied by other koalas
- does not place the koala at a high risk of injury (e.g. a suburban park surrounded by busy roads).

- 11.2.1.2. If the exact location where the koala was found is known but it is an unsuitable environment for release, the koala must be released in a suitable environment as near as possible to this location, without transporting it across a physical boundary that it would not normally cross (e.g. a river) or further than it would normally move (10 km for adults; 30 km for hand-reared sub-adults).

If there is no suitable environment within 10 km (adults) or 30 km (hand-reared sub-adults) of the rescue location, the koala must not be released.

- 11.2.1.3. If only the general location where the koala was found is known and it contains or adjoins a suitable environment for release, the koala must be released there without potentially transporting it across a physical boundary that it would not normally cross, or further than 10 km (adults) or 30 km (hand-reared sub-adults). If the general location where the koala was found is wider than 10 km (adults) or 30 km (hand-reared sub-adults) at its widest point, the koala must not be released.



11.2.1.4. If there is no information about where the koala was found, it must not be released.

11.2.1.5. A koala can only be released in a park if:

- it was originally found in that location
- the release has written consent from the relevant National Parks and Wildlife Area Manager (issued under section 9 of the National Parks and Wildlife Regulations 2009)
- the release complies with the relevant OEH policies on translocation and environmental integrity.

These conditions also apply to the release of a koala in a location where it might reasonably be expected to immediately enter a park (e.g. on a property adjoining a park).

### **11.2.2. Guidelines**

11.2.2.1. A koala should be released in an area that is connected to other suitable koala habitat.

11.2.2.2. If a koala is going to be released in a different area from where it was found, rehabilitators should first survey the area for resident koalas. A sub-adult koala should not be released into the home range of an adult koala.

### **Note**

Rehabilitators who wish to release a rehabilitated or hand-reared koala further than 10 km (adults) or 30 km (hand-reared sub-adults) from where they were found require a translocation approval issued by OEH (under section 132c of the NPW Act).

## **11.3. Release techniques**

### **Objectives**

The use of release techniques that facilitate successful reintegration into the wild population. The collection of information regarding the fate of rehabilitated koalas after release so that the relative merits of different rehabilitation and release techniques can be compared.

### **11.3.1. Standards**

11.3.1.1. Rehabilitators must arrange for the koala to be ear-tagged prior to release (numbered swivel sheep tags are appropriate).

### **11.3.2. Guidelines**

11.3.2.1. A hand-reared koala should be soft released. This can involve putting the koala into a food tree that is surrounded by a temporary fence. After a few days the fence can be removed.

11.3.2.2. A hand-reared koala should be released with a similarly aged koala with which it has been housed.

11.3.2.3. Rehabilitators should not release multiple adult koalas at a single location, as increased competition is likely to have a detrimental effect on the existing koala population.

11.3.2.4. A koala should be fitted with a micro-chip prior to release. Rehabilitation groups and zoological parks are encouraged to develop post-release monitoring programs to determine survivorship.

#### **Note**

All research involving protected fauna requires a licence issued under section 132c of the NPW Act and an ethics approval issued under the *Animal Research Act 1985*.

## **12. Training**

Refer to Section 13 of the *Code of Practice for Injured, Sick and Orphaned Protected Fauna* (OEH2011).

## **13. Record keeping**

Refer to Section 14 of the *Code of Practice for Injured, Sick and Orphaned Protected Fauna* (OEH 2011).

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# Appendix E - Guidelines and Conditions for Koala Care in NSW

**GUIDELINES AND CONDITIONS  
FOR  
KOALA CARE  
IN NEW SOUTH WALES**

**June 1997**

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## **1. INTRODUCTION**

### **1.1 Standards for the care of koalas**

Many reasons have been identified for caring for koalas, including the need to maintain the health and integrity of local populations, the personal satisfaction of rehabilitating and returning a koala to the wild, a moral responsibility for care, an emotional involvement, a commitment to community quality of life and spirit, and the public expectation of government responsibility for both the welfare of individual koalas and for ensuring the long-term survival of koala populations in the wild.

Koalas may require assistance as a result of disorientation through loss or fragmentation of their habitat, disease, injury (often associated with traffic or dog attack), death of a mother with dependent young, bushfire, or the necessity to relocate a koala away from a highly dangerous location. Koala welfare incorporates issues such as rescue, care, hand raising, rehabilitation and release. It is desirable that every temporarily disadvantaged wild animal is given the best available care to maximise its chances of successful return to the wild. In the case of a high profile and vulnerable species like the koala, it is vital to set and maintain the highest standard of care. The koala is listed as a Vulnerable species in New South Wales under the *Threatened Species Conservation Act 1995*. These conditions and guidelines have been prepared to assist in the recovery of this species.

From a welfare viewpoint, the primary aim of wildlife rehabilitation is to return each individual to the wild population with maximum chances of survival. The length of time a koala is held, the means by which it is held and the place of release are crucial factors. Beyond these principles, there are many points that need to be addressed so that there is consistency among individuals and among groups. This document draws together the considerable experience of koala care that exists in the community and frames the conditions of care in the context of this skill and understanding.

### **1.2 Legislation and policy**

The koala is a protected species under the *National Parks and Wildlife Act 1974* and it is an offence to harm a protected species and the definition of “harm” in the legislation (in addition to its normal meaning) includes hunt, shoot, poison, net, snare, spear, pursue, capture, trap, injure or kill. The legislation also imposes restrictions on holding protected fauna, including for the purpose of rehabilitating an animal which is incapable of fending for itself. When a person comes into possession of a sick, injured or orphaned protected species, such as a koala, but has not been licensed to rescue, hold and rehabilitate protected fauna by the National Parks and Wildlife Service, or a licensed wildlife rehabilitation organisation, they are legally required to notify the Director-General of the National Parks and Wildlife Service in writing within seven (7) days and to comply with any direction given. In the case of a koala, in every situation, directions will be given that it immediately be passed to a skilled licensed/authorised koala carer.

Since the mid-1980s the New South Wales National Parks and Wildlife Service has supported the establishment of specialist wildlife rehabilitation organisations. These train their members in the skills of animal care and wildlife rehabilitation, authorise appropriately trained and skilled members who have the necessary facilities and other resources to care for particular groups or species of animals and then supervise and monitor their activities. These groups also ensure that their members are kept up-to-date with advances in wildlife rehabilitation techniques and encourage peer liaison. There are now over 20 such organisations in NSW and some have regional branches. It is only in a very rare situation, and generally only in a region which does not have a licensed rehabilitation organisation, that the Service will licence an individual to care for sick, injured or orphaned native animals.

These conditions and guidelines refer to the care of koalas by carer groups for the purpose of rehabilitation to the wild, rather than for captive management in zoos or fauna parks. Also they were not written to be binding on researchers, who are subject to the *Animal Research Act 1985*, but where those aspects of research protocols require care and handling of koalas these guidelines may be utilised. to fulfil those requirements. This will particularly apply when a researcher and a carer group are working co-operatively.

These conditions and guidelines are consistent with the Australian and New Zealand Environment and Conservation Council (ANZECC) 1996 *Draft National Koala Conservation Strategy* and contribute to fulfilling Objective 5: 'To manage captive, sick or injured koalas and orphaned wild koalas to ensure consistent and high standards of care'. Thus, although parts of this document carry conditions that are binding in New South Wales, it has also been prepared to assist koala carers, other interested parties and the relevant authorities in other states. In doing so, it has provided a worked example of the welfare aspect of wildlife management, a need made explicit by Objective 5 of the *Draft National Koala Conservation Strategy*.

This document has been prepared in two parts: 1) guidelines, and 2) formal conditions for koala care in New South Wales. Both parts have been prepared in conjunction with carers, veterinarians, Service officers and other interested parties through an extended period of negotiation, including workshops, discussions and a wide circulation of drafts for critical comment. The acknowledgments section lists the participants in this process.

Part 1) The guidelines, which outline the concerns, points of interest and importance for koala care. They were prepared to assist carer groups in their detailed response to comply with the conditions when seeking accreditation.

Part 2) *The formal conditions for koala care in New South Wales are presented in italics at the end of each section.* Accreditation is a formal requirement under the *National Parks and Wildlife Act 1974* and is administered through the Field Services Division of the National Parks and Wildlife Service. These are the conditions that need to be met by carer groups prior to, or to preserve, accreditation.

Each of the following topics is dealt with in two parts. The first contains the guidelines, which are in a normal typeface; the other part, which is in italics, states

the condition that must be satisfied to obtain or maintain accreditation as a koala care group in New South Wales.

## **2. REQUIREMENTS FOR CARERS**

Everyone who cares for koalas must be appropriately skilled and have appropriate facilities, access to reliable sources of a variety of recognised koala food tree species and an ability to collect it.

### **2.1 Training**

- Training for new carers should cover all aspects of the care that they will be expected to undertake, and may consist of one or all of the following options:
  - a) Carers course/workshop;
  - b) Apprentice System (one-on-one training with an accredited carer or fauna park);
  - c) Experience in koala hospital situation in districts where this is possible;
  - d) Voluntary work in fauna parks or zoos where this is possible.
- Training should cover all aspects of handling, observation, restraint, treatment and tree identification and leaf collection.
- Training should include an assessment of competence and be appropriately recorded.

*Conditions: New carers must be trained by an accredited carer or group.*

### **2.2 Licensing**

Carers and carer groups in NSW require licences from the NPWS (Wildlife Licensing Unit, NPWS, PO Box 1967, Hurstville NSW 2220) Phone (02) 9585-6481, FAX (02) 9585-6401.

*Conditions: New carers must be registered in a licensed group. The group must provide a detailed training program and a list of all registered carers as requirements to gain or continue to hold a licence.*

### **2.3 Accreditation**

- An independent Accreditation Committee will be established by the National Parks and Wildlife Service to undertake the accreditation of organisations and in the case of appropriate groups, their regional branches. (Only in special cases will individuals, not part of a group, receive accreditation.) This Committee will comprise at least a Service officer, a carer and a veterinarian.
- Koalas will not be permitted to be held by groups or individuals who have not been accredited to care for koalas. An accreditation system will be established to ensure that each carer group and individual carers are accredited as having the expertise and facilities etc, to provide excellent care for koalas.
- An accredited group/branch will be required to establish its own Accreditation Committee to review the credentials of each of its own carers.



- Koalas will be permitted to be cared for only by accredited carers. Each accreditation committee will establish grievance procedures and undertake grievance resolution.
- Trained and accredited wildlife rescuers may rescue a koala and transport to a vet or accredited carer, or hold temporarily.

*Conditions: An independent Accreditation Committee, established by the National Parks and Wildlife Service, and consisting of at least a carer, veterinarian and a Service officer, will undertake the accreditation of organisations applying for accreditation. A carer group is to set up an accreditation committee, keeping all appropriate records (such as minutes and correspondence). The formal procedures for accreditation need to be listed by each committee and this must be used in the accreditation of each carer or carer group.*

#### **2.4 Facilities**

- Homecare specific requirements - facilities must be available for: intensive care, intermediate care and rehabilitation.
- Individual carers need not have all facilities, but all should be available within a care group.
- Facilities are to be checked for suitability by the co-ordinator in the accredited care group.
- If possible, a carer is to have no dogs or cats and the facilities must be in a quiet area. If they are owned by the carer, then they should never have contact with koalas which are in care.

*Conditions: All facilities for each stage of care must be available within a group. A detailed list of facilities must be prepared as part of the accreditation process. Each carer must have their facilities checked for suitability by the group co-ordinator and a record kept.*

### **3. LIAISON WITH VETERINARIANS**

- Carers should advise vets that they are an accredited carer and offer assistance.
- Common experience and practice shows that an authorised or experienced person is often required to restrain and feed the koala while in veterinary care.
- Carers should be respected for their expertise, but should not tell vets what to do. Rather, they should advise on the best practice, including medication and restraining.
- When koalas are taken directly to the vet, by the public (including police, RTA and council workers), the vet should notify the carer group in the area.
- The carer group has a responsibility to disseminate current information on koala care and a list of experienced vets in koala care to all vets in the area.
- Vets should not hold koalas in care if there are appropriate care facilities available in the carer group.
- Within veterinary facilities, koalas should be in isolation and vets should not hold koalas in pet kennel areas.
- Carers must respect veterinary advice on euthanasia of koalas, but retain the right for a second opinion from another vet.

- Vets instructions relating to medication should be adhered to.
- No animal medication, human medication, ointment or herb should be administered to a koala in care unless it has been approved by a vet.

*Conditions: Carers must advise the vets in the area of their existence, what information is available and the best procedures for koala care. Carers must respect the vet's professional rights and responsibilities.*

#### **4. RESCUE**

- Members of the public who find a sick, injured, orphaned or otherwise distressed koala should note its location and condition and contact the local koala care group or the National Parks and Wildlife Service as soon as possible. Members of the public should not attempt to capture or transport the animal.
- The carer group should attend ASAP with proper catching gear, restraining and transport equipment.
- Carer groups should ensure that all vets, RTA, RSPCA, police and firefighting in the area have the contact numbers of the group.

##### **4.1. Criteria to rescue**

- Sick, injured and orphaned wild koalas which are unable to fend for themselves should be rescued.
- Extreme care should be taken when rescuing orphans that the mother is not nearby.
- Juvenile koalas with weights estimated in excess of 3 kg should not be rescued on the grounds of being orphaned.
- Wild koalas should not be handled or moved unless considered absolutely necessary. An example of a dangerous situation would be a koala on a median strip on a highway.
- If a koala is in an unusual place but appears healthy and in no immediate danger it should be left alone and its location reported to the carer group or the National Parks and Wildlife Service.
- Koalas in a research program are the responsibility of the researcher under the *Animal Research Act 1985*. Contact can be made with the researchers to discuss their project or liaise with the researcher via the NPWS District Manager. Research koalas may not be rescued unless by prior arrangement with the researcher. It is in the interests of the researcher to notify the local carers of the program and to discuss contacts and actions should an animal in the program be found sick or injured or in a dangerous situation. If a carer, or anyone, considers that the welfare of a koala in a research program is being neglected, they should contact the researcher and discuss options for change. If that proves unsatisfactory, the concerned person should then contact the chair or secretary of the Animal Care and Ethics Committee (ACEC) that gave the authority to the researcher.

*Conditions: Only koalas which have a poor chance of survival from obvious signs of injury or disease, or that are orphaned, or that are in a dangerous location, may be*

*rescued. No koala known to be covered by an Animal Research Authority may be rescued without consent of the researcher.*

#### **4.2. Catching and retrieving injured animals**

- Always assess the danger to the rescuer.
- Ask bystanders to stand back and remain quiet. Rescuers must be assertive but not aggressive to onlookers. Rescuers should explain what is happening with the animal.
- Use a blanket or cloth bag to wrap the animal - first place it over the head when catching so the risk of biting to the rescuer is minimised.
- Pick the koala up from behind. A koala can be picked up safely from behind by the lower forearms. Alternatively, bring the koala to the ground and hold it on the ground and ease into an appropriate catching bag. Do not pick up from the front by the ribcage or wrists.
- Put in a carrybox or similar properly-secured container.
- Prop animal up with towels into sitting position.
- Avoid unnecessary handling and avoid loud noise, dogs and unnecessary photos.
- Be conscious of possible injuries, such as fractures, when handling injured animals.
- If attending a road accident at night, rescuers should wear bright-coloured clothing to reduce the risk of being hit by other vehicles, or use a reflective sign.

*Conditions: Procedures for catching and retrieving koalas must be specified by the carer groups in seeking accreditation. Procedures should include methods of catching, holding and securing for transportation. Koalas may only be handled by an authorised person.*

#### **4.3. Transport**

- The koala must be restrained in containers for transport. Suitable containers include garbage bins with plenty of large holes for ventilation and air circulation; two clothes baskets tied together; or custom-made koala boxes.
- In emergency situations, hessian bags are suitable but not preferred- a light canvas bag or large pillowcase is adequate. Do not use hessian bags to contain koalas unless there is no alternative as they can damage claws and shed fibres that can be inhaled. Do not transport koalas suffering burns in canvas bags.
- Koalas are not to be transported on the body of carers.
- The koala should be kept dark, quiet, and warm (15-25 degrees Celsius).
- Do not transport the koala in the boot, or with dogs in the vehicle, or with the radio on.
- Be conscious of the time factor - act quickly and get the animal to a vet or carer by the most direct route.
- If possible, transport the koala with leaves picked from the area. The smell may relieve some stress.
- Do not leave koalas in any container for a long period.
- Ensure that the koala and container are out of direct sunlight when being transported.

- Koalas should not be moved from home care unless for treatment or to an external location within the home care premises or for the purposes of pre-release or release to the wild.

*Conditions: Each koala care group is to establish detailed criteria under which koalas are to be transported.*

## **5. CRITERIA FOR ENTERING CARE OR FOR EUTHANASIA**

- The following questions should be asked:
  - a) Should the koala be released immediately?
  - b) Is it able to be rehabilitated?
  - c) Is euthanasia the best welfare option?
- The decision on the fate of the koala is to be made by the carer and a vet and/or koala coordinator.
- In deciding, a note is to be taken of the animal's past history if its identification is known (eg. by microchip or eartag).
- Reasons for euthanasia include:
  - a) No chance of a normal life, eg. loss of tongue, limb;
  - b) Signs of extreme pain and stress;
  - c) Serious and multiple wounds eg. from dog bites which usually become infected.
- Euthanasia to be performed by a vet.
- If a fire victim, burns on paws are not always evident for a couple of days, so the animal should be held for later assessment.

*Conditions: The decision to take a koala into care or to euthanase is to be made by the carer and a veterinarian and/or group co-ordinator. The carer group must review each decision to assist in refining the decision making process. A record of the reasons for decision must be kept on a standard record form.*

## **6. CARE**

There are three stages in the care of koalas:

1. First 12 hours - may be temporary care following rescue;
2. Next 48 hours - koalas are considered wild in care;
3. Long-term care (greater than 48 hours) - koalas are considered captive;

The conditions for long-term care require a substantial commitment of resources, time and record keeping. The only reason for long-term care is that the koala is likely to improve in health and be rehabilitated to the wild.

*Conditions: Detailed specifications, record sheets, inspection procedures and care protocol need to be formally established for koalas in long-term care as a requirement for accreditation.*

### **6.1 Assessment**

- The initial assessment of the koala needs to be thorough but should be performed with as little disturbance as possible.
- Check the pouch to see if a joey is attached to the teat. If so, do not anaesthetise the mother.
- Koalas should be assessed for wounds, fractures (including jaw area), ticks, swollen lymph glands, anaemia (check colour of gums) as well as more obvious signs such as wet bottom and conjunctivitis.
- Koalas should be weighed. Normal body weights vary across the koala's range. Carers should be aware of the normal body weights for different ages and sex of the koalas in their area.
- *Chlamydia* status can be checked by the clinical presence of conjunctivitis and wet bottom. Clearview test kits may help.
- Dehydration can be critical in sick animals. Hydration status can be assessed by changes in skin tone. In normal condition, the skin over the scapula (shoulder blade) area should slide freely and, when pinched, skin on the top of the head, between the ears, should snap quickly back to place. Dry rough skin on the paws and nose is a sign of dehydration.
- Body condition can be assessed by palpation over the scapula area. In poor condition, the edges and spine of the scapula become prominent.
- Body temperature can be checked. Normal body temperature is 35.5-36.5°C.
- In care having been assessed by a vet.
- There should be a monthly review of koalas in long-term care by the carer group co-ordinator and records to be kept of the decision to remain in care.
- Mature/aged koalas in excess of 8 years, particularly males, should not be held in captive conditions for more than 6 months.
- Koalas in care for more than 6 months should be re-evaluated.
- A check list for assessment should be prepared by the care group. An opportunity exists here for an exchange of information among care groups as to what should be on this list.

*Conditions: The health status of the koala must be assessed to decide what treatment the koala requires. A decision must be made and recorded by the carer as to whether the koala is to be released within 48 hours or to go into long-term care.*

## **6.2. Holding /Housing**

- Minimum standards should be identified by the group and deal with all aspects of holding and housing. The Standards for Exhibiting Koalas set by NSW Agriculture (Appendix 1) may be used as a guide. Standards should be set for conditions under temporary holding, normal care, intensive care and long-term care.
- Many issues have been identified for consideration. These include:
  - a quiet environment;
  - not accessed by the public;
  - walls and floors should be constructed of materials which can be easily sterilised;
  - design to be such that temperature is controlled, with natural lighting and ventilation;
  - use of lawn lockers, garages and laundries are not suitable.

- Koalas in care for more than 12 hours should be contained in housing more structured than the conditions necessary for the rescue and holding in the first 12 hours.
- Depending on the state of the animal, a licensed carer is to decide how the animal is to be housed. Temporary housing may include baskets, cots or enclosures.
- Diseased koalas should be housed in isolation from other koalas.

*Conditions: The minimum standards for enclosure design and management must be prepared by each carer group as a requirement for accreditation. This must include housing requirements for koalas under intensive care as well as non-intensive care, temporary holding and long-term care.*

### **6.3. Diet**

#### **6.3.1. Fluid balance**

- Dehydration can be critical in sick animals. The following are offered to rectify and maintain positive fluid balance.
- Drip under veterinary supervision.
- Subcutaneous fluids under veterinary supervision.
- Oral fluids can be administered, such as “Lectade” and “Portagen”. Dehydrated koalas which don’t recognise free water should accept fluids via a syringe.
- Koalas should be encouraged to lap fluid from a shallow container. Feeding by unnatural methods, such as syringes and eye droppers, should be restricted to animals which are incapable of lapping.
- Milk supplements should only be given to injured, sick, dehydrated or juvenile animals.
- Other ways to restore and maintain positive fluid balance are:
  - a) feed younger leaves;
  - b) spray leaves with water before offering;
  - c) ensure leaves are as fresh as possible and standing in water.

#### **6.3.2. Dietary supplements**

- Supplementary feeding with:
  - a) “Portagen”/ high protein baby cereal. If adding high protein baby cereal, changes in faeces should be closely monitored; excess use can cause diarrhoea.
  - b) “Wombaroo”
  - c) Glucose and water
  - d) “Divetelac”
  - e) “Prosobee”
  - f) Yoghurt in the milk mixtures.

#### **6.3.3. Leaves**

- Offer three to five species a minimum of twice daily in areas where this is possible. Wet the leaves with water spray, and stand leaves in container with water supply. Also offer a supply of clean bark, water and dirt, unless on a drip or immobile.

- Leaves are to be collected from trees in such a manner as not to destroy the bush. Leaves should not be collected from the roadside where they are likely to be contaminated with high levels of lead.
- A list should be prepared of preferred koala browse leaves available in the area of the carer group.
- Carers should demonstrate that they have guaranteed access to adequate supplies of fresh leaves.
- Koalas should be offered the leaf species found in the potential release area.

*Conditions: The diet, method of feeding and source and species of leaves must be codified by the carer group as a requirement for accreditation.*

## **7. ORPHANED/HAND-REARED KOALAS**

- A hand-reared orphan is back or pouch young raised by a carer.
- Orphaned koalas present the problem of knowing the right age or weight for release. Koalas are normally independent at 18 months (2-3 kilograms; the range generally represents the geographical increase in weight from north to south. However, local population variation on weight is acknowledged and in establishing criteria for orphans, local background data are to be included in the submission for accreditation.) The age or weight at release should not be greater than the age or weight at which the koala would normally be independent of its mother. However, orphans from diseased and aged koalas, or mothers who have been sick or injured for some time before being found, are usually debilitated, dehydrated and hence small for their age and slow to grow. On the other hand, orphans from road kills are often well fed and developed and adapt well to hand rearing. Thus discretion must be taken when assessing the weight/age of orphans.
- The regular weighing of an orphan to ensure adequate weekly weight gains, observing progress, independence and activity should help indicate the time for release.
- The date of release and hence the length of time the koala is kept in care is an issue, especially if it coincides with the tick and breeding season. For males, this release time could cause extra stress. Alternatively, this is the normal time for dispersal and establishment for males.

*Conditions: The age or weight at release of orphaned koalas must not be greater than the age or weight at which the koala would normally be independent of its mother. Carer groups must establish criteria for identifying, caring for and releasing an orphan, including a weight that is appropriate for the local area, as a requirement for accreditation.*

## **8. PUBLIC EXHIBITION**

At no time should koalas being rehabilitated for eventual release be placed on public exhibition or used for educational purposes. Contact with humans should be minimised at all times to ensure koalas maintain a healthy fear of human presence.

*Conditions: Koalas in care undergoing rehabilitation must not be placed on public exhibition or be used for educational purposes.*

## **9. CRITERIA FOR RELEASE**

- At regular intervals the carer and vet must consult on the welfare and state of the animal. Communication must be maintained between carer, co-ordinator and vet to decide on release date.
- A set of criteria to assess ability to be released to be developed by each carer group.

For example:

| <b>Category</b>                                          | <b>Criteria for release</b>                                    |
|----------------------------------------------------------|----------------------------------------------------------------|
| Age                                                      | > weaning age (2 kg)                                           |
| Teeth wear                                               | not worn down to gums (Vet assessment required for old koalas) |
| Eyes                                                     | bright, clear, clean                                           |
| Ability to climb                                         | must be able to climb - check for healing of injuries          |
| Ability to feed                                          | independent feeding - check for healing of jaw injuries        |
| Chlamydia status                                         | absence of wet bottom/ conjunctivitis/ swollen lymph nodes     |
| Body weight maintenance                                  | consistent with age and history and holding body weight        |
| Behaviour                                                | appears alert, ears up, etc.                                   |
| Signs of capture stress, need to be released immediately | pacing behaviour, vocalisations                                |

- Release at the earliest opportunity. For koalas in long-term care, animals may be retained for one week after treatment has finished to monitor if symptoms return.

*Conditions: Koalas must be released at the earliest opportunity, after having satisfied the criteria for release.*

## **10. PRE- RELEASE**

### **10.1 Rehabilitation for koalas in long-term care or hand-reared**

- Exercise wherever possible. Koalas with fractures should be in an area where it is at least able to walk after 6-8 weeks.
- Appropriately sized tree forks and cross branches should be available to the koala to match its development and confidence. These should be renewed whenever possible so that the bark is fresh.
- Hand-reared koalas should be gradually weaned into different stage trees and away from contact with the carer.



- Koalas in long-term care or hand-reared are to be placed in a rehabilitation area for a period of tree climbing under normal weather conditions prior to release. They should have access to the ground so they become familiar with travelling on the dirt and grass. Koalas should display natural behaviour as much as possible.
- Capture at night when the koalas come down to the ground is a good option to reduce stress and injury.

*Conditions: Koalas in long-term care or hand-reared must be placed in a rehabilitation area for a period of tree climbing under normal weather conditions prior to release.*

## **10.2 Identification**

- All koalas must be ear tagged. Ear tagging should be done, if possible, a couple of days before release. Koala ears are to be clipped and prepped with alcohol prior to tagging. Males are to be tagged in the left ear, females right ear. The tag should be placed with the point to the front of the ear so the tagger can check for veins and target the tag away from them.
- Ear tags must be numbered so that individual animals can be identified.
- Ear-tagging is to be applied only to koalas which are already in care and only by a trained person or under the supervision of a veterinary surgeon or a National Parks and Wildlife Service officer with appropriate experience, or a researcher holding a current Research Authority from an accredited Animal Care and Ethics Committee. A koala may not be captured for the sole purpose of tagging without both a Research Authority from the National Parks and Wildlife Service and an appropriate Research Authority from an Animal Care and Ethics Committee.
- Records must be kept of all tagged koalas.
- All koalas may be microchip, ie. a microchip inserted with a needle beneath the skin and read with an electronic microchip reader.
- Plucked hair for genetic studies of population is acceptable, and a convenient time to do this is while the koala is being marked, eg tagged and/or microchipped. The easiest way to pluck the hair is with tweezers or a pair of pliers to make sure that the bulb of tissue at the base of the hair is attached. It is this tissue that is analysed. Eight to ten hairs are sufficient, and on or around the ear can be a convenient site.

*Conditions: Koalas must be ear tagged prior to release by an appropriately trained person and records kept. The record form needs to part of the submission for accreditation.*

## **11. RELEASE / RELOCATION**

- Koalas should be released as close to their original encounter location as possible so that the animal has a reasonable opportunity to resume life in its original home range.

- Relocation should only be considered as a last resort to remove a koala from immediate and imminent danger or threat and where the koala is considered to be independent and appears to be in a healthy condition. The decision to relocate must be made by two people.
- A potential relocation or release site should not be a site of known high danger or threat (eg. beside a busy road). The original capture site can create dilemma for release if it is deemed to cause recurring injury over the short-term (eg. in a killer dog area or near a black spot on the road).
- A potential relocation site should preferably have secure tenure and compatible land management.
- A potential relocation site should be one known to already support a population of koalas.
- Relocations should be part of an approved strategy or local koala management plan which should consider potential adverse effects associated with manipulation of gene pools, spread of disease, potential inability of a koala to cope with relocation, potential disruption of resident koalas at the relocation site and potential destabilisation of koalas at the encounter site due to removal of a key individual. Care groups should prepare a list of potential relocation and release areas (where site of origin unknown), if there is no local strategy, and gain approval of district office of the National Parks and Wildlife Service and relevant landholders.
- The district office of the National Parks and Wildlife Service should be notified of the proposed release of all koalas so they have the option to attend.
- Release of koalas within Service areas will generally not be approved unless it is consistent with a Plan of Management or the animal was originally recovered from the area.
- Knowledge of koala habitat and any previous release or relocation of the animal is essential for deciding on relocation.
- Koalas which are suffering from a communicable disease should not be relocated to an area outside its home range.

*Conditions: The site of release of koalas must be as close to the initial encounter site as possible except for koalas being relocated out of immediate danger. The release of all koalas must be made in consultation with the district office of the National Parks and Wildlife Service.*

## **12. OPTIONS FOR NON RELEASABLE KOALAS**

- Option 1 - Euthanasia is acceptable for all suffering animals. If no possibility of reasonable care, euthanasia is the preferred option.
- Option 2 - Released into "safe" areas - eg rehabilitation or feral proof areas.
- Option 3 - Place into a licensed zoo or fauna park, which already holds a captive colony of koalas, with approval from the Director-General of NPWS.
- Option 4 - Used for teaching with approval from an Animal Care and Ethics Committee to be obtained by the recipient of the non-releasable koala.
- Option 5 - Used in research programs with approval from an Animal Care and Ethics Committee to be obtained by the recipient of the non-releasable koala.

*Conditions: Koalas deemed to be non-releasable must be either euthanased or, following the recipient obtaining an appropriate authority or licence, be placed in a licensed zoo or fauna park, kept in a “safe area” and/or used for teaching and research.*

### **13. PROTOCOL FOR DEAD KOALAS**

- Often when a carer is contacted, the koala is already dead, usually killed by a car or a dog. The information on blackspots is valuable to record, and samples from these koalas can contribute to research. Collect all relevant information, where possible, such as location, cause of death, date, sex and aged of koala.
- Samples are to be made available for research, where possible.
- An autopsy protocol is to be established. All koalas should be autopsied where cause of death is not positively known. An option that can be utilised is the Wildlife Pathology Service (University of Sydney free service).

*Conditions: Autopsies must be undertaken where possible, a protocol established, and animals or tissues made available to researchers.*

### **14. RECORD KEEPING**

- Each koala must be given a registration number, call number or identifying code at rescue.
- Each carer should keep records of all animals which come into their care and a database should be kept by one nominated person to register and regularly update all details within each group. Records should be kept in duplicate, eg. hardcopy and on disc. Copies should be provided to the district NPWS on a regular basis, who then send these at least annually to the licensing unit in Field Services Division in Head Office.
- Records should be kept on standard forms. The care group should develop a detailed standard record form(s) for individual carers.
- The following details should be recorded: time and date of rescue, location of rescue, name and phone numbers of initial contacts, rescuers and carers, circumstances for being taken into care, approximate age, weight, sex of the koala, condition of the koala, treatment undertaken, veterinary details, daily records of eating, urinating, defecating, observations and approximate volumes, treatments and dosages, type of leaf offered and eaten, identification tag number, fate including release or relocation details or autopsy results.
- Recording of the original location of koalas, including details of habitat, on Atlas of NSW Wildlife data cards is encouraged.

*Conditions: A standard record sheet must be prepared for each rescued koala. Each koala rescued must be given an identifying code. The record sheet must accompany the koala and a copy kept in a central record system of the carer group. The care group must develop a detailed standard record form(s) for individual carers as a requirement for accreditation.*

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**APPENDIX 1**

**Standards for Exhibiting Koalas**

*(Phascolarctos cinereus)*

**in New South Wales**

**Exhibited Animals Protection Act, 1986**

A publication of the Director-General, NSW Agriculture  
pertaining to the conditions of display of koalas  
(pursuant to Clause 8(2) of the Exhibited Animals Protection Regulations, 1995)



## **GENERAL REQUIREMENTS**

### **1.1 Construction**

- a) Enclosures shall be constructed of such materials and be maintained in sufficiently good repair to ensure that they will contain the animals at all times and are to be safe for the animals, for the staff attending them, and for the public.
- b) Enclosures, or the perimeter fence in the case of an establishment where koalas are permitted to free range, shall be designed in such a way as to prevent the entry of wild koalas. This requirement only applies to establishments located in areas where wild koalas are known to occur.
- c) Enclosures may be of open, semi-enclosed or totally enclosed design.
- d) Sufficient shelter must be provided to allow protection from wind, rain and extremes in temperature and allow sufficient access to shade during the hot periods of the day.
- e) The size and shape of enclosures for *P.cinereus* shall provide freedom of movement, both vertically and horizontally.
- f) The enclosure shall be well drained and have either a readily cleanable substrate or be of a material which can be replaced to avoid the accumulation of faeces and urine.

### **1.2 Isolation Facilities**

Suitable isolation facilities shall be provided for quarantine of incoming or sick animals.

### **1.3 Protection from Noise, Harassment and Stress**

Each operator exhibiting koalas to the public shall:

- a) Provide a sufficient number of experienced, identifiable staff in attendance at any session allowing visitors to handle koalas to protect the koalas from abuse and harassment where koala handling occurs and to ensure that stress on the koalas does not occur.
- b) Ensure koalas are not placed directly on any visitor or directly held by any visitor for any purpose. Handling koalas by members of the public shall be restricted to patting, stroking and cuddling to the extent of putting an arm around the koala while the animal remains on a fixed perch.
- c) Ensure that koalas are not repeatedly removed from objects to which they are clinging.

#### **1.4 Enclosure Furniture**

- a) There must be at least two tree forks per koala not less than 1.8 metres above ground and not closer than 0.9 metres to the next fork.
- b) All supports and branches shall provide sufficient traction for koalas to climb easily and safely.

#### **Clause 2 Hygiene**

Substrate of enclosures shall be cleaned daily. The supports and branches shall be replaced as necessary and be maintained in a clean and hygienic condition, free from the accumulation of faeces and urine.

#### **Clause 3 Records**

##### **3.1 Identification**

Each koala shall be individually identified by an approved method of identification.

##### **3.2 Record-Keeping**

- a) Establishments shall keep records of all koalas on an individual basis in a form which can be quickly and easily examined, analysed and compared with those kept by other establishments.
- b) All documents and other information pertaining to each animal, including records from previous locations, must be kept safely. Animals moving to new locations must be accompanied by copies of all records relevant to those animals.
- c) The records shall provide for each koala at least the following information:
  - i) the correct identification number, scientific name, any personal name and any distinctive markings;
  - ii) the origin (i.e. details of the wild population or of the parents and their origin, and of any previous location);
  - iii) the dates of acquisition and disposal, with details of circumstances and addresses;

- iv) the date or estimated date of birth, and the basis on which the date is estimated, or the date of the first emergence of the juvenile from the pouch;
  - v) weight on arrival, and thereafter monthly. The requirement for weighing animals monthly shall not apply to koalas which are either free-ranging within the perimeter barrier of the establishment, or are not dependent on hand-feeding for nourishment.
  - vi) clinical data, including results of physical examination by a qualified veterinarian and details of and date when any form of treatment was given, together with results of routine health examinations;
  - vii) breeding and details of any offspring;
  - viii) the date of death and the results of the post mortem reports which must be performed by a qualified veterinarian.
- d) The Director-General may require records of daily leaf collections to be maintained, including details of -
- i) leaf species,
  - ii) area of collection,
  - iii) weights of leaves before and after feeding,
  - iv) the identities of the koalas which fed on the leaves.

Records may be required to be submitted to the Director-General at three monthly intervals for a period of two years from the date of initial issue of a permit to exhibit koalas.

### **3.3 Transaction Records**

- a) A written report, including records of any clinical observations, shall be submitted to the Director-General within 30 days, on every transport operation, in particular detailing any problems arising and with suggestions as to how these may be avoided.
- b) The Director-General must keep a current summary of transport advice, based on these reports and provide a copy to applicants for their information.

## Clause 4      Diet and food collection

### 4.1      General

a)      An establishment applying for a permit to exhibit koalas must satisfy the Director-General that it has guaranteed access to adequate fresh supplies of leaves from at least three suitable koala food tree species. This is important when particular species can be susceptible to insect attack at particular times of the year. Known food trees include the species listed below:

|                        |                          |
|------------------------|--------------------------|
| <i>E.botryoides</i>    | Southern Mahogany        |
| <i>E.camaldulensis</i> | River Red Gum            |
| <i>E.camphora</i>      | Broad-leafed Sally       |
| <i>E.citriodora</i>    | Lemon-scented Gum        |
| <i>E.cypellocarpa</i>  | Mountain Grey Gum        |
| <i>E.goniocalyx</i>    | Long-leafed Box          |
| <i>E.grandis</i>       | Flooded Gum              |
| <i>E.haemastoma</i>    | Scribbly Gum             |
| <i>E.maculata</i>      | Spotted Gum              |
| <i>E.microcorys</i>    | Tallowwood               |
| <i>E.nicholii</i>      | Small-leafed Peppermint  |
| <i>E.obliqua</i>       | Messmate                 |
| <i>E.ovata</i>         | Swamp Gum                |
| <i>E.paniculata</i>    | Grey Ironbark            |
| <i>E.pilularis</i>     | Blackbutt                |
| <i>E.propinqua</i>     | Small-fruited Grey Gum   |
| <i>E.punctata</i>      | NSW Grey Gum             |
| <i>E.radiata</i>       | Narrow-leafed Peppermint |
| <i>E.robusta</i>       | Small Mahogany           |
| <i>E.rubida</i>        | Candle Bark              |
| <i>E.saligna</i>       | Sydney Blue Gum          |
| <i>E.scoparia</i>      | Wallengarra White Gum    |
| <i>E.sideroxyton</i>   | Red Iron Bark            |
| <i>E.tereticornis</i>  | Forest Red Gum           |
| <i>E.viminalis</i>     | Manna Gum                |

- b)      A sufficient quantity of eucalypt leaves shall be provided continuously and replaced at least once daily.
- c)      Preferred species of eucalypt should be supplemented by a variety of different species of eucalypt as a precaution against local or seasonal differences in digestibility and palatability of dietary leaf matter. Both young and mature leaves should be provided.
- d)      Feed must be presented as close and accessible to the koalas perch as possible and care taken to prevent wastage of feed placed out of reach.

- e) Fresh soil shall be provided, but not around the base of perches, to provide for supplementation of mineral intake or alternatively a mineral salt lick be provided.
- f) Clean accessible drinking water facilities shall be provided. Water shall be replaced at least once daily.

#### **4.2 Quality of Food Leaves**

Frequency of leaf cutting and the operation of leaf storage facilities shall ensure the koalas receive palatable, uncontaminated, nutritionally adequate food leaves.

### **Clause 5 Transport**

#### **5.1 Quarantine**

- a) Koalas to be transferred between establishments must be subject to a period of 30 days quarantine at either the importing or exporting establishment unless an exemption from the quarantine period is advised and certified by a veterinarian following a complete veterinary examination.

The certificate must also establish that the koala is -

- i) not in a weakened or emaciated condition; and
- ii) is free from
  - keratoconjunctivitis,
  - pneumonia,
  - dermatitis, and
  - urogenital discharge,

before release from quarantine.

#### **5.2 Transport Cage**

Koalas must be transported individually in solid framed cages measuring at least 95cm x 75cm x 95cm high. The cages must have removable, leakproof metal drop trays fitted at the base. Sides and top must be of stout wire mesh and be fitted with light hessian or shade cloth covers. Each cage must be fitted with a resting branch providing at least two forks.

### **5.3 Feeding in Transit**

- a) Koalas must each be accompanied by at least 3.6kg of the leaves on which they are normally fed; the leaves being left on the stem and the base of the stem remaining in water or sealed.
- b) One kilogram of these leaves must be placed in the cage with the koala before departure.

### **5.4 Stress Reduction**

- a) Koalas must not be subjected to temperatures greater than 30 degrees or less than 10 degrees Centigrade during the trip.
- b) Koalas must be accompanied by a keeper familiar with the animals being transported at all times except during air transport.
- c) Noise must be minimised during transport.
- d) Time from caging to destination must be minimised.

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