

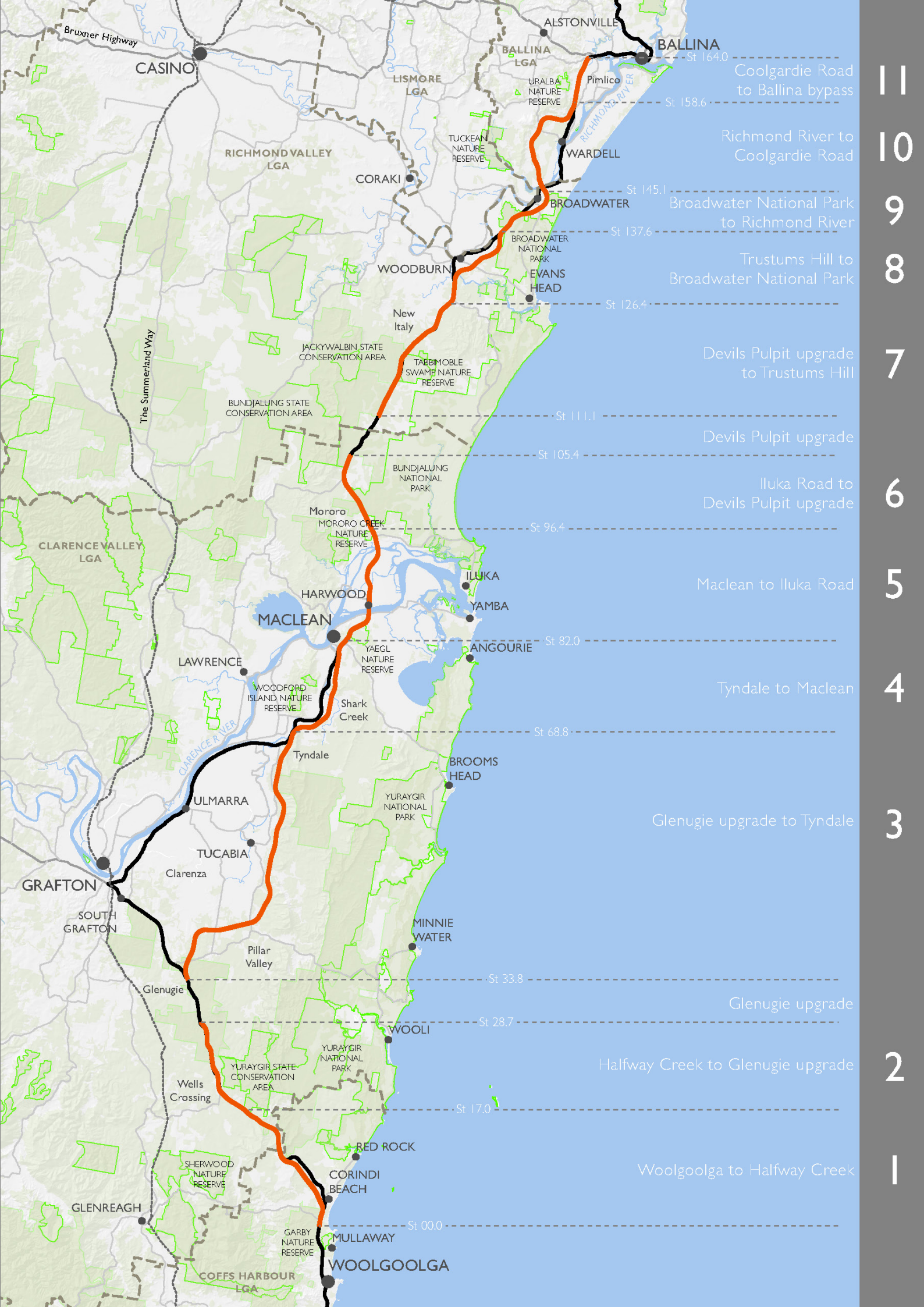


Roads &
Maritime

Biodiversity Mitigation Framework

**Woolgoolga to Ballina Pacific Highway
upgrade**

April 2015



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Glossary and Abbreviations

Term	Definition
BACI	Before and After Control Sites (BACI) is a form of monitoring methodology being used to assess impacts on nominated threatened species. The adopted approach focuses on a paired sampling strategy that allows for comparing populations that could be subject to impacts from the project and compares them to other nearby populations that occur in adjacent areas unaffected by the project. This method allows for the assessment of the success of mitigative measures.
BMF	Biodiversity Mitigation Framework (this document)
CEMP	Construction Environmental Management Plan
CoA	Conditions of Approval
Construction footprint	The direct area of the design alignment (also referred to as the clearance limits)
Direct impact	An impact that causes direct harm within the project boundary (i.e. clearing of vegetation)
DoE	Commonwealth Department of the Environment (formally known as the Department of Sustainability, Environment, Water, Population and Communities)
DP&E	NSW Department of Planning and Environment (formally known as Department of Planning and Infrastructure)
DPI	NSW Department of Primary Industries
EIS	Environmental Impact Statement
EPA	NSW Environment Protection Authority
EP&A Act	<i>Environmental Planning and Assessment Act 1979</i>
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
EIS	Environmental Impact Statement (Biodiversity Assessment Working Paper)
EWMS	Environmental work method statement
FFMP	Flora and Fauna Management Plan
Hydro-period	The period in which a soil area is waterlogged
Indirect impact	An impact that causes harm outside of the project boundary as a result of a direct impact (i.e. edge effects, erosion, changes in water quality etc.)
<i>In situ</i>	Locations where threatened plant populations already exist and occur naturally in the landscape and will be retained and managed. They are within the project boundary but outside the construction footprint.
MCoA	Ministers Condition of Approval
NSW	New South Wales
OEH	Office of Environment and Heritage
Offset	An offset may be an area of land that is protected and managed to improve biodiversity values or an action that compensates for adverse impacts to biodiversity. Requirements for offsets are determined using an objective assessment of predicted loss of biodiversity at the development site and expected gain in biodiversity to be achieved at the offset site.
Trigger for corrective action	This is a measurable target that, should it be reached, will trigger an assessment as to why the mitigation objectives are not being met and the implementation of appropriate corrective action.
The Project	Refers to all the proposed works in all eleven sections which includes the construction footprint with a 10 metre construction buffer, ancillary and compound sites and design changes.
Revegetation	The planting of native species to stabilise areas and restore bushland in areas that were required to be cleared as a result of construction, but not required for ongoing highway operations.
Roads and Maritime	NSW Roads and Maritime Services
SAP	Sensitive Area Plans
SPIR	Submissions / Preferred Infrastructure Report
Suitably qualified and experienced persons	A person with a tertiary degree in a related field (e.g. Environmental Science / Ecology) with a minimum five years of experience conducting targeted frog surveys, and for projects of a similar scale and complexity as the W2B project.
Targeted surveys	Field surveys completed post SPIR between 2013-2015 that included targeted surveys for threatened species currently listed under the provisions of the EPBC Act and TSC Act.
Threatened species	Any organism listed as vulnerable, endangered or critically endangered under state and/or Commonwealth legislation.
TSC Act	<i>Threatened Species Conservation Act 1995</i>
UDLP	Urban Design and Landscape Plan
W2B	Woolgoolga to Ballina Pacific Highway Upgrade
W2G	Woolgoolga to Glenugie Project

Term	Definition
Weeds	Plants that may threaten agricultural land adjacent to the project, have detrimental effects on the natural environment or impact human health. Includes noxious weed species under the <i>Noxious Weeds Act 1993</i> as categories W1, W2, W3 or W4.
WQMP	Water Quality Management Program

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 under Part 5.1 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) on 24 June 2014 and the *Environment Protection and Biodiversity Conservation Act 1999* (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 on completion will complete the four-lane divided road program between Hexham and the NSW / Queensland border. For the purposes of the EIS the project has been divided into 11 sections as illustrated in the figure above.

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.

Construction and delivery of the project will be undertaken in a number of separate stages. These stages are detailed in the Staging Report prepared to satisfy NSW Government Approval – Minister's Condition of Approval (MCoA) A7. The Staging Report was submitted to the Secretary of NSW Department of Planning and Environment and Commonwealth Minister of Department of the Environment on 24 March 2015.

The Project is separated into 11 Sections as outlined below:

- Section 1 – Woolgoolga to Halfway Creek
- Section 2 – Halfway Creek to Glenugie
- Section 3 – Glenugie interchange to the Tyndale interchange
- Section 4 – Tyndale interchange to the existing highway at the Maclean interchange
- Section 5 – Maclean interchange to the Iluka Road interchange at Woombah
- Section 6 – Iluka Road at Woombah to Devil's Pulpit
- Section 7 – Devils Pulpit to Trustums Hill
- Section 8 – Trustums Hill to Broadwater National Park
- Section 9 – Broadwater National Park to the Richmond River
- Section 10 – Richmond River to the interchange at Coolgardie Road
- Section 11 – Coolgardie Road to the tie-in with the Pimlico to Teven project.

The project is 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 Stage 1 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, with Glenugie and Devils Pulpit now complete. Altogether, these three projects would upgrade 164 kilometres of the Pacific Highway. The project does include a partial upgrade of the existing dual carriageways at Halfway Creek.

For a more detailed project description (as approved in late 2014) refer to the Roads and Maritime Services Woolgoolga to Ballina Pacific Highway Upgrade Submissions/Preferred Infrastructure Report (SPIR) dated November 2013 and the W2B Staging Plan.

The MCoA and EPBC Act approval requires Roads and Maritime to develop a Mitigation Framework to outline the finalisation of biodiversity plans, programs and strategies for the project, and map the relationships between each document. The MCoA also require the preparation and implementation of Threatened Species Management Plans (TSMPs) for species identified as significantly impacted in the Environmental Impact Statement (EIS) and SPIR, or as subsequently determined within the Mitigation Framework.

Roads and Maritime is managing the delivery of supplementary targeted surveys, pre-construction baseline surveys and finalisation of the TSMPs to meet State and Federal conditions of approval.

1.2 Purpose and objectives of the framework

The purpose of this Biodiversity Mitigation Framework (BMF) is to address the:

- NSW MCoA, in particular Condition D1; and
- EPBC Act approval conditions, in particular Condition 14.

The objectives of the BMF are to:

- Provide details regarding the biodiversity plans, programs and strategies being prepared, how they inform and relate to each other, the project sections and biodiversity values they relate to.
- Provide a summary of the targeted survey methods and a reference to compliance of targeted threatened species surveys with relevant State and Commonwealth survey guidelines.
- Summarise changes to avoid/mitigate/offset measures post the SPIR as a result of supplementary surveys and levels of impact on biodiversity.
- Provide a process for the updating of TSMPs.
- Provide schedules for the delivery of targeted surveys, biodiversity plans, programs and strategies referenced within the BMF.

The State conditions of approval applicable to the BMF are listed in **Table 1-1** and EPBC Act conditions applicable to the BMF are listed in **Table 1-2**, along with reference to where these requirements are addressed in this document.

Table 1-1 Minister's Conditions of Approval Applicable to the Mitigation Framework

Infrastructure Approval

Section 115ZB of the *Environmental Planning and Assessment Act 1979*

24 June 2014

Condition No	Condition Details	Chapter of Document
D1	The applicant shall develop a framework for finalising mitigation measures for threatened species. This Mitigation Framework shall be developed by a suitably qualified and experienced ecologist in consultation with DPI (Fisheries), EPA and DoE, and submitted to the satisfaction of the Secretary prior to commencement of detailed design of the relevant stage, unless otherwise agreed by the Secretary. The Mitigation Framework shall detail the process for finalising the biodiversity strategies, plans and programs required under this approval.	Entire document forms the Mitigation Framework. Authors and consultation are described in Chapter 1. Process for finalising documents and surveys are outlined in Appendix B.
D1(a)	a description of the survey methodologies for all proposed pre-construction species and habitat surveys (including 2013-2014 spring and summer seasons and as otherwise required under this project approval), and with reference where relevant to compliance with relevant NSW and Commonwealth field survey methods and guidelines	Chapter 4
D1(b)	a summary of potential changes to the avoidance, mitigation and/or offset measures specific in original documents (A2 of state approval) justified by survey results of D1a)	Chapter 5
D1(c)	a summary of the potential avoidance, mitigation and/or offset measures for all species for which the proposed level of impact or mitigation required differs from that assessed in the documents listed in condition A2, including evidence that those measures would achieve the same or an improved biodiversity outcome	Chapter 5
D1(d)	Provision for updating the relevant Threatened Species Management Plans required under MCoA Condition D8.	Chapter 6 and Appendix B
D1(e)	A schedule for submission of all biodiversity strategies, plans and programs required under this approval in accordance with the requirements for submission in Conditions D1(a) to D1(d).	Appendix B

Table 1-2 EPBC Act approval conditions applicable to the Mitigation Framework
Section 130(1) and 133 of the Environmental Protection and Biodiversity Conservation Act 1999 (EPBC 2012/6394)
14 August 2014

Condition No	Condition Details	Section of Document
14	In order to minimise impacts to threatened species and communities, and migratory species, the approval holder must develop and implement all Frameworks, Strategies Plans or Programs, in accordance with the requirements of the following NSW approval conditions: <ul style="list-style-type: none"> a) The Mitigation Framework required by NSW approval condition D1; b) The Connectivity Strategy required by NSW approval condition D2 and the requirements of NSW approval condition B12; c) The Threatened Species Management Plans required by NSW approval condition D8 and D9; d) The Construction Soil and Water Quality Management Plan required by NSW approval condition D26(c); e) The Construction Flora and Fauna Management Plan required by NSW approval condition D26(e) ; f) The Borrow Site Management Plan required by NSW approval condition D22; g) The Water Quality Monitoring Program required by NSW approval condition D12; and h) The Ancillary Facilities Management Plan required by NSW approval condition D21. 	Entire document forms the Mitigation Framework referenced in CoA 14(a).

1.3 Authors

Roads and Maritime has commissioned senior ecologists and environmental scientists from Amec Foster Wheeler with experience in conducting surveys for threatened species and preparing threatened species management plans to prepare the BMF. These personnel are listed in **Table 1-3**, along with a summary of their qualifications and experience.

Table 1-3 Authors of the BMF

Personnel	Qualifications	Experience
Berlinda Ezzy	Bachelor of Applied Science, Natural Systems and Wildlife Management (Honours)	Berlinda has 14 years professional experience that includes working in the areas of environmental planning, environmental impact assessments, ecology and environmental offsets. Berlinda's experience includes managing flora and fauna studies, including targeted surveys for threatened species. Berlinda also has extensive experience delivering and managing environmental offsets including application of various offset assessment tools. Berlinda has also prepared numerous threatened species management plans that identify potential impacts, mitigation measures and monitoring methods and programs. Berlinda has comprehensive knowledge and experience with State and Commonwealth legislation regarding environmental impact assessment, threatened species management and environmental offset policies. Berlinda also has experience in natural resource management including vegetation management, fire management, weed management and ecological monitoring. This has been demonstrated through her experience preparing and implementing offset management plans. Berlinda has project managed small and large scale projects in Queensland and New South Wales including in the mining, gas, roads and rail sectors.
Mitch Taylor	Bachelor of Environmental Science	Mitch is a senior ecologist with 10 years consulting experience in Queensland and New South Wales. Mitch is a fauna specialist and has led a number of targeted fauna surveys and management strategies in Qld and NSW. Mitch has completed impact

Personnel	Qualifications	Experience
		<p>assessments in relation to threatened fauna and developed tailored mitigation strategies and monitoring programs. Mitch is licensed by the appropriate authorities to undertake flora and fauna investigations.</p> <p>Mitch's experience in NSW includes:</p> <ul style="list-style-type: none"> Conducting surveys for threatened microbats and developing management programs in the northern rivers and south western deserts of NSW for mining and quarry development. Targeted threatened fauna assessments and impact assessments throughout the northern rivers of NSW for various large scale residential developments and quarry developments. In-field implementation of threatened fauna management plans including one of Australia's largest macropod management programs. Threatened flora and ecological community assessments for large scale residential developments in the Lismore, Ballina and Grafton areas.
Richard Floyd	Bachelor of Science Graduate Diploma Natural Resources (Ecosystem Management)	Richard Floyd has more than 19 years' professional experience undertaking and managing ecology studies throughout Australia. Richard's experience has primarily been with mining and linear infrastructure such as roads, rail and pipelines. He has coordinated aquatic and terrestrial ecology studies for numerous major projects within Australia. Richard has developed threatened species management plans including management and monitoring regimes for the conservation of threatened flora and fauna species, including NSW. Richard is licensed by the appropriate authorities to undertake flora and fauna investigations.

1.4 Agency Consultation

The BMF has been developed in consultation with the NSW Department of Planning and Environment (DP&E), the NSW Environmental Protection Agency (EPA), the Department of Primary Industries (DPI) Fisheries and the Commonwealth Department of the Environment (DoE). Prior to implementation, the BMF will be updated following agency review to incorporate any necessary changes. Full details of agency consultation comments and responses are included as **Appendix A**.

1.5 Document Updates

The BMF provides an overarching framework for the W2B project, summarising the supplementary targeted ecological surveys and methods that have been completed post project approval and the biodiversity plans, programs and strategies to be developed including timing of submission to regulatory agencies for approval.

It is not intended that the BMF itself will require regular updates. Rather, it is proposed that prior to construction commencing for each section, the individual plans and programs (such as TSMPs) will be submitted for approval to regulatory agencies. MCoA (A8) requires that Roads and Maritime ensure that any strategy, plan, program or other document required by the conditions of approval and relevant to each stage is submitted to the Secretary no later than one month prior to the commencement of the relevant stage(s), unless otherwise agreed by the Secretary. Refer to **Section 3** for further details.

Delivery schedules regarding the estimated timing for delivery of pre-construction targeted surveys and reports is provided in **Appendix B** of the BMF. These will be updated as required by Roads and Maritime and will be submitted to regulatory agencies for their information.

2. Impact Assessment and Approvals

A summary of the W2B project approvals process and ongoing refinements to the project design is summarised below. A diagram summarising the key stages completed up to the preparation of this BMF and subsequent stages to project implementation is illustrated in **Figure 2-1**.

2.1 Environmental Impact Assessment

Roads and Maritime commissioned detailed biodiversity studies (including ecological surveys) between 2006 and 2012 as part of the route selection process. These studies took a robust approach aimed at providing a level of detail sufficient for inclusion in the environmental impact statement (EIS) and were planned for consistency with survey guidelines outlined in the *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities* (Department of Environment and Conservation (DEC) 2004).

The project was referred to the Commonwealth Department of the Environment (DoE) (previously Department of Sustainability, Environment, Water, Population and Community) in May 2012. The project was declared to be a controlled action under the EPBC Act on 20 June 2012, requiring assessment and approval by the Federal Minister for the Environment. The majority of the Commonwealth requirements to be addressed for this approval were incorporated into the NSW Department of Planning and Environment (DP&E) environmental assessment requirements for the project EIS.

The EIS was submitted to the NSW DP&E on 12 December 2012, seeking approval for the project under Part 5.1 of the EP&A Act, and was placed on public exhibition for 69 days up to 18 February 2013. During and following the exhibition of the EIS, 145 submissions were received from the community, councils and government agencies.

Taking into consideration submissions and results of consultation with regulatory authorities a number of additional ecological studies were then commissioned by Roads and Maritime. A number of refinements were made to the design of the project to minimise impacts on the environment, cultural heritage and community. Taking into consideration the project refinements, new or revised assessments of the project's impacts on threatened species and threatened ecological communities, and revised environmental management measures to be implemented to mitigate the impacts of the project were documented and presented in a SPIR submitted to the Secretary in November 2013.

The SPIR included:

- Revised environmental management measures to be implemented to mitigate the impacts of the project (SPIR Appendix H).
- Supplementary biodiversity assessment report (SPIR Appendix E).
- Ecological Monitoring Program (SPIR Appendix K).
- For those threatened species where a significant impact may occur as a result of the project, Draft TSMPs were prepared to provide species-specific and site-specific mitigation measures and document a monitoring program and adaptive management approach (SPIR Appendix J).

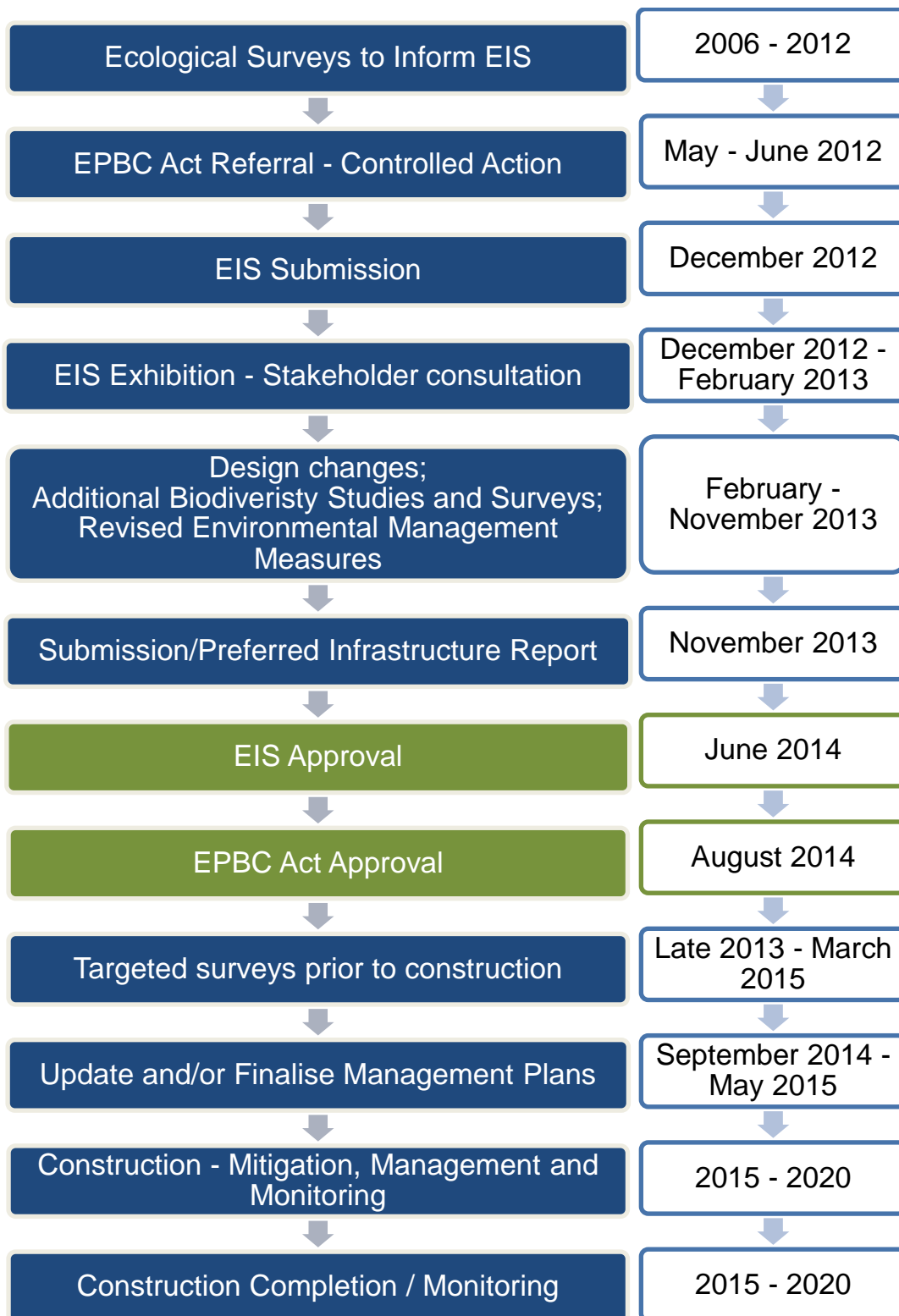


Figure 2-1 Project Approvals Process

2.2 Project Approval Conditions

Roads and Maritime received approval for the W2B project under Part 5.1 of the EP&A Act on 24 June 2014. The approval includes a number of conditions that relate to biodiversity conservation including threatened species management. The Minister's conditions that relate to the BMF and associated plans and strategies are summarised in **Table 3-1**.

Approval under sections 130(1) and 133 of the EPBC Act was granted on 14 August 2014. Controlling provisions relate to threatened species and communities, and migratory species. The approval includes a number of conditions that reflect the MCoA and relate to threatened flora and fauna species and communities. Those conditions that relate to the BMF and associated plans and strategies are summarised in **Table 3-2**.

These approvals include conditions pertaining to the preparation of additional biodiversity plans, strategies and programs, including the completion of pre-construction targeted ecological surveys, updates to TSMPs and development of management programs such as a Connectivity Strategy and Translocation Strategy for threatened plants which must be prepared, approved and implemented prior to commencement of construction.

As construction of the project will be staged, these documents are to be updated following targeted surveys for each stage prior to construction. Pre-construction reports for the first stage of the project are proposed to be completed in early 2015, prior to commencement of construction anticipated to commence in April 2015.

The Construction Environmental Management Plan (CEMP) and Construction Flora and Fauna Management Plan (FFMP) will be prepared and approved prior to construction commencing. They will then be implemented during construction for each stage. Monitoring will occur during construction and post construction as illustrated in **Figure 2-1**.

3. Mitigation Framework, Plans, Strategies and Programs

The MCoA and EPBC approval conditions (collectively referred to as conditions of approval (CoA)) outline the additional biodiversity plans, strategies and programs to be prepared and managed via the BMF.

The relationships between the BMF and project biodiversity plans, strategies and procedures are illustrated in **Table 3-1**. These documents work in conjunction to identify how the various State and Commonwealth biodiversity significant matters will be conserved and managed during the three phases of the project: pre-construction, construction and operation. In particular post project approval Roads and Maritime has commissioned targeted surveys and baseline surveys to establish monitoring programs. Post these surveys TSMPs and other relevant reports such as the Connectivity Strategy and Biodiversity Offset Strategy have been updated to incorporate survey results including by updating mitigation measures, the extent of impacts and monitoring program. These documents will then inform site specific construction related management plans including Construction Environmental Management Plan (CEMP).

A summary of the CoA as they relate to the BMF and subsequent biodiversity plans, strategies and procedures is provided in **Table 3-1** (State) and **Table 3-2** (Commonwealth), including a description as to how the conditions are being met. Please note this is not a comprehensive summary of all conditions but a summary of those key conditions pertaining to the main documents that inform the BMF.

In addition to submission and approval timeframes specified by the MCoA, the EPBC Act approval conditions (EPBC Act CoA 27) require that all frameworks, plans and strategies are published on the project website within one month of approval.

Figure 3-1 Mitigation Framework and Related Project Documentation

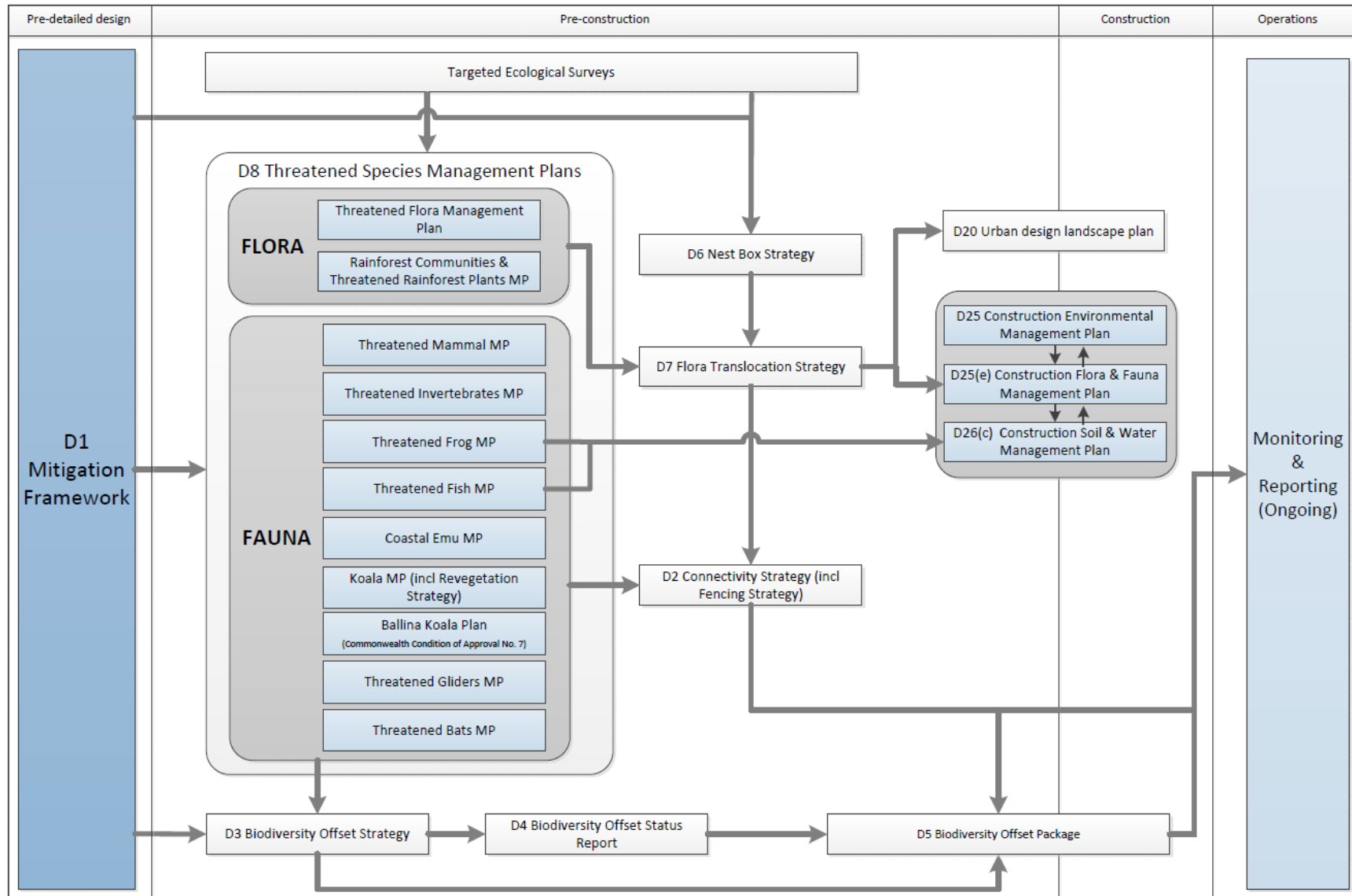


Table 3-1 Conditions of State Approval relating to BMF

State Approval

Condition No.	Document Title	Condition requirements	How conditions are being met
MCoA A7	Staging Report	<p>The Applicant may elect to construct and/or operate the State Significant Infrastructure (SSI) in stages. Where staging is proposed, the Applicant shall submit a Staging Report to the Secretary prior to the commencement of each proposed stage. The Staging Report shall provide details of:</p> <p>(a) how the SSI would be staged, including general details of work activities associated with each stage and the general timing of when each stage would commence; and</p> <p>(b) details of the relevant conditions of approval, which would apply to each stage and how these shall be complied with across and between the stages of the SSI.</p> <p>Where staging of the SSI is proposed, these conditions of approval are only required to be complied with at the relevant time and to the extent that they are relevant to the specific stage(s).</p>	<p>The Staging Report was submitted to the Secretary of NSW Department of Planning and Environment and Cwth Minister of Department of the Environment on 24 March 2015.</p> <p>It identifies the stages upon which the project will be constructed and the CoA that apply to each stage.</p>
MCoA A8	Submission of plans, strategies and programs	<p>The Applicant shall ensure that any strategy, plan, program or other document required by the conditions of this approval and relevant to each stage (as identified in the Staging Report) is submitted to the Secretary no later than one month prior to the commencement of the relevant stage(s), unless otherwise agreed by the Secretary.</p> <p><i>Notes:</i></p> <ul style="list-style-type: none"> While any strategy, plan or program may be submitted on a progressive basis, the Applicant will need to ensure that the existing operations on site are covered by suitable strategies, plans or programs at all times; and If the submission of any strategy, plan or program is to be staged, then the relevant strategy, plan or program shall clearly describe the specific stage to which the strategy, plan or program applies, the relationship of this stage to any future stages, and the trigger for updating the strategy, plan or program. 	<p>A Staging Report has been prepared and submitted in March 2015. It identifies the stages upon which the project will be constructed. A number of documents required under the BMF will be finalised and implemented in stages in accordance with the Staging Plan. Sections 1, 2 and early works areas form Stage 1 therefore plans relating to these areas have priority for approval. These documents will be submitted to the Secretary prior to works commencing in that stage.</p>
MCoA B10, B11 and B12	Connectivity	<p>Subject to conditions B11 and B12, the Applicant shall revise the Connectivity Strategy identified in the documents listed in condition A2(e), based on the outcomes of the Mitigation Framework required by condition D1.</p>	<p>Roads and Maritime has submitted for approval a Fauna Connectivity Strategy for Sections 1 and 2. The Connectivity Strategy details the proposed design and location of fauna crossing structures and takes into consideration the results of supplementary targeted fauna surveys and conditions of approval. Crossing structures to aid koala movement in Section 1 and 2 are included. Specific details for the Coastal Emu and Koala in relation to</p>
MCoA B11	Connectivity	<p>As part of detailed design, the Applicant shall further investigate design refinements for fauna crossings and associated exclusionary measures, between station 41.500 and station 80.000 to improve connectivity for the Coastal Emu, and in the proximity of station 96.000 and between station 137.800 and station 159.700 to improve connectivity for the Koala. Any changes to fauna crossings and exclusionary measures shall be included in the Connectivity Strategy required under condition D2.</p>	

Condition No.	Document Title	Condition requirements	How conditions are being met
MCoA B12	Connectivity	Investigations into the location and design of connectivity structures, including but not limited to those identified in the documents listed under conditions A2(c) and A2(e), shall be undertaken during detailed design with the input of a suitably qualified and experienced ecologist. The investigations shall be undertaken in consultation with the EPA, DPI (Fisheries) and DoE and include workshops and on-site ground verification. The results of these investigations shall be detailed in the Connectivity Strategy required under condition D2.	connectivity and fencing in Sections 3-11 will be outlined in a subsequent Fauna Connectivity Strategy(s) and detail will also be provided in the relevant TSMP for the species. Construction sequencing for Sections 3 to 11 is unknown at present. A separate Connectivity Strategy(s) will be prepared for and submitted for these Sections prior to construction.
MCoA D1	Mitigation Framework	The applicant shall develop a framework for finalizing mitigation measures for threatened species. This Mitigation Framework shall be developed by a suitably qualified and experienced ecologist in consultation with DPI (Fisheries), EPA and DOE, and submitted to the satisfaction of the Secretary prior to commencement of detailed design of the relevant stage, unless otherwise agreed by the Secretary. The Mitigation Framework shall detail the process for finalising the biodiversity strategies, plans and programs required under this approval. The Mitigation Framework shall include: <ol style="list-style-type: none"> a) a description of the survey methodologies for all proposed pre-construction species and habitat surveys (including 2013-2014 spring and summer seasons and as otherwise required under this project approval), and with reference where relevant to compliance with relevant NSW and Commonwealth field survey methods and guidelines; b) a summary of potential changes to the avoidance, mitigation and/or offset measures specific in original documents (A2 of state approval) justified by survey results c) a summary of the potential avoidance, mitigation and/or offset measures for all species for which the proposed level of impact or mitigation required differs from that assessed in the documents listed in condition A2, including evidence that those measures would achieve the same or an improved biodiversity outcome d) process for updating the relevant TSMPs; and e) a schedule for submission of all biodiversity strategies, plans and programs required under approvals. 	The required information for the Mitigation Framework is contained in this plan. Authors of this Mitigation Framework and experience is summarised in Section 1.3. Survey methodologies are summarised in Chapter 4. Changes to avoidance and mitigation measures post targeted surveys are summarised in Chapter 5. Process for updating TSMPs is provided in Chapter 6. Schedules for submission of plans and strategies are provided in Appendix B.
MCoA D2	Connectivity Strategy	The Applicant shall prepare and implement a Connectivity Strategy , to be submitted and approved by the Secretary prior to the commencement of construction. The strategy shall describe the rationale for, and final design and location of, fauna connectivity structures for the SSI and shall demonstrate the effectiveness of connectivity measures for the species targeted for the crossing. The Strategy shall be developed from the draft Connectivity Strategy in the documents listed in condition A2 in consultation with the EPA, DPI (Fisheries) and DoE, to the	Roads and Maritime is finalising a Fauna Connectivity Strategy for Sections 1 and 2 in accordance with the Staging Plan. The strategy describes the rationale for, and final design and location of, fauna connectivity structures for this part of the project and demonstrates the effectiveness of

Condition No.	Document Title	Condition requirements	How conditions are being met
		<p>satisfaction of the Secretary. The Strategy shall include:</p> <p>(a) details of all crossings for terrestrial and aquatic fauna, including but not limited to land bridges, bridge, arch and culvert crossings, and crossings for arboreal fauna;</p> <p>(b) justification for the location and design, and spacing of the connectivity structures, with reference to relevant State and Commonwealth threatened species guidelines and the results of on-ground surveys as required by D2(d);</p> <p>(c) demonstration of the effectiveness of the connectivity structures (including exclusionary fencing) in terms of location, design and number of connectivity structures to mitigate impacts to the relevant threatened species, and that the crossings:</p> <ul style="list-style-type: none"> (i) maintain or improve connectivity and movement pathways; (ii) reduce the risk of mortality for threatened species; (iii) are located at locations, at sufficient frequency along the alignment, based on the ecological requirements of the targeted species, including but not limited to home range size, movement patterns, and habitat use; the results of surveys undertaken to determine the habitat, species movement patterns, distribution of species to confirm the design and location; <p>(e) consideration of connectivity under the existing highway, service roads and local roads (servicing over 100 vehicles per day);</p> <p>(f) commitment that pathways to connectivity structures are not to be impeded by ancillary facilities, rest areas or service roads, or local roads (servicing over 100 vehicles per day) that are realigned as part of the SSI or experience an increase in traffic volumes during operation of the SSI;</p> <p>(g) commitment to implement the landscaping of vegetation leading to connectivity structures;</p> <p>(h) a fencing strategy, describing the location, design and length of fencing, which must extend beyond the edges of habitat for threatened species;</p> <p>(i) the maintenance of connectivity measures and fencing for the life of the impact of the action, including the timing and frequency;</p> <p>(j) an assessment of the flooding risk for proposed structures, and measures to confirm and provide for flood immunity of those structures in light of this assessment. The agreement of the EPA on flood immunity levels shall be obtained prior to the commencement of construction of the relevant stage;</p> <p>(k) commitment that all bridges in identified wildlife corridors, or adjacent to threatened species habitat, or are likely to provide connectivity for threatened species based on surveys undertaken in accordance with the Mitigation Framework required in condition D1, shall provide a minimum three metre wide dry passage from toe of the scour protection to the top of the bank, with natural substrate and refuge features. Where this criteria cannot be achieved and with the agreement of the EPA, consideration shall</p>	<p>connectivity measures for the species targeted for the crossing. The Connectivity Strategy also addresses exclusion fencing for Sections 1 and 2.</p> <p>The NSW EPA provided comment on this plan in December 2014; this plan is currently pending approval.</p> <p>A separate Emu Fencing Strategy has been finalised in November 2014 by Roads and Maritime. This applies to Sections 3 and 4 of the project.</p> <p>Changes to connectivity structures for specific fauna species are summarised in Chapter 5 of this BMF.</p> <p>TSMPS have been updated to ensure that specific wording to meet MCoA D2 has been included stating "Unless connectivity measures can be demonstrated to be effective at successfully mitigating the barrier and fragmentation impact to relevant species, in accordance with the requirements of the construction flora and fauna management plan required under condition D26(e), and threatened species management plans required under conditions D8 and D9, the residual impact to connectivity shall be offset."</p> <p>In relation to addressing agency comments, each TSMP has details in Appendix A which summarises all agency comments received and how they have been addressed.</p>

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		<p>be given to the use of suitable materials in, and the final form of, the scour protection to provide for the safe and effective passage of fauna;</p> <p>(l) detailed consideration of the effects of connectivity structures on the maintenance or improvement of population viability and gene flow; and</p> <p>(m) incorporate the outcomes of the Mitigation Framework required under condition D1.</p> <p>Unless connectivity measures can be demonstrated to be effective at successfully mitigating the barrier and fragmentation impact to relevant species, in accordance with the requirements of the construction flora and fauna management plan required under condition D26(e), and threatened species management plans required under conditions D8 and D9, the residual impact to connectivity shall be offset.</p> <p>Where the location and/or design of connectivity structures has changed from that identified in the documents listed under conditions A2(c) and A2 (e), the Strategy shall demonstrate how the new location and/or design would result in an improved biodiversity outcome. The Strategy shall clearly identify how the connectivity structures will work in conjunction with other biodiversity measures, such as complementary fauna exclusion fencing measures and the regeneration/replanting of native vegetation, to be implemented for the SSI.</p> <p>The Applicant shall demonstrate to the satisfaction of the Secretary how public authority comments on the Strategy have been addressed.</p> <p>The Strategy may be submitted in stages to suit the staging of the SSI.</p>	
MCoA D3	Biodiversity Offset Strategy	<p>The Applicant shall prepare and implement a Biodiversity Offset Strategy to outline how the ecological values lost as a result of the SSI will be offset in perpetuity. The Strategy shall be developed from the draft Biodiversity Offset Strategy in the documents listed in condition A2, in consultation with the EPA, DPI (Fisheries) and DoE, to the satisfaction of the Secretary.</p> <p>The Biodiversity Offset Strategy shall be submitted to, and approved by, the Secretary prior to the commencement of construction work that would result in the disturbance of the relevant existing ecological communities, threatened species, or their habitat, unless otherwise agreed by the Secretary.</p>	<p>Roads and Maritime has prepared a Biodiversity Offset Strategy. The Strategy was informed by targeted surveys and updates to the TSMPs that refine the residual impacts to State and Commonwealth biodiversity values.</p> <p>The Biodiversity Offset Strategy has been submitted for approval in March 2015.</p>
MCoA D4	Biodiversity Offset Status Report	<p>Prior to the commencement of construction work that would result in the disturbance of the relevant existing ecological communities, threatened species, or their habitat, unless otherwise agreed by the Secretary, the Applicant shall submit for the approval of the Secretary, the offset sites for the species listed under condition D4(a). The selection of the offset sites should be undertaken in consultation with the EPA, DPI (Fisheries) and DoE. Submission of the offset sites for approval shall be accompanied by:</p> <p>(a) details of offset sites to compensate the impacts on:</p>	<p>Detailed information regarding the subject species offsets is provided in the Biodiversity Offset Status Report . The Biodiversity Offset Status Report will be used to account for unavoidable impacts where impacts cannot be avoided, minimised or mitigated.</p>

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		<p>(i) Koala populations in Coolgardie/Bagotville, Broadwater and Woombah/Iluka;</p> <p>(ii) Moonee Quassia (<i>Quassia</i> sp. <i>Moonee Creek</i>);</p> <p>(iii) Sandstone Rough-Barked Apple (<i>Angophora robur</i>);</p> <p>(iv) Singleton Mint Bush (<i>Prostanthera cineolifera</i>); and</p> <p>(v) Lowland Rainforest in Sub-tropical Australia;</p> <p>(b) a map that defines the locations and boundaries of the sites;</p> <p>(c) demonstration, through ground truthing survey or an alternative method(s), the adequacy of the site(s), in terms of habitat suitability and presence of the relevant species, to offset the impacts of the SSI;</p> <p>(d) consideration of how the offsets achieve the outcomes required by the Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy to the satisfaction of DoE; and</p> <p>(e) details of how the offset sites would be secured and managed in perpetuity.</p>	<p>The Biodiversity Offset Status Report will address the requirements of MCoA D4 as it will:</p> <ul style="list-style-type: none"> • Outline impacts and offsets required (as informed by ground-truthing surveys) • Identify offset sites and how they will be managed; and • Provide maps showing the locations and extents of offset sites. <p>Further information regarding impacts and management measures associated with threatened species is provided in the related TSMPs including the Threatened Flora Management Plan, Threatened Rainforest Community and Plants Management Plan and Koala Management Plan.</p>
MCoA D5	Biodiversity Offset Package	<p>The Applicant shall prepare and implement (following approval) a Biodiversity Offset Package, within twenty-four months of approval of the Biodiversity Offset Strategy, or as otherwise agreed by the Secretary. The package shall detail how the ecological values lost as a result of the SSI will be offset. The Biodiversity Offset Package shall be prepared in consultation with the EPA, DPI (Fisheries) and DoE, for the approval of the Secretary and shall (unless otherwise agreed by the Secretary) include, but not necessarily be limited to:</p> <p>(a) the identification of the extent and types of habitat that would be lost or degraded as a result of the final design of the SSI;</p> <p>(b) the objectives and biodiversity outcomes to be achieved;</p> <p>(c) details of the final suite of the biodiversity offset measures selected and secured in accordance with the Biodiversity Offset Strategy including the identification of all offset sites, including, offset attributes, shapefiles, textual descriptions and maps that clearly define the location, boundaries of the offset areas;</p> <p>(d) an assessment demonstrating how the offset area(s) achieve the outcomes required by the Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy and user guide to the written satisfaction of DoE;</p> <p>(e) the management and monitoring requirements for compensatory habitat works and other biodiversity offset measures proposed to ensure the outcomes of the package are achieved, including:</p> <p>(i) the monitoring of the condition of species and ecological communities at offset locations;</p>	To be prepared following approval of the Biodiversity Offset Strategy.

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		<p>(ii) the methodology for the monitoring program(s), including the number and location of offset monitoring sites, and the sampling frequency at these sites;</p> <p>(iii) provisions for the annual reporting of the monitoring results for a set period of time as determined in consultation with the EPA, DPI (Fisheries) and DoE; and</p> <p>(iv) the monitoring and reporting on the effectiveness of these measures, and progress against the performance and completion criteria;</p> <p>(f) the results of targeted field surveys within the offset sites (undertaken at any ecologically appropriate time of the year) to assess and describe habitat suitability, presence/absence of threatened species and ecological communities and an assessment of the baseline population;</p> <p>(g) a description of the current quality (prior to any management activities) of the offset area(s);</p> <p>(h) targeted management actions, regeneration and/or revegetation strategies to be undertaken on the offset area(s) to improve the ecological quality of these areas for the relevant species and communities;</p> <p>(i) clear performance objectives for management actions that will enable maintenance and enhancement of habitat within the offset area, as well as contribute to the better protection of individuals and/or populations of the relevant species;</p> <p>(j) performance and completion criteria for evaluating the management of the offset area, including contingency actions, criteria for triggering contingency actions and a commitment to the implementation of these actions in the event that performance objectives are not met; a program to monitor and report on the effectiveness of these measures, and progress against the performance and completion criteria;</p> <p>(k) timing and responsibilities for the implementation of the provisions of the Biodiversity Offset Package and achieving performance objectives;</p> <p>(l) details of who would be responsible for monitoring, reviewing, and implementing the Biodiversity Offset Package; and</p> <p>(m) a description of funding arrangements or agreements including work programs and responsible entities.</p> <p>Land offsets shall be consistent with the Principles for the use of Biodiversity Offsets in NSW. Any land offset shall be enduring and be secured by a conservation mechanism which protects and manages the land in perpetuity. Where land offsets cannot solely achieve compensation for the loss of habitat, additional measures shall be provided to collectively deliver an improved or maintained biodiversity outcome for the region.</p> <p>The Biodiversity Offset Package shall include details of the offset sites approved under condition D4, and timeframe for the delivery of the offset sites.</p>	

Condition No.	Document Title	Condition requirements	How conditions are being met
		<p>Where monitoring required under conditions D8 and/or D9 indicates that biodiversity outcomes are not being achieved, remedial actions, as approved by the Secretary, shall be undertaken to ensure that the objectives of the Biodiversity Offset Package are achieved.</p> <p>The requirements of the Biodiversity Offset Package shall be implemented by the responsible parties according to the timeframes set out in the Biodiversity Offset Package, unless otherwise agreed by the Secretary.</p> <p>Note:</p> <ul style="list-style-type: none"> If an offset site proposed as a part of the Biodiversity Offset Strategy or Biodiversity Offset Package is already required to be protected as a result of a separate approval, only the management actions which can be demonstrated to be additional to those required for the separate approval, can be considered as an offset for this project in accordance with the EPBC Act Environmental Offsets Policy 2012 (or subsequent published revisions). 	
MCoA D6	Nest Box Plan	<p>Prior to the commencement of construction of the relevant stage that would result in the disturbance of native vegetation (or as otherwise agreed by the Secretary), the Applicant shall prepare and implement a Nest Box Plan to provide replacement hollows for displaced fauna. The Plan shall be prepared in consultation with the EPA and to the satisfaction of the Secretary. The Plan shall be prepared by a suitably qualified and experienced ecologist and detail the number and type of nest boxes to be installed, which shall be justified based on the number and type of hollows removed (based on pre clearing surveys), the density of hollows in the area to be cleared and in adjacent areas, and the availability of adjacent food resources. The Nest Box Plan will also provide details of maintenance protocols for the nest boxes installed including responsibilities, timing and duration.</p>	<p>Roads and Maritime has developed Nest Box Management Plans for relevant sections. NSW Secretary of Department of Planning and Environment approved Nest Box Plans for Sections 1, 2, 4 & 5, 8 & 9, 10 & 11 on 16 January 2015 and plans for sections 3, 6 & 7 approved on 17 February 2015. The plans were informed by results of detailed supplementary targeted surveys that have identified the number and type of hollows to be replaced within each section. The Nest Box Management Plans also provides details regarding maintenance and monitoring of nest boxes.</p>
MCoA D7	Translocation Strategy	<p>The Applicant shall prepare and implement a Flora Translocation Strategy to determine the feasibility and potential efficacy of translocation measures (as identified in the threatened species management plans required under condition D8), prior to the commencement of construction work that would result in the disturbance of threatened flora species for which translocation is proposed. The Strategy shall be prepared by a suitably qualified and experienced ecologist, in consultation with the EPA and DoE, and to the satisfaction of the Secretary. The Strategy shall include:</p> <p>(a) a feasibility assessment of timeframe and staging requirements, availability of expertise, risk effectiveness analysis</p>	<p>Roads and Maritime has prepared a Translocation Strategy for Sections 1 and 2 in accordance with the Staging Plan. The Translocation Strategy has been informed by the findings of supplementary targeted flora surveys and will include the relevant information as required under this condition. The Translocation Strategy (Section 1 and 2) will shortly be</p>

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		<p>and availability/suitability of translocation sites;</p> <p>(b) detail of species specific information on the proposed methods of, and discussion of results of past recorded responses to, translocations;</p> <p>(c) a framework for the translocation process applicable to each affected species; and</p> <p>(d) consideration of appropriate compensatory habitat in the Biodiversity Offsets Package required under condition D5 where translocation is not reasonable or feasible.</p>	<p>submitted for approval following comments received from the NSW EPA and DoE.</p> <p>A separate Translocation Strategy (Sections 3-11) and the soft soil early works will be prepared and submitted for approval prior to construction activities impacting threatened flora species.</p>
MCoA D8	Threatened Species Management Plans	<p>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. 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 EPA, DPI (Fisheries) and DoE, and to the satisfaction of the Secretary, and shall include but not necessarily be limited to:</p> <p>(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, distribution, habitat use and movement patterns of these species;</p> <p>(b) identification of potential impacts on each species;</p> <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>(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>(e) monitoring methodology for threatened flora and fauna adjacent to the SSI footprint,</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>The TSMPs are being developed from the draft TSMPs included in the SPIR. Updates to the TSMPs are occurring in stages as targeted surveys and pre-construction baseline surveys are being completed.</p> <p>Expert and agency comments are also being considered and incorporated. Priority has been given to those plans relevant to Sections 1 and 2 of the project.</p> <p>The TSMPs include consultation with DP&E, EPA, DPI (Fisheries) and DoE (for Commonwealth listed species).</p> <p>A schedule for the updating of TSMPs is provided in Appendix B of this document.</p>

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		<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>(h) provision for the assessment of monitoring data to identify changes to habitat usage and whether this can be attributed to the SSI;</p> <p>(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> <p>(j) mechanisms for the monitoring, review and amendment of these plans;</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 EPA, DPI (Fisheries) and DoE; and</p> <p>(l) provision for annual reporting of monitoring results to the Secretary and the EPA, DPI (Fisheries) and DoE, or as otherwise agreed by those agencies.</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. 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.</p>	
MCoA D9	Koala Management Plan	<p>As part of the TSMPs under condition D8, the applicant shall prepare and implement a Koala Management Plan to demonstrate the ongoing survival of the Koala populations at Coolgardie/Bagotville, Broadwater and Woombah/Iluka. The plan is to be prepared by a suitably qualified and experienced species expert and shall include, but not necessarily be limited to:</p> <p>(a) results of detailed surveys to determine:</p> <p>(i) the population status of the Coolgardie/Bagotville, Broadwater and Woombah/Iluka Koala populations;</p> <p>(ii) habitat use and movement patterns of Koala populations within five kilometres of the proposed upgrade, or such area as determined by the independent ecologist; and</p> <p>(iii) habitat areas likely to be fragmented by the SSI; including the results of SPOT assessment and radio tracking. The results and adequacy of surveys shall be verified by an independent suitably qualified and experienced ecologist with</p>	<p>The Koala Management Plan is being developed by Roads and Maritime and will be submitted in three stages.</p> <p>Update 1 - For Sections 1 and 2 to meet the requirements of Condition D8. This has been submitted for approval after addressing comments received from DP&E, EPA and DoE.</p> <p>Update 2 – For all remaining sections to meet the requirements of Condition D8 excluding the populations referred to in MCoA D9 (Coolgardie/Bagotville, Broadwater and Woombah/Iluka).</p>

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		<p>appropriate qualifications and experience in Koala and road ecology. Where appropriate, the Applicant may vary the required area of survey specified under condition D9(a)(ii) to the satisfaction of the independent ecologist;</p> <p>(b) a detailed assessment of the impacts to the Koala populations based on the survey results required by condition D9(a), including population impacts and the identification of habitat likely to be fragmented and/or isolated as a result of the SSI;</p> <p>(c) a detailed description, including the location and design, of all proposed avoidance and mitigation measures;</p> <p>(d) justification that the location and design of mitigation measures:</p> <p>(i) have been designed with the objective of no Koala road kill from the commencement of construction of the SSI. In the event that a Koala is injured or killed during construction or operation, this shall be reported on the Applicant's website within 24 hours of this occurring, and the record shall remain available for a period of at least five years, unless otherwise agreed by the Secretary;</p> <p>(ii) include permanent fencing of the entire SSI for the length of the distribution of the Coolgardie/Bagotville, Broadwater and Woombah/Iluka populations and for two kilometres beyond the distribution of the Coolgardie/Bagotville, Broadwater and Woombah/Iluka population, following the highway or to the nearest natural barrier to Koala movement (e.g. river), after baseline surveys are complete in accordance with condition D9(a) and prior to operation;</p> <p>(iii) result in the complete, safe crossing of fauna crossings by the Koala. Fauna crossings shall be provided at a sufficient frequency to ensure that habitat connectivity is maintained or improved from pre-construction conditions, as determined by the independent ecologist and agreed by EPA;</p> <p>(iv) provide sufficient opportunities for species dispersal and re-colonisation as determined by the independent ecologist and EPA;</p> <p>(v) are in areas that, and are at a sufficient frequency to, achieve (i) - (iv), based on site specific information contained in the survey results required by condition D9(a) and the ecological requirements of the Koala, including but not limited to home range size, local movement patterns and habitat use, in accordance with the advice of the independent ecologist and EPA;</p> <p>(vi) all koala underpass structures shall have a minimum height and width of 2.4 metres and a maximum length of 40 metres, or a minimum height and width of 3 metres and a maximum length of 50 metres. The underpass/culvert entrance shall be located at ground level, and no higher in the fill. Structures that provide passage over the road shall have a minimum width of 30 metres and shall be treated with contiguous habitat features;</p> <p>(vii) provide passage for Koalas under or over the existing highway (where the existing highway forms part of the SSI) and service roads or local roads (servicing over 100 vehicles per day);</p> <p>(viii) effectively minimise the risk of predation from dogs in both</p>	<p>Update 3 – To meet the requirements of Condition D9 including populations at Coolgardie/Bagotville, Broadwater and Woombah/Iluka.</p> <p>The Koala Management Plan is being prepared by a suitably qualified and experienced expert (Dr Rod Kavanagh) and will include details of revegetation of koala habitat.</p>

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		<p>dedicated and combined crossings;</p> <p>(ix) provide dry passage for dedicated fauna crossings and for combined fauna crossings to the satisfaction of EPA and DoE, at a flood immunity level determined in accordance with condition D2(c)(j);</p> <p>(x) provide habitat linkages to crossing structures from adjacent Koala habitat; and</p> <p>(xi) ensures that pathways to connectivity structures are not impeded by ancillary facilities, rest areas, service roads or local roads;</p> <p>(e) if the mitigation measures discussed in condition D9(d) cannot be demonstrated to be effective to the satisfaction of the Secretary, in consultation with EPA and DoE, provision for the Plan to be revised to include the design and construction of a minimum of one dedicated underpass or land bridge every 500 metres. Underpass structures shall have a minimum height and width of three metres and a maximum length of 50 metres;</p> <p>(f) provision for the installation and vegetation planting of fauna overpasses prior to the commencement of construction;</p> <p>(g) a revegetation strategy to be implemented to increase connectivity adjacent to the SSI and leading to crossing locations, and the provision of vegetation planting on land bridges, to ensure the establishment of the vegetation prior to the commencement of construction;</p> <p>(h) details of the proposed monitoring methodology to ensure the effectiveness of the mitigation measures and the ongoing survival of the Coolgardie/Bagotville, Broadwater and Woombah/Iluka Koala populations. Monitoring shall:</p> <p>(i) include goals that demonstrate the mitigation measures are effective, including clear objectives, milestones, performance measures, corrective actions, and thresholds for corrective actions, and timeframes for completion;</p> <p>(ii) occur until such time as the mitigation measures are demonstrated to be effective for three consecutive monitoring periods, or as agreed by the Secretary, to the satisfaction of the independent ecologist and EPA; and</p> <p>(iii) for the purposes of the Coolgardie/Bagotville population, consider the results of the surveys undertaken in the Koala habitat and population assessment: Ballina Shire Council LGA (Biolink Ecological Consultants Pty Ltd, November 2013) in determining the baseline population;</p> <p>(i) where the results of monitoring undertaken in accordance with condition D9(h) suggests that the mitigation measures are ineffective or changes to the population have occurred, the Applicant shall provide the Secretary, within one month of recording the changes, the corrective actions that have been implemented and/or proposed to be implemented, or a procedure for demonstrating that this change is not a result of the SSI. Should the Applicant be unable to demonstrate to the satisfaction</p>	

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		<p>of the Secretary that any change to the population is not attributable to the SSI, the SSI shall be deemed as the cause of the impact and the Applicant shall, within one month of these findings, provide, to the satisfaction of the Secretary, in consultation with the EPA and DoE, the proposed corrective actions to address the impacts of the SSI. Any required corrective actions shall include, but not necessarily be limited to:</p> <ul style="list-style-type: none"> (i) installation of further crossings or modifications to existing crossings and the provision of evidence of the complete, safe crossing of these fauna crossings by the Koala. Any additional crossings shall be provided at a sufficient frequency to ensure that habitat connectivity is maintained or improved from pre-construction conditions, within two years of their installation; and (ii) reassessment of all revegetation areas and frequent reporting and maintenance including addressing failures; (j) if the measures in condition D9(i) cannot be demonstrated to be successful within one year of their implementation, procedure for the submission of further offsets in accordance with conditions D5 and D6(j), to be provided within one year of these findings. Further offsets may include: <ul style="list-style-type: none"> (i) the legal protection and conservation management of additional areas of existing habitat that actively regenerated and secured into conservation management; and/or (ii) strategic revegetation of cleared areas to improve connectivity; and/or (iii) development of a supplementary feeding program and/or breeding program; and/or (iv) development of a long term predator control program; and (k) evidence of consultation with species experts, EPA and DoE in addressing the requirements of this condition, and demonstration of how comments provided by the species experts, EPA and DoE, as a result of this consultation, have been addressed. <p>The Koala Management Plan shall be submitted and approved by the Secretary prior to the commencement of construction of the relevant stages of the SSI. The approved Koala Management Plan shall be implemented prior to the commencement of construction of the relevant stages.</p>	
MCoA D20	Urban Design and Landscaping	<p>The Applicant shall prepare and implement an Urban Design and Landscape Plan prior to the commencement of permanent built works and/or landscaping, unless otherwise agreed by the Secretary, to present an integrated landscape and design for the SSI. The Plan shall be prepared in accordance with the Roads and Maritime Services urban design and visual guidelines, the design principles outlined in the EIS, and the revegetation principles outlined in the EIS Working Paper—Biodiversity. The Plan shall be prepared by an appropriately qualified expert in consultation with the relevant council and community, to the satisfaction of the Secretary. The Plan shall be prepared by an appropriately qualified expert in</p>	<p>Roads and Maritime has developed an Urban Design and Landscape Plan for Section 1 and Section 2. This plan was submitted for agency approval in December 2014.</p> <p>Remaining sections will be prepared and submitted for approval in stages in accordance with the Staging Plan.</p>

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		<p>consultation with the relevant council and community, to the satisfaction of the Secretary. The Plan shall include, but not necessarily be limited to:</p> <ul style="list-style-type: none"> (a) identification of design principles and standards based on: <ul style="list-style-type: none"> (i) local environmental values, (ii) heritage values; (iii) urban design context; (iv) sustainable design and maintenance; (v) community amenity and privacy; (vi) relevant design standards and guidelines; and (vii) the urban design objectives outlined in Section 4.2 of the EIS Working Paper—Urban Design Landscape Character and Visual Impact ; (b) the location of existing vegetation and proposed landscaping (including use of indigenous and endemic species where possible). Details of species to be replanted/revegetated shall be provided, including their appropriateness to the area and habitat for threatened species; (c) a description of locations along the corridor directly or indirectly impacted by the construction of the SSI (e.g. temporary ancillary facilities, access tracks, watercourse crossings, etc.) and details of the strategies to progressively rehabilitate regenerate and/or revegetate the locations with the objective of promoting biodiversity outcomes and visual integration; (d) take into account appropriate roadside plantings and landscaping in the vicinity of heritage items and ensure no additional heritage impacts; (e) a description of disturbed areas (including borrow sites) and details of the strategies to progressively rehabilitate, regenerate and/or revegetate these areas, including clear objectives and timeframes for rehabilitation works, procedures for monitoring success of regeneration or revegetation, and corrective actions should regeneration or revegetation not conform to the objectives adopted; (f) location and design treatments for any associated footpaths and cyclist elements, and other features such as seating, lighting (in accordance with AS 4282-1997 Control of the Obtrusive Effect of Outdoor Lighting), fencing, materials and signs; (g) an assessment of the visual screening effects of existing vegetation and the proposed landscaping and built elements. Where properties have been identified as likely to experience high visual impact as a result of the SSI and high residual impacts are likely to remain, the Applicant shall, in consultation with affected landowners, identify opportunities for providing at-property landscaping to further screen views of the SSI. Where agreed with the landowner, these measures shall be implemented during the construction of the SSI; (h) graphics such as sections, perspective views and sketches for key elements of the SSI, including, but not limited to built elements 	

Condition No.	Document Title	Condition requirements	How conditions are being met
		<p>of the SSI;</p> <p>(i) strategies for progressive landscaping and other environmental controls such as erosion and sedimentation controls, drainage and noise mitigation;</p> <p>(j) monitoring and maintenance procedures for the built elements, rehabilitated vegetation and landscaping (including weed control), including performance indicators, responsibilities, timing and duration and contingencies where rehabilitation of vegetation and landscaping measures fail; and</p> <p>(k) evidence of consultation with the relevant council and community on the proposed urban design and landscape measures prior to its finalisation.</p> <p>The Plan may be submitted in stages to suit the staged construction program of the SSI.</p>	
MCoA D25	Construction Environmental Management Plan	<p>The Applicant shall prepare and implement (following approval) a Construction Environmental Management Plan for the SSI, prior to the commencement of construction, or as otherwise agreed by the Secretary. The Plan shall be prepared in consultation with the EPA, DPI (Fisheries), NOW and DoE and outline the environmental management practices and procedures that are to be followed during construction, and shall be prepared in consultation with the relevant government agencies and in accordance with the Guideline for the Preparation of Environmental Management Plans (Department of Infrastructure, Planning and Natural Resources, 2004). The Plan shall include, but not necessarily be limited to:</p> <p>(a) a description of activities to be undertaken during construction of the SSI (including staging and scheduling);</p> <p>(b) statutory and other obligations that the Applicant is required to fulfil during construction, including approvals, consultations and agreements required from authorities and other stakeholders under key legislation and policies;</p> <p>(c) a description of the roles and responsibilities for relevant employees involved in the construction of the SSI, including relevant training and induction provisions for ensuring that employees, including contractors and sub-contractors, are aware of their environmental and compliance obligations under these conditions of approval;</p> <p>(d) an environmental risk analysis to identify the key environmental performance issues associated with the construction phase and details of how environmental performance would be managed and monitored to meet acceptable outcomes, including what actions will be taken to address identified potential adverse environmental impacts (including any impacts arising from the staging of the construction of the SSI). In particular, the following environmental performance issues shall be addressed in the Plan:</p> <p>(v) measures to monitor and manage dust emissions including dust from stockpiles, blasting, traffic on unsealed public roads and materials tracking from construction sites onto public roads;</p>	<p>The Contractor will be responsible for developing and implementing the CEMP to meet this condition of approval.</p> <p>The CEMP will be approved in stages, in accordance with the Staging Plan.</p> <p>The CEMP will also incorporate key requirements outlined in individual TSMPs to identify, conserve and mitigate impacts to threatened species, habitats and communities.</p>

Condition No.	Document Title	Condition requirements	How conditions are being met
		<p>(vi) measures to minimise hydrology impacts, including measures to stabilise bed and bank structures as required;</p> <p>(vii) measures for the handling, treatment and management of contaminated materials;</p> <p>(viii) measures to monitor and manage waste generated during construction including but not necessarily limited to: general procedures for waste classification, handling, reuse, and disposal; use of secondary waste material in construction wherever feasible and reasonable; procedures or dealing with green waste including timber and mulch from clearing activities; and measures for reducing demand on water resources (including potential for reuse of treated water from sediment control basins);</p> <p>(ix) measures to monitor and manage spoil, fill and materials stockpile sites including details of how spoil, fill or material would be handled, stockpiled, reused and disposed in a Stockpile Management Protocol. The Protocol shall include details of the locational criteria that would guide the placement of temporary stockpiles, and management measures that would be implemented to avoid/minimise amenity impacts to surrounding residents and environmental risks (including surrounding water courses). Stockpile sites that affect heritage, threatened species, populations or endangered ecological communities require the approval of the Secretary, in consultation with the EPA and DPI (Fisheries);</p> <p>(x) measures to monitor and manage hazard and risks including emergency management and management measures to address potential risks to the Woodburn borefield drinking water catchment. These measures shall be developed in consultation with Rous Water;</p> <p>(xi) the issues identified in condition D26;</p> <p>(xii) details of community involvement and complaints handling procedures during construction, consistent with the requirement of conditions C1 to C4;</p> <p>(xiii) details of compliance and incident management consistent with the requirements of condition D27; and</p> <p>(xiv) procedures for the periodic review and update of the Construction Environmental Management Plan and Plans required under condition D26, as necessary (including where minor changes can be approved by the Environmental Representative). The Plan shall be submitted for the approval of the Secretary no later than one month prior to the commencement of construction, or as otherwise agreed by the Secretary. The Plan may be prepared in stages, however, construction works shall not commence until written approval of the relevant stage has been received from the Secretary.</p> <p>The approval of a Construction Environmental Management Plan does not relieve the Applicant of any requirement associated with this SSI approval. If there is an inconsistency with an approved Construction Environmental Management Plan and the conditions of this SSI approval, the requirements of this SSI approval shall</p>	

Condition No.	Document Title	Condition requirements	How conditions are being met
		prevail.	
MCoA D26(c)	Construction Soil and Water Quality Management Plan	<p>Manage surface and groundwater impacts during construction of the project. Of particular note, must include an Oxleyan Pygmy Perch (OPP) habitat waterway management framework to detail the measures and construction methods that will be employed to avoid direct discharge of construction water to known Oxleyan Pygmy Perch habitat waterways.</p> <p>Developed in consultation with the EPA, DPI (Fisheries), NOW, Rous Water (in relation to the Woodburn borefield), DoE and the relevant council.</p>	<p>The Contractor will be responsible for developing and implementing the Construction Soil and Water Quality Management Plan (CSWQMP).</p> <p>Mitigation and management measures for the OPP are detailed in the Threatened Fish Management Plan which have been developed in consultation with RMS and DPI (Fisheries). These measures will also be incorporated into the CSWQMP.</p>
MCoA 26(e)	Construction Flora and Fauna Management Plan	<p>Details how construction impacts on ecology will be minimised and managed. Includes:</p> <p>D26(e)(iv) Protocol for the removal and relocation of fauna during clearing</p> <p>Includes provision for engagement of a suitably qualified and experienced ecologist to identify locations where they would be present, to oversee clearing activities and facilitate fauna rescue and relocation, and consideration of timing of vegetation clearing with consideration to the avoidance of clearing native vegetation during the breeding/nesting periods of threatened species, where feasible and reasonable.</p> <p>Prepared in consultation with the EPA, DPI (Fisheries) and DoE.</p>	<p>The Contractor will be responsible for developing and implementing the Construction Flora and Fauna Management Plan. It will include provision for suitably qualified fauna spotters to undertake the roles as required under this condition.</p>

Table 3-2 Conditions of Commonwealth Approval relating to BMF
EPBC Act Approval

Condition No.	Document Title	Summary of Required Content	How conditions are being met
Condition 1	Staging Report	<p>The Staging Report as required by NSW approval condition A7 must be submitted to the Minister prior to the commencement of each of the proposed stage(s). The Staging Report must also outline the threatened species and communities, and migratory species impacted in each stage.</p>	<p>The Staging Report was submitted to the Secretary of NSW Department of Planning and Environment and Cwth Minister of Department of the Environment on 24 March 2015.</p> <p>It identifies the stages upon which the project will be constructed and the CoA that apply to each stage.</p> <p>A number of documents required under the BMF will be finalised and implemented in accordance with the identified stages.</p>
Condition 2	Avoidance and mitigation of impacts	<p>In order to minimise impacts to threatened species and communities, and migratory species the approval holder must:</p> <p>a) adhere to clearance limits outlined in NSW approval</p>	<p>A number of targeted pre-construction surveys have been completed. These surveys have included recording and</p>

Condition No.	Document Title	Summary of Required Content	How conditions are being met
		<p>Condition B1</p> <ul style="list-style-type: none"> b) undertake pre-clearance surveys in accordance with NSW approval condition B5 c) undertake all soil and water management measures in accordance with NSW approval condition B34 d) design and construct any additional ancillary facilities in accordance with the requirements of NSW approval condition B73 to ensure no impacts occur to threatened species and communities, and migratory species or habitat. 	<p>tagging threatened flora species.</p> <p>Results have been summarised and incorporated into the relevant TSMPs.</p> <p>Clearing limits will be adhered to by the construction contractor and areas for clearing will be clearly marked in the field.</p> <p>Pre-clearance surveys and inspections for endangered and threatened species will be undertaken by the construction contractor. The surveys and inspections, and any subsequent relocation of species, shall be undertaken under the guidance of a suitably qualified ecologist and shall be in accordance with the methodology incorporated into the approved Construction Flora and Fauna Management Plan.</p> <p>Ancillary facilities will be located and designed to ensure no impacts occur to threatened species and their habitats and threatened communities to the greatest extent possible.</p>
Condition 7	Ballina Koala Plan	In addition to the Koala Management Plan required by NSW approval condition D8 and D9, a Ballina Koala Plan must be submitted no less than 3 months prior to commencement of Section 10.	Roads and Maritime have commenced preparation of the Ballina Koala Plan and supplementary targeted koala surveys. The Ballina Koala Plan will be submitted for approval prior to commencement of Section 10.
Condition 8	Koala Management Plan	A Koala Management Plan must be developed for each relevant stage(s) consistent with NSW approval condition D8 and D9. The relevant stages cannot commence until the Koala Management Plan is approved by the Minister. The Koala Management Plan for Section 10 must be consistent with the Ballina Koala Plan.	<p>The Koala Management Plan is being developed by Roads and Maritime and will be submitted in three stages.</p> <p>Update 1 - For Sections 1 and 2 to meet the requirements of Condition D8.</p> <p>Update 2 – For all remaining sections to meet the requirements of Condition D8 excluding the populations referred to in MCoA D9 (Coolgardie/Bagotville, Broadwater and Woombah/Iluka).</p> <p>Update 3 – To meet the requirements of Condition D9 including populations at Coolgardie/Bagotville, Broadwater and Woombah/Iluka.</p> <p>The Stage 1 Koala Management Plan (Sections 1 and 2) has been submitted</p>

Condition No.	Document Title	Summary of Required Content	How conditions are being met
			for approval after addressing comments received from DP&E, EPA and DoE.
Condition 11	Threatened Mammal Management Plan	A Threatened Mammal Management Plan pursuant to NSW approval condition D8 must be developed for each stage impacting on the Spotted-tail Quoll and Long-nosed Potoroo. The plan must minimise impacts to the Spotted-tail Quoll and Long-nosed Potoroo to the satisfaction of the Minister and must be submitted to the Minister for approval.	Roads and Maritime has submitted an updated Threatened Mammal Management Plan for final approval. Agency comments have been received and the plan updated to address agency comments. Roads and Maritime have commissioned additional targeted surveys for the Long-nosed Potoroo. A second update will be required to the Mammal Management Plan post completion of these additional surveys. A Threatened Bats Management Plan for Sections 1 and 2 of the Project was approved by the Secretary, Department of Planning and Environment in accordance with the draft Threatened Mammal Management Plan in September 2014. Targeted Microbat surveys have now been completed across Sections 3, 4, 5, 6, 7, 8, 9, 10 and 11. An updated Threatened Bats Management Plan incorporating sections 3-11 will be submitted for agency approval.
Condition 12	Threatened Flora Management Plan	A Threatened Flora Management Plan pursuant to NSW approval condition D8 for each stage impacting on EPBC listed flora species is to be developed. The plan must be submitted to the Minister for approval.	Roads and Maritime commissioned supplementary targeted flora surveys. All targeted flora surveys have now been completed for Sections 1-11. An updated Threatened Flora Management Plan (TFMP) for Stage 1 has been prepared and submitted for final approval. This update has incorporated expert and agency comments and results of targeted flora surveys for Sections 1 and 2 and early works. A second update to the TFMP is being prepared to include Sections 3-11 and will be submitted for agency review later in 2015 and prior to commencement of the second stage.
Condition 13	Connectivity Strategy	The approval holder must develop a Connectivity Strategy pursuant to NSW approval condition D2 for each stage impacting on threatened species and ecological communities.	Roads and Maritime is finalising a Fauna Connectivity Strategy for Sections 1 and 2 in accordance with

Condition No.	Document Title	Summary of Required Content	How conditions are being met
			<p>the Staging Plan. The strategy describes the rationale for, and final design and location of, fauna connectivity structures for this part of the project and demonstrates the effectiveness of connectivity measures for the species targeted for the crossing.</p> <p>The Fauna Connectivity Strategy also addresses fencing including exclusion fencing for Sections 1 and 2.</p> <p>The Connectivity Strategy for Stage 1 was submitted for agency comment in December 2014. Comments have been received by NSW EPA, and are pending from DoE. The plan will be submitted for approval prior to construction.</p> <p>Separate Connectivity Strategy(s) will be prepared for Sections 3 to 11 at a later date dependent on construction staging.</p>
Condition 14	Mitigation Framework	<p>The approval holder must develop and implement all frameworks, strategies, plans or programs in accordance with the following NSW approval conditions:</p> <ul style="list-style-type: none"> a) the Mitigation Framework required by NSW approval condition D1 b) connectivity strategy required by NSW approval condition D2 and B12 c) Threatened Species Management Plans required by NSW approval condition D8 and D9. 	<p>The Mitigation Framework is this document. Roads and Maritime is developing the required strategies, plans and programs. The relevant documents will be submitted to the Minister for approval prior to construction commencing for that relevant stage.</p>
Conditions 15 to 18	Offsets	<p>The approval holder must prepare and implement a Biodiversity Offset Strategy and Biodiversity Offset Package that compensates for residual impacts to listed species and communities.</p>	<p>Roads and Maritime has prepared a Biodiversity Offset Strategy. The Strategy was informed by targeted surveys and updates to the TSMPs that refine the residual impacts to State and Commonwealth biodiversity values.</p> <p>The Biodiversity Offset Strategy has been submitted for approval in March 2015.</p> <p>The Biodiversity Offset Package will be submitted post approval of the Offset Strategy.</p>

4. Survey Methodologies

Targeted surveys have been commissioned by Roads and Maritime to provide supplementary information to the EIS and SPIR regarding the presence or absence of a particular threatened species and ecological community. The surveys also gathered additional information regarding matters such as habitats and populations, connectivity structures, habitat trees and monitoring sites. Targeted surveys commenced in late 2013 with the majority of targeted pre-construction surveys being finalised in 2014. All surveys for Sections 1 and 2 have now been completed. A few surveys remain to occur in early to mid-2015 for the later sections of the project.

The targeted surveys and pre-construction baseline surveys undertaken and planned have been designed to adequately identify the project impacts, baseline conditions and appropriate mitigation responses to these surveys have been incorporated into the species management plans where new species or occurrences species that now been recorded, and the increase in the predicted impacts to a number of species occurs. These changes are summarised in Section 5 of this document.

A summary of the targeted survey methodologies adopted for particular threatened species and communities, and compliance with applicable State and Federal survey guidelines is provided in **Table 4-2** to **Table 4-9**.

The survey guidelines relevant to the target species and communities are:

- Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities – Working Draft (DEC, 2004).
- Threatened Species survey and assessment guidelines: field survey methods for fauna - Amphibians (DECC, 2009).
- Commonwealth Survey Guidelines for Australia’s Threatened Fish (DSEWPaC, 2011a).
- Commonwealth Survey Guidelines for Australia’s Threatened Mammals (DSEWPaC, 2011b).
- Commonwealth’s Survey guidelines for Australia’s threatened frogs (DEWHA, 2010).
- EPBC Act referral guidelines for the vulnerable koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) (DoE, 2014).

Further details regarding a particular survey including timing and results are included in the relevant TSMP required under MCoA 8 and Commonwealth CoA 11 and CoA 12. The targeted survey reports that have currently been undertaken following the EIS/SPIR approval are listed below. Post EIS/SPIR studies build on a significant level of survey effort previously undertaken for the Project. Details of survey efforts prior to the below can be found within the Project EIS and SPIR reports.

Table 4-1 Threatened species and ecological community surveys undertaken for the Project since EIS and SPIR Approval

Applicable Management Plan	Title of Survey Report	Report Author/s	Report Date

Applicable Management Plan	Title of Survey Report	Report Author/s	Report Date
	Woolgoolga to Ballina Pacific Highway Upgrade Rufous Bettong & Brush-tailed Phascogale Preconstruction Baseline Monitoring Survey	Lewis, B.D. (Lewis Ecological)	5/12/2014
	Woolgoolga to Ballina: Pacific Highway Upgrade Long-nosed Potoroo Site Survey and Selection Study	Lewis, B.D. and Smith, A.C.M. (Lewis Ecological)	31/10/2014
Threatened Gliders	Pacific Highway Upgrade - Woolgoolga to Ballina Threatened Glider Baseline Surveys Sections 1 and 2 (Woolgoolga to Glenugie)	Sandpiper Ecological	30/10/2014
	Pacific Highway Upgrade - Woolgoolga to Ballina Threatened Glider Aerial Crossings Targeted Surveys: sections 3 and 11	Sandpiper Ecological	31/10/2014
Koala	Woolgoolga to Ballina Koala Preconstruction Surveys Final Report	EcoSure	09/10/2014
Coastal Emu	Pacific Highway Upgrade Woolgoolga to Ballina Coastal Emu Monitoring Study Roads And Maritime Services Phase 1: Pre-construction Survey Report (pre-fencing)	Jacobs	19/08/2014
	Pacific Highway Upgrade Woolgoolga to Ballina Coastal Emu Monitoring Study Aerial survey of emus in Sections 3 and 4: a pilot study	Jacobs	20/02/2015
Threatened Bats	Woolgoolga to Glenugie Pacific Highway Upgrade Targeted Bat Surveys – Section 1 (Ref. 2149-1048). Unpublished report to Roads and Maritime Services.	GeoLINK	2014
	Woolgoolga to Glenugie Pacific Highway Upgrade Targeted Bat Surveys – Section 2 (Ref. 2149-1045). Unpublished report to Roads and Maritime Services.	GeoLINK	2014
	Woolgoolga to Glenugie Pacific Highway Upgrade Targeted Bat Surveys – Section 3 - 11 (Ref. 2149-1045). Unpublished report to Roads and Maritime Services.	GeoLINK	2015
Threatened Invertebrates	Woolgoolga To Ballina Pacific Highway Upgrade, Targeted Survey And Habitat Assessment For Coastal Petaltail Dragonfly	BAAM Ecological Consultants	12/12/2014
	Woolgoolga To Ballina Pacific Highway Upgrade Preconstruction Survey and Nocturnal Monitoring For Conservation Significant Invertebrates	BAAM Ecological Consultants	23/05/2014
Threatened Fish	Aquatic Monitoring - Roads and Maritime Woolgoolga to Glenugie - Stage 1.	GeoLINK	2012
	Aquatic Monitoring RMS Woolgoolga to Ballina – Sections 6 - 11	GeoLINK	20/11/2013
	Oxleyan Pygmy Perch Drought Refuge Assessment RMS Woolgoolga to Ballina – Sections 7 - 9	GeoLINK	27/05/2014
	RMS W2B Threatened Species Management – Threatened Fish Stage 2 Aquatic Monitoring – Sections 6 - 9	GeoLINK	28/01/2015
Threatened Flora	Woolgoolga to Ballina Pacific Highway Upgrade Roads And Maritime Services Supplementary Assessments of Significance - Threatened Flora	Jacobs	07/01/2014

Applicable Management Plan	Title of Survey Report	Report Author/s	Report Date
	Pacific Highway Upgrade: Woolgoolga to Ballina Roads And Maritime Services Identification, distribution and abundance of <i>Angophora robur</i>	Jacobs	21/11/2014
	Woolgoolga to Ballina Pacific Highway Upgrades NSW Roads And Maritime Services Threatened Flora Pre-construction Surveys	Jacobs	18/07/2014
	Vegetation Survey Report Woolgoolga to Ballina Pacific Highway Upgrade Section 1 – Woolgoolga to Halfway Creek. Prepared for NSW Roads and Maritime Services	Biosis	03/10/2014
	Woolgoolga to Ballina Pacific Highway Upgrade – Vegetation Survey Report for Section 2 of Woolgoolga to Ballina Pacific Highway Upgrade. Prepared for NSW Roads and Maritime Services	EcoSure	
	Vegetation Survey Report Woolgoolga to Ballina Pacific Highway Upgrade (Section 3)	GeoLINK	21/10/2014
	Vegetation Survey Report Woolgoolga to Ballina Pacific Highway Upgrade (Sections 4 and 5)	GeoLINK	01/10/2014
	Woolgoolga to Ballina Pacific Highway Upgrade Section 6: Vegetation Surveys	Aecom	09/10/2014
	Vegetation Survey Report Woolgoolga to Ballina Pacific Highway Upgrade Section 7 – Devils Pulpit Upgrade to Trustums Hill	Biosis	03/10/2014
	Vegetation Surveys Sections 8 and 9 of the Woolgoolga to Ballina Pacific Highway Upgrade	Melaleuca Group	16/06/14
	Vegetation Surveys of Sections 10 & 11 of the Woolgoolga to Ballina Pacific Highway Upgrade	Australia Museum Consulting	16/10/2014
Rainforest	Pacific Highway Upgrade Woolgoolga to Ballina Prepared for Roads and Maritime Service, Rainforest communities and threatened rainforest plants. Preconstruction targeted surveys and baseline monitoring report.	EMM	12/08/2014

4.1 Frogs

Table 4-2 Threatened Frog Survey Methodologies

Species	Survey Methodology	Relevant State and Commonwealth Guidelines
	<p>Baseline surveys were performed to determine the extent of Wallum sedge frogs along the Woolgoolga to Ballina Pacific Highway project corridor. The survey focused on monitoring sites in sections 7-11, with the intention to implement a series of paired impact/control sites into a BACI sample monitoring program. Field surveys were originally scheduled to occur in January and again in March, however, ongoing dry conditions prevented this from occurring. Following some substantial rainfall in late March 2014 (>100 mm) the field sampling schedule was amended to the following:</p> <ul style="list-style-type: none"> ▪ Autumn surveys whilst conditions were still similar to a late summer sampling period with field surveys being conducted between 18 March and 11 – 13 April 2014; and ▪ Late autumn / early winter surveys also around rainfall and with the objective to sample at a time when juvenile and sub adult frogs could be expected. These surveys were performed between 31 May and 4 June 2014. <p>Frog surveys were performed in the following manner:</p> <ul style="list-style-type: none"> ▪ Surveys were performed generally within 7 days of a notable rainfall event (>10 mm in 24 hrs) using the Bureau of Meteorology (BoM) weather stations at Evans Head (058212). At other times the BoM website and radar images from Grafton were used to determine more fine scale survey requirements post rainfall; ▪ Surveys commenced at 30 minutes after dark with the latest surveys being performed up to around 0130 hrs; ▪ A 50 metre transect was installed at some sites whilst a timed 20 minute search was used as other sites where a 50 m transect could not be installed due to the small size of the habitat; ▪ All surveys involved the use of active search with a head lamp (Led Lensor H14R rated 850 lumens) and the use of call broadcast was used at only those sites which necessitated its use. For example, the control sites were already known to contain frogs and the objective was to obtain a count of frogs over a 100 m2 area and trying to minimise disturbance when performing this count; and ▪ For all frogs that were detected, the age class was determined with: <ul style="list-style-type: none"> ○ Adults defined as being >16 mm; ○ Sub adult <16 mm; and ○ Juvenile showing some form of a tail tad from recent metamorphosis. <p>For further detail refer to Lewis Ecological (2014a).</p> <p>In accordance with recommendations included in Lewis Ecological (2014a) and the Draft Threatened Frog Management Plan, Roads and Maritime have commissioned:</p> <ul style="list-style-type: none"> ▪ An additional opportunistic survey to be undertaken in early summer 2014/15 to try and establish a BACI fifth site. This survey will be undertaken should the ground water table have recharged at a suitable location in Section 8-10. ▪ Additional pre-construction surveys to occur in summer 2014 / 2015 to obtain baseline data counts for sub adults and juvenile frogs during a season of average to above average rainfall. The report is due to be completed mid-April 2015. <p>These additional surveys will provide both dry and wet season data on the population dynamics of Wallum Sedge Frogs and provide a sound basis to compare monitoring data in accordance with the Draft Threatened Frog Species Management Plan for the project.</p>	<p>Compliant with <i>Threatened Species survey and assessment guidelines: field survey methods for fauna - Amphibians</i> (DECC, 2009).</p> <p>Compliant with Commonwealth's Survey guidelines for Australia's threatened frogs (DSEWPaC, 2010).</p>

Species	Survey Methodology	Relevant State and Commonwealth Guidelines
<p>Giant barred frog (<i>Mixophyes iterates</i>)</p>	<p>Pre-construction surveys were undertaken with the purpose of confirming Giant Barred Frog activity within the Woolgoolga to Ballina Pacific Highway upgrade area. To achieve this objective the survey focused on collecting baseline population and habitat data to facilitate ongoing monitoring of impacts to populations as well as the effectiveness of mitigation measure as part of an adaptive management approach. Field surveys were undertaken over 21 nights summarised as follows:</p> <ul style="list-style-type: none"> ▪ Summer sampling over 6 nights in December 2012 and in January and February of 2013 for Sections 1 and 2. Some diurnal surveys were performed at a specific location (ch. 8400) on 16 May 2013; and ▪ Summer and autumn sampling was undertaken over 15 nights between February 2014 and April 2014. ▪ Frog surveys were performed in the manner outlined in the draft Threatened Frog Management Plan (RMS 2013). This involved: <ul style="list-style-type: none"> ▪ 500 m transect with 250 m either side of the Project corridor with the start and finish extent recorded using a hand held GPS in GDA94; ▪ At sites where this cannot be achieved (i.e. dams) a timed 60 minute search was undertaken. <p>Field surveys comprised spotlighting and call broadcast during the nocturnal transect followed by a timed 30 min search for tadpoles using a dip net during daylight hours.</p> <p>For each frog, the following information was collected:</p> <ul style="list-style-type: none"> ▪ Distance from the stream edge measured to the nearest 0.1 m; ▪ Position within the microhabitat (i.e. under litter, above litter, exposed, on rock/log); ▪ Sex (male, female, unknown) based on size of frog and inspection of nuptial pads present in male frogs; ▪ Age class (adult = >60 mm; sub adult = 40-60 mm; juvenile = <40 mm) ▪ Snout-vent length (mm); ▪ Weight (grams); and ▪ Breeding condition with: <ul style="list-style-type: none"> ▪ males assessed on the colouration of their nuptial pads (i.e. no colour, light, moderate, dark) in accordance with a classification developed by Lewis Ecological Surveys (Table 2-1); ▪ females based on whether they were gravid (i.e. typically adult weighing > 100 grams) or not gravid (egg bearing); ▪ frogs with a snout vent length of <60 mm were classified as immature <p>For further detail refer to Lewis Ecological (2014b).</p>	<p>Compliant with <i>Threatened Species survey and assessment guidelines: field survey methods for fauna - Amphibians</i> (DECC, 2009).</p>
<p>Green-thighed frog (<i>Litoria brevipalmata</i>)</p>	<p>Two forms of surveys were undertaken as part of the baseline monitoring surveys: nocturnal aural/ visual searches and diurnal searches for tadpoles and metamorphs in areas of suitable habitat holding water. To facilitate the implementation of mitigation and ongoing monitoring measures, these surveys aimed to confirm the presence of Green-thighed Frog activity in the Woolgoolga to Ballina Pacific Highway upgrade area as well as collecting baseline population and habitat data to inform adaptive management.</p> <p>Aural/ visual searches</p> <ul style="list-style-type: none"> ▪ On March the 28th 2014 a survey was undertaken to examine the areas of breeding habitat that had been identified as known or likely to be used by Green-thighed Frogs. This survey was undertaken in response to consistent light to moderate rainfalls across the range of the upgrade over the previous seven days followed by predictions of rainfall of between 50mm and 150mm across the region between the 27th and 28th of March 2014. ▪ Surveys were undertaken by two teams starting at 8:00PM on the night of the 28th, working north and south from Maclean. 	<p>Compliant with <i>Threatened Species survey and assessment guidelines: field survey methods for fauna - Amphibians</i> (DECC, 2009).</p>

Species	Survey Methodology	Relevant State and Commonwealth Guidelines
	<p>Surveys consisted of an initial five minute listening period at the identified suitable habitat to identify the species of frog present calling at the time. This was followed by a search of any flooded habitat to visually identify any non-calling species present in and around the flooded areas. At each site the following were recorded: time at start and end of survey for each survey site, conditions during the survey (including temperature, humidity, cloud cover, relative wind intensity and rainfall) and species of frogs calling.</p> <p><i>Tadpole/ metamorph frog surveys</i></p> <ul style="list-style-type: none"> ▪ These were undertaken on two occasions: 5-7th of February 2014 and 12th-14th of May 2014. ▪ Tadpoles were searched for by sweeping any water present with a fine scale mesh dip net of approximately 25cm diameter. A minimum of 10 sweeps were undertaken per 25m² of water body. ▪ Any tadpoles captured were examined to determine if they were hylids representative of Green thighed Frogs. If so, a sample was taken for further identification. If no tadpoles were seen, water bodies and the bank area within five metres were traversed to visually search for metamorphosed froglets. <p>For further detail refer to Niche (2014).</p> <p>Additional preconstruction baseline monitoring surveys for Green-thighed Frog have been commissioned by Roads and Maritime to occur in the first quarter of 2015. They will be conducted post suitable rainfall events. The surveys will be conducted at five paired BACI sites (nos 6-10) in Sections 3 and Section 1 & 2 of the W2B Upgrade Corridor. This proposal is based on the current knowledge of Green-thighed Frog distribution in these sections. The surveys are not to determine the distribution of frogs but rather a survey to obtain adequate preconstruction baseline monitoring data that can be meaningfully compared at a later stage during the construction or post construction stage of the relevant Upgrade sections. Results will inform the monitoring program for this species.</p>	

4.2 Mammals

Table 4-3 Threatened Mammals Survey Methodologies

Species	Survey Method	Relevant Guideline
<p>Koala (<i>Phascolarctos cinereus</i>)</p>	<p>Completed surveys</p> <p>Multiple methods have been employed to survey Koala populations in the study area to date. EIS (Roads and Maritime 2012) and SPIR (Roads and Maritime 2013) surveys mapped 18 sites across the project, in sections 1, 3, 5, 7, 9 and 10 using SPOT Assessment Technique (SAT) searches for Koala scats, call playback, spotlight surveys and habitat assessment plots.</p> <p>Additional Koala scat searches were conducted to supplement the presence/absence data reported in the EIS. Review of spatial data relied on data gathered for all previous surveys. Where there was no spatial data for Koala surveys, this was identified as a gap for the purposes of the supplementary surveys. The survey targeted spatial gaps from the previous fieldwork, identified using the project spatial data, including data on vegetation communities and BioMetric Vegetation Types. An additional 72 scat search plots were surveyed in February 2013 for this supplementary investigation. These included:</p> <ul style="list-style-type: none"> • Sites where potential habitat was recorded previously but no evidence of koalas reported (n=41). • The three vegetation types listed above, and locations near proposed connectivity structures in sections 7–11 that were not subject to previous Koala surveys(n=31). • The total number of sites assessed and mapped across all project sections includes: 160 Koala habitat assessment plots and 132 scat search plots. <p>Pre-construction Koala surveys were completed by Ecosure (2014a) in accordance with the 2013 draft Koala Management Plan using targeted SAT surveys. These surveys aimed to develop a baseline to provide recommendations for suitable monitoring locations and connectivity strategies. The specific objective of surveys varied among sections of the proposed project corridor, however, focused on assessing the presence and activity of Koalas in the region to identify the presence of resident and transient Koala populations by undertaking:</p> <ul style="list-style-type: none"> ▪ Searches for Koala faecal pellets and presence of Koalas were conducted in sections 5, 7, 9 and 10 within the project area. ▪ SAT's were used as a baseline survey assessed the presence and activity of Koala's in order to develop a population distribution model. ▪ A central tree was selected (breast height >100 millimetres) and used as a centre point. ▪ The base of the 29 closest trees (with breast height >100 millimetres) to the centre point were surveyed for signs indicating the presence of Koalas within a 1m radius of each tree. ▪ The surveys also incorporated a visual search for Koalas within a 25m radius of the centre tree and opportunistic observations of Koalas which recorded; sex, age, health status and behaviour. ▪ Results from the SAT were used to undertake population modelling and estimate the Koala activity/occupancy rate. <p>Additionally the distribution of potential habitat for the Koala throughout the footprint area of the Pacific Highway upgrade between Woolgoolga and Ballina 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, including the presence of faecal pellets. A</p>	<p><i>Compliant with Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities – Working Draft (DEC, 2004)</i></p> <p><i>Compliant with the requirements of the Commonwealths Draft EPBC Act referral guidelines for the vulnerable koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) (DoE, 2014)</i></p> <p><i>Compliant with Commonwealth Survey Guidelines for Australia's Threatened Mammals (DSEWPaC, 2011)</i></p>

Species	Survey Method	Relevant Guideline
	<p>Koala habitat quality score was assigned for each vegetation polygon.</p> <p>For further detail refer to Ecosure (2014a).</p> <p>Proposed surveys</p> <p>A population viability analysis (PVA) is proposed to be undertaken by Niche (2015), to enable construction of a robust PVA Ecosure/BioLink are undertaking a population demographic and genetic profile of the Koala meta-population inhabiting the general area (i.e. 3 – 4 km either side) of the preferred Stage 10 alignment of the W2B upgrade. This population demographic and genetic study consists of:</p> <ul style="list-style-type: none"> ▪ Demographic profiling to assess the distribution and central tendency measure associated with Koala age-class cohorts, as well as derived indices of mortality and reproductive output. ▪ Genetic profiling, by collecting tissue samples from individuals to investigate the genetic important of Koala populations in the Ballina area, establish the extent of gene flow among populations and determine the extent of inbreeding within populations. <p>Additional data such as sex, cohort, age (tooth wear), condition, reproductive status (females) and evidence of chlamydoisis will be collected from 60-70 Koalas that will be captured for the aforementioned PVA.</p> <p>Results will be summarised in the Ballina Koala Management Plan to be prepared.</p>	
<p>Rufous bettong <i>(Aepyprymnus rufescens)</i></p> <p>Brush-tailed phascogale <i>(Phascogale tapoatafa)</i>.</p>	<p>To assess the presence of the Rufous bettong and Brush-tailed phascogale as well as areas of suitable habitat for these species in the W2B upgrade corridor, pre-construction field studies were undertaken by Lewis Ecology (2014c). Field surveys were executed during a week-long field survey between the 16th and 23rd February 2014 along with some days in March 2014 and involved:</p> <ul style="list-style-type: none"> ▪ A habitat critiquing exercise to assess each site as to its suitability for the target species; ▪ Road kill traverse through the broader area whilst commuting between each of the sites and potential control sites; and ▪ Some spotlighting within 600 m x 600 m potential grid sites using a stratified process from the habitat critiquing. <p>A modified survey design was then adopted to complete the pre-construction baseline monitoring (Lewis Ecology 2014d) and develop a site selection survey report to guide the section of baseline mentoring sites for the Rufous Bettong and Brush-tailed Phascogale. For the Rufous Bettong survey methodology focused on the use of camera traps and spotlighting at each of the five paired sites previously identified.</p> <ul style="list-style-type: none"> ▪ Spotlighting was carried out by two experienced spotlighters for 1 hour per night at all 10 sites on two non-consecutive nights. ▪ Thirty-six baited camera traps were installed across a 600m grid with a 100m trap spacing. Camera traps were set to continuously operate over a 14 night (504 night's effort) periods between the 3rd of March and 5th of July. ▪ Trap bait was scattered over an area of 4-9 m2 and the earth was partly disturbed to increase the likelihood of the area being visited by the target species. ▪ Cameras were generally fixed to a tree or stump in a horizontal facing position around 1m off the ground with the primary objective of obtaining the largest field of view possible. ▪ Additional ancillary techniques such as nocturnal drive transects and morning road kill surveys were also employed to compliment these survey efforts. 	<p><i>Compliant with Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities – Working Draft (DEC, 2004)</i></p>

Species	Survey Method	Relevant Guideline
	<p>For the Brush-tailed Phascogale the survey effort was modified to include Elliot B traps, which were positioned on tree mounted brackets 2m above the ground and set out in a 1ha configuration. Phascogale were also surveyed for during the spotlighting, nocturnal drive transects, morning road kill surveys and camera trap surveys as described for Bettong.</p> <p>For further detail refer to Lewis, B.D. (Lewis Ecological) (2014c)</p>	
<p>Long-nosed potoroo (<i>Potorous tridactylus tridactylus</i>)</p>	<p>The purpose of the survey was to assess the presence of Long-nosed potoroo, areas of suitable habitat for these species in the W2B upgrade corridor and establish suitable BACI sites. 38 sites were selected in Sections 1, 2, 3, 6, 7, 9, 10 and 11. Pre-construction field studies were undertaken by Lewis Ecology (2014e). Field surveys were undertaken between the 26th May and 14th October 2014 and involved the following sampling regime:</p> <ul style="list-style-type: none"> ▪ Camera traps (ScoutguardTM 560 k zero glow) using a nine trap grid with 100 m spacing over a 300 m x 300 m area (9 ha). This area was considered adequate in the context that it is approximately twice the home range of Potoroo (2-5 ha) in north east NSW (see Bali et al. 2003). Moreover, it enabled smaller areas of suitable habitat to be sampled which otherwise could not have been sampled. ▪ Cameras were positioned in a horizontal manner approximately 0.5-1.5 m above ground and the timer set for activation between 1730-0600 hrs using video mode lasting 10 seconds with a 1 minute delay option between triggering events over a four night period (n=36 trap nights per site) with 1368 camera trap nights in total. All camera trap sites were baited with peanut butter, honey and oats scented with vanilla essence in freshly disturbed soil. ▪ Some spotlighting for 1 person hour within a sub set of survey sites (Sites 1-17, 19, 23, 24, 28, 29, 31, 32, 35 37) to gauge its usefulness as a survey technique for Potoroo. This technique culminated in 26 person hours of effort. ▪ Road kill transects in the general vicinity (i.e. <3 km) of the survey sites plus some adjacent areas totalling 190 km. ▪ Vehicle traverses (10-30 km/h) at night along small tracks and easements in the vicinity of survey sites totalling 42 km. <p>Each of the surveyed impact sites were critiqued to assess their overall likelihood of detecting the target species.</p> <p>During the site visit, the following information was collected:</p> <ul style="list-style-type: none"> ▪ Broad habitat type; ▪ Proximity of crossing structures at three scales of <0.3 km; 0.3-1 km and > 1 km; ▪ Diggings consistent with Potoroo observed; ▪ Substrate Type; ▪ Assess whether the area supported >50 ha of suitable habitat on either side of the Upgrade corridor; ▪ The number of records within 2 km of the proposed mitigation device; ▪ Consideration of the existing land tenure; and ▪ Suitability of a neighbouring control site which exhibited similar habitat attributes. <p>Supplementary seasonal targeted baseline surveys for the Long-nosed Potoroo (<i>Potorous tridactylus</i>) for the project are commissioned for Summer 2014/15. The additional Potoroo surveys will undertake a second round of monitoring to replicate population density surveys and confirm the extent of suitable habitat for the species in proximity to the project (particularly in Sections 6 and 7 where new records were found), confirm three additional monitoring locations and finalise mitigation measures such as the extent of exclusion fencing required. Results will inform the next update to the TMMP and the Fauna Connectivity</p>	<p>Generally compliant with <i>Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities – Working Draft</i> (DEC, 2004)</p> <p>Generally compliant with <i>Commonwealth Survey Guidelines for Australia's Threatened Mammals</i> (DSEWPaC, 2011)</p> <p>Note: Surveys commissioned by RMS for the Long-nosed potoroo (<i>Potorous tridactylus tridactylus</i>) included both identification of suitable habitat along the project, and identifying suitable locations for BACI monitoring sites. Methodologies employed for the determination of suitable BACI site locations and the gathering of initial baseline survey data were considered adequate for their purposes. Survey methods included camera traps, spotlighting, road kill transects and vehicle traverses. The survey method specifically for camera trapping efforts, was guided by recent scientific surveys for the Long-nosed potoroo which achieved detection levels of 95% over 6-8 nights (Taylor et al. 2013).</p> <p>Commonwealth guideline recommends for sites up to 5ha is:</p> <ul style="list-style-type: none"> • cameras should be deployed for at least 14 nights, and • approximately 10 cameras should be deployed per hectare. <p>The methods adopted by Lewis Ecological did not fully meet the above requirements. The survey method included camera traps</p>

Species	Survey Method	Relevant Guideline
	<p>Strategy for Sections 3-11.</p> <p>For further detail refer to Lewis, B.D. (Lewis Ecological) (2014d).</p>	<p>(Scoutguard™ 560 k zero glow) using a nine trap grid with 100 m spacing over a 300 m x 300 m area (9 ha). This area was considered adequate in the context that it is approximately twice the home range of Potoroo (2-5 ha) in north east NSW (see Bali et al. 2003). Moreover, it enabled smaller areas of suitable habitat to be sampled which otherwise could not have been sampled.</p> <p>Cameras were positioned in a horizontal manner approximately 0.5-1.5 m above ground and the timer set for activation between 1730-0600 hrs using video mode lasting 10 seconds with a 1 minute delay option between triggering events over a four night period (n=36 trap nights per site) with 1368 camera trap nights in total. All camera trap sites were baited with peanut butter, honey and oats scented with vanilla essence in freshly disturbed soil.</p> <p>Again this method was considered adequate for the purposes of establishing suitable habitats and BACI sites. Also a reduced number of trap nights was recommended due to a higher success rate being demonstrated in the first 6-8 nights (Taylor et al. 2013).</p> <p>It should be noted that initial surveys detected Long-nosed potoroos at 9 of 38 sites where habitat was suitable for this species with high activity levels achieved at most sites. Further surveys will be conducted in 2015 to refine methods, establish additional BACI sites and gather more baseline data.</p> <p>These monitoring locations will be monitored throughout construction and operational phases of the project to assess impacts on the Long-nosed potoroo (<i>Potorous tridactylus tridactylus</i>) and the potential need for corrective actions should unacceptable impacts be observed.</p>

Species	Survey Method	Relevant Guideline
<p>Gliders</p> <p>Squirrel Glider (<i>Petaurus norfolcensis</i>) and Yellow-bellied Glider (<i>Petaurus australis</i>).</p>	<p>Pre-construction surveys have been undertaken to establish baseline information on abundance of gliders both near and away from aerial crossings along the W2B upgrade. The aims of this assessment were to survey for threatened gliders in roadside habitat proximal to aerial crossings, in roadside habitat away from aerial crossings and within habitat away from the road alignment. Collecting this information is essential for developing management measures which can be adopted to reduce the potential impact on the squirrel glider and yellow-bellied glider populations and their habitats. Surveys were undertaken in known and likely habitat areas in the vicinity of the project to confirm presence of threatened gliders, refine the location of connectivity structures (glider poles, widened medians and rope bridges) and inform the selection of monitoring sites.</p> <p>The targeted surveys undertaken in the vicinity of the project area include three components:</p> <ol style="list-style-type: none"> 1. Glider surveys – spot-lighting surveys to detect the presence of gliders and indicate relative abundance in known and likely habitat areas. 2. Tree surveys – particularly focused on proposed location of connectivity structures to ascertain habitat suitability, tree heights and adequacy for glider use (i.e. 20m height or more). 3. Habitat tree surveys – to identify the number and size classes of habitat trees (i.e. trees with hollows for denning) in areas of known and likely habitat. <p>These surveys have been commenced and are at various stages of completion along the project area. In Sections 1 – 2 (Woolgoolga to Glenugie – W2G) all the components of the targeted survey have been completed. In Sections 3 – 11 (Glenugie to Ballina) the tree survey component of the targeted surveys has been completed with the remainder of the surveys due for completion in 2015.</p> <p>Surveys for Sections 1 and 2 were conducted by Sandpiper Ecological Surveys (2014a) and referred to as ‘pre-construction baseline surveys’. A total of 28 sites were selected for investigation, as follows:</p> <ul style="list-style-type: none"> • 11 impact sites (adjacent to proposed connectivity structures and within 100m of the road) • 8 control sites (within 100m of the road but at least 1km from an impact site) • 9 reference sites (at least 800m from the road). <p>At each site a basic habitat assessment was conducted to record habitat type, dominant species, hollow trees, disturbance (fire, roads, clearing etc.) and connectivity. Spot-lighting was undertaken at each site twice during summer 2014 and twice during winter 2014. Spot-lighting was undertaken by two ecologists walking for 30 minutes along a 500m transect. The species of each animal sighted was recorded.</p> <p>Targeted pre-construction surveys were also undertaken by Sandpiper Ecological Surveys (2014b) on 6 and 7 May 2014 to examine the potential for glider crossing (Sections 6 & 8) and assess the proposed locations for aerial crossing structures (Sections 3,4,7,9 & 10). Field assessment consisted of:</p> <ul style="list-style-type: none"> ▪ Site inspections focused on recording site features and assessing the suitability of the site for an arboreal crossing ▪ Assessment of vegetated median tree heights: Four 250m-long transects largely following the centre of eastern and western medians were sampled (total of 8 transects for 2km sample effort) to provide indicative mean tree heights ▪ Each transect was inspected by two ecologists whereby the tallest tree within a 5m radius was recorded at 15m 	<p><i>Compliant with Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities – Working Draft (DEC, 2004)</i></p>

Species	Survey Method	Relevant Guideline
	<p>intervals along each transect.</p> <ul style="list-style-type: none"> ▪ Spotlight transects were between 500 and 1000m and followed existing tracks or roads, with each transect being sampled on two non-consecutive nights ▪ Call playback for yellow-bellied glider was conducted on each transect which included a 10 minute listening period, five minutes of playback followed by spotlighting. ▪ Each crossing site was sampled on two non-consecutive nights by two experienced ecologists. <p>For further detail refer to Sandpiper Ecological (2013), Sandpiper Ecological (2014a) and Sandpiper Ecological (2014b).</p>	

4.3 Coastal Emus

Table 4-4 Coastal Emus Survey Methodologies

Species	Survey Method	Relevant Guideline
<p>Coastal Emu <i>Dromaius novaehollandiae</i></p>	<p>The coastal emu monitoring program aims to understand the distribution and habitat use by emus near the road corridor, and identify trends in population density for resident populations within the study area in order to evaluate successful mitigation measures. Surveys during the pre-construction period commenced in December 2013, followed by a February, April and June survey (2014) for a total of 40 field-person days (Jacobs 2014a). The autumn survey was conducted in late April to target the start of the breeding season with a second breeding survey conducted in June 2014. A number of surveys methods were undertaken as part of the baseline monitoring surveys: Walking transect, scat collection, vehicle bases surveys and camera trapping.</p> <ul style="list-style-type: none"> ▪ Each transect was surveyed once over a week long survey period. Transects were sampled throughout daylight hours (0730 to 1700) and involved a single observer walking slowly along the designated transect route and actively searching for signs of emu presence, concentrated over a 10 m wide search area. ▪ When encountered, the contents of scats were recorded and collected to be compared with reference plant material from each location to document dietary items. ▪ A vehicle-based survey was conducted in the Shark Creek area (Section 4) during the December, February, April and July surveys. Each survey was conducted in the late afternoon (commencing 1400-1500) and continued for 2 hours. ▪ The use of remote cameras provided the opportunity to collect additional information on emu distribution and seasonal habitat use. Camera trapping used fixed cameras, triggered by infra-red sensors, to 'trap' images of passing emus. ▪ Up to two traps were placed semi-systematically along each transect to provide a total of 4-8 cameras per study site. The number of traps used was increased at each survey as further transects were added resulting in a total of 33 cameras. Traps were placed at a height of approximately 1.5 metres above ground and were not baited, in some instances we trialled the use of a reflective object (compact disk) tied to a nearby tree to attract interest by passing emus and this technique is still being trialled. Cameras were set to take pictures 12 hours per day in daylight hours only, with a 10 second delay between exposures to minimise repeat photographs of the same animal while allowing continuous recording to capture additional emus in the case of pairs or juveniles. For further information refer to Jacobs (2014a). <p>Pilot Study: Aerial survey of emus in Sections 3 and 4 As per expert recommendation, a pre-construction aerial survey for the coastal emu was undertaken within Sections 3 and 4 of the Project. The aim of the pilot study was to determine the efficacy of conducting an aerial survey for emus as a means of supplementing ground-surveys, and to survey the distribution and abundance of the Coastal Emu. The study utilised the following methodology:</p> <ul style="list-style-type: none"> ▪ two survey blocks were selected (centred on Section 3 of the W2B project between Pillar Valley and Tyndale (Area A) and Section 4 from the Shark Creek wetlands to the cane properties between Tyndale and Maclean (Area B). ▪ distance sampling was used to count emus along transect lines from a helicopter (Bell 206 BIII) flown at 250 feet (76 m) above ground with a ground speed of 50 knots (93 km h-l) ▪ The pilot used a global positioning receiver (GPS) with pre-recorded start and end points to navigate along each transect. ▪ Two observers sat in the rear seat and counted emus from either side of the transect centre line. A third observer sat in the front seat. ▪ Emu sightings were noted and placed into 25 m distances classes, up to 150 m perpendicular to the transect line and 	<p><i>Compliant with Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities – Working Draft (DEC, 2004)</i></p>

Species	Survey Method	Relevant Guideline
	<p>recorded on to a Dictaphone for later transcribing and analysis of data. This allowed a search width of 300 metres along each transect.</p> <p>Findings: Despite a search area of 61.2 km² only one adult emu was observed in the Project area. A second emu was observed southwest of Sandon to the northeast of the Project study area using a random meander search method. The survey revealed that due to the low-population density, the commonly reported presence of single birds or pairs and the widespread habits of the species, aerial survey method for emus is likely to yield low results when conducted over a single survey and that repeated surveys over multiple days may be required to obtain robust data for analysis of density. Given these constraints and costs involved with aerial surveys the use of repeated surveys over multiple days is not considered an efficient or cost effective method of survey of emus in the Project area compared with the repeated ground surveys.</p>	

4.4 Bats

Table 4-5 Threatened Bats Survey Methodologies

Species	Survey Method	Relevant Guideline
<p>Cave-roosting Bats Little Bentwing-bat (<i>Miniopterus australis</i>), Eastern Bentwing-bat (<i>Miniopterus schreibersii oceanensis</i>), Southern Myotis (<i>Myotis macropus</i>), Large-eared Pied Bat (<i>Chalinolobus dwyeri</i>)</p>	<p>Microbat surveys were originally undertaken by GeoLINK in November 2013 in the form of a habitat assessment to identify the presence of potential roosting features.</p> <ul style="list-style-type: none"> ▪ Large-footed Myotis has two breeding events per season in Northern NSW. November was chosen to maximise detection of breeding activity as it coincides with the first breeding event of the season. A total of 71 culverts were surveyed within Section 1 in November 2013 and a total of 58 culverts (including the Bebo Arch crossing at Glenugie Creek) and two bridges (Halfway Creek Bridge and Wells Crossing Bridge) were surveyed within Section 2 in November 2013. ▪ Upon completion of the November 2013 surveys, 34 drainage structures within Sections 1 and 2 were assigned to the high, medium or low-medium conservation/ habitat value categories. These 34 drainage structures were surveyed again on 11 February 2014, coinciding approximately with the second Large-footed Myotis birthing event of the breeding season. ▪ Pre-construction winter surveys were recommended by Schulz (2013) as part of the TMMP peer review. These surveys aim to address seasonal variations in microbat roost behaviour and in particular, identify important winter roost sites (e.g. for threatened bentwing-bats). Winter (June to mid-August) surveys therefore targeted all identified drainage structures categorised in GeoLINK’s summer 2013-14 surveys in the high, medium and low-medium conservation/ habitat value category, and low conservation/ habitat value drainage structures where evidence of microbat usage was recorded. ▪ Based on the results of summer 2013-14 surveys, a total of 24 structures within Section 1 and 16 structures within Section 2 were identified as low (with evidence of microbat usage), low-medium, medium or high conservation/ habitat value and therefore re-surveyed in winter 2014. Following the winter 2014 surveys, the conservation/ habitat value of the surveyed drainage structures were re-assessed in order to re-assign the low-medium conservation/ habitat value category drainage structures into low or medium. This plan applies to four structures within Section 1 and four structures within Section 2 that were categorised as high or medium conservation/ habitat value following assessment of data collected during summer 2013-14 and winter 2014. <p>Additional targeted microbat surveys have now been undertaken across Sections 3, 4 (part), 5 (part), 6, 7, 8, 9, 10 and 11 and will inform detailed design and updates to the Threatened Bats Management Plan.</p> <p>GeoLink undertook surveys within Section 3-11 where the aim of these surveys was identifying the use of identified drainage structures by cave-roosting microbats with a focus on use by threatened bat species, including any potential for breeding roosts to be impacted. All culverts and bridges were checked pre-construction for roosting bats in the following periods:</p> <ul style="list-style-type: none"> ▪ Winter (for wintering bats of all cave-roosting bats) ▪ Mid to late spring (all species, particularly for breeding Southern Myotis) ▪ A third check of culverts/bridges where Southern Myotis were found roosting in the first two checks for breeding activity in January-February). <p>85 drainage structures were surveyed. The surveys involved a habitat assessment to identify the presence/ absence of potential roosting features at each drainage structure, followed by inspection throughout each drainage structure, inspecting potential roosting sites. Features documented included:</p> <ul style="list-style-type: none"> ▪ Drainage structure type and dimensions. ▪ Location. ▪ Broad habitat type (surrounding area). 	<p>Survey method is compliant with the <i>Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities Working Draft</i> (DEC 2004).</p> <p>With respect to <i>Chalinolobus dwyeri</i> surveys undertaken are compliant with <i>Commonwealth Survey Guidelines for Australia’s Threatened Bats</i> (DSEWPac, 2010).</p>

Species	Survey Method	Relevant Guideline
	<ul style="list-style-type: none"> ▪ Presence of water (potential Large-footed Myotis foraging habitat). ▪ Presence of potential microbat roosting features (airflow, humidity, light penetration, structural roosting features). ▪ Presence of microbats (direct observation and bat chatter) and/ or evidence of previous occupancy (staining and/ or guano). ▪ Evaluation of the significance or conservation value of each drainage structure for microbats and; ▪ Where microbats were detected: recording the species and number of individuals. <p>Findings: 40 drainage structures showed evidence of microbat usage; 11 drainage structures had large footed myotis (<i>Myotis Macropus</i>) within/on them. The following species were identified during the survey: Little Bentwing-bat (<i>Miniopterus australis</i>), Eastern Bentwing-bat (<i>Miniopterus schreibersii oceanensis</i>), and Southern Myotis (<i>Myotis macropus</i>).</p>	

4.5 Invertebrates

Table 4-6 Threatened Invertebrates Survey Methodologies

Species	Survey Method	Relevant Guideline
<p>Southern Pink Underwing Moth <i>Phyllodes imperialis smithersi</i></p> <p>Atlas Rainforest Ground Beetle <i>Nurus atlas</i></p> <p>Coastal Petaltail Dragonfly <i>Petalura litorea</i></p>	<p>Targeted surveys for Southern Pink Underwing Moth and its host plant, as well as Atlas Rainforest Ground Beetle, were conducted during early Autumn 2014 (March, April 2014). Surveys applied the active searching techniques as per BAAM (2012, 2013), to confirm and establish suitable locations for ongoing monitoring throughout the project.</p> <p>Targeted surveys for the Coastal Petaltail Dragonfly were undertaken between 17 and 21 November 2014. A preliminary survey for Coastal Petaltail Dragonfly was conducted by BAAM in Sections 10 and 11 of the Study Area (between Wardell and Ballina) during February 2012.</p> <p>Invertebrate surveys were suggested to record the presence, age and abundance of any Southern Pink Underwing Moth individuals detected, as well as any potentially influential factors. Surveys aimed to accurately identify and quantify individual host plants in habitat areas adjacent to the impact areas and/or project and to identify locations where any individuals of the species are found, or have been encountered within 20 metres of the project. Each survey included at least two control sites, with survey sites selected based on the likely presence of potential habitat for the target species</p> <ul style="list-style-type: none"> ▪ Surveys for the Southern Pink Underwing Moth consisted of 50 metres long transects with observations 10 metres on either side of the centre line recorded. Data collected from transects included, but not be limited to; ▪ Number, sex and form of individuals of <i>Carronia multiseppalea</i>. ▪ Leaf characteristics (in particular, presence of soft, pale new leaf growth) of individuals of <i>Carronia multiseppalea</i>. ▪ Presence, abundance and age of any Southern Pink Underwing Moth larvae found on host plants. ▪ Number of fleshy-fruited native tree species. ▪ Per cent cover of native and exotic plant species in each stratum. <p>Surveys for adult moths were suggested to be undertaken at night, between dusk and 10pm. During the known peak breeding periods, moths were targeted in transects one night a week over a 6 week period using the following method:</p> <ul style="list-style-type: none"> ▪ 3 to 5 fruit baits, consisting of a rotting banana in a mesh bag, at intervals along each transect. <p>A baseline survey for the larval host plant of the Richmond Birdwing Butterfly, <i>Pararistolochia praevenosa</i> and nocturnal surveys for Atlas Rainforest Ground-beetle were to be conducted at the same time as surveys are for the Pink Underwing Moth.</p> <p>Targeted surveys for the Atlas Rainforest Ground-beetle was reported that monitoring transects were located within areas supporting burrows or preferred habitat features, using the same survey method defined for the Pink Underwing Moth. Data collected from transects included:</p> <ul style="list-style-type: none"> ▪ Number of identified burrows ▪ Presence of any live or dead Atlas Rainforest Ground-beetles. ▪ Presence and abundance of preferred habitat features (rocks, logs and large ground roots). <p>Targeted surveys and field assessments for the Coastal Petaltail Dragonfly were conducted at 32 unique sites along the footprint of the proposed road corridor. Survey sites were selected where suitable wetland habitat occurred in proximity (within 10km) to known</p>	<p>Survey method is compliant with the <i>Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities Working Draft (DEC 2004)</i>.</p>

Species	Survey Method	Relevant Guideline
	<p>records. At each site active observations and meandering searches were undertaken, encountered dragonflies were captured with an insect net.</p> <p>At each site habitat assessments were undertaken, capturing data pertaining to the suitability of the habitat to support breeding habitat for the Coastal Petaltail Dragonfly (i.e. vegetation composition with particular reference to the presence of wetland species, the presence of permanent or semi-permanent wetland features including standing water and dominant wetland plants specie, and signs of disturbance).</p> <p>Data collected during habitat assessments was then used to determine the Habitat Condition Score (between 0 and 5) of each site. 'Habitat Condition' Scores awarded a point for each of the following breeding habitat criteria:</p> <ul style="list-style-type: none"> • Presence of permanent or semi-permanent open standing freshwater, • Freshwater wetland without obvious signs of pollution, • Presence of ample aquatic vegetation, • Presence of fringing vegetation, • Presence of extensive freshwater swamp within 100 metres of the site <p>Based on the targeted surveys and habitat assessment, wetland polygons were then mapped into 'known' or 'potential' habitat for the Coastal Petaltail Dragonfly as follows:</p> <ul style="list-style-type: none"> • Known habitat for Coastal Petaltail where records occur associated wetlands represent breeding habitat for the dragonfly; and • Potential breeding habitat Coastal Petaltail permanent or semi-permanent wetlands are known or considered likely to be present, but where the dragonfly has not yet been recorded. <p>For further information refer to BAAM Ecological Consultants (2014a) and (2014b).</p>	

4.6 Fish

Table 4-7 Threatened Fish Survey Methodologies

Species	Survey Method	Relevant Guideline
<p>Oxleyan Pygmy Perch (<i>Nannoperca oxleyana</i>)</p>	<p>Two seasons of pre-construction targeted surveys for the threatened Oxleyan Pygmy Perch were completed for sections 1 and 2 (Woolgoolga to Glenugie) (GeoLink 2012, Aquatic Science and Management 2013) and for sections 6 to 9 (Iluka Road to the Richmond River) (GeoLink 2013, 2014). The objective of these surveys was to:</p> <ul style="list-style-type: none"> • locate drought refuges and how changes in ground water levels and a reduction in surface water runoff can influence the movement of threatened fish species between drought refuges and suitable ephemeral habitat. • Establish baseline conditions for the habitat and water quality parameters at known or potential threatened fish sites for ongoing monitoring during the construction and operational stages of the project. • Re-assess the likelihood of presence of threatened fish species for input into the final design of waterway crossing structures, and temporary and permanent detention basins in consultation with DPI (Fisheries); and • Identify a final list of monitoring sites that focuses on known habitat for threatened fish species. <p>GeoLINK (2014b) conducted the sampling of sites using a combination of backpack electrofisher and unbaited box traps. In summary, this involved:</p> <ul style="list-style-type: none"> • The deployment of 10 unbaited standard collapsible bait traps for 30 minutes. Where no threatened species were recorded during the initial 30 minutes, traps would be deployed for an additional 30 minutes. Unbaited traps would be used as baiting does not increase the probability of attracting fish (Knight et al. 2007). Unbaited bait traps would be placed 1.5 to 2 m apart amongst or near submerged or emergent vegetation • Undertaking backpack electrofishing, where safe to do so, generally restricted to shallow areas (e.g., <1 m depth) due to safety concerns operating in deeper water, targeting still or flowing habitats with submerged or emergent aquatic vegetation and submerged rocks and logs. Voltage, current and pulse settings would be adjusted according to local conductivity recordings to ensure fish were only stunned temporarily. Sampling would be undertaken for a maximum of 600 second pulse time or two passes of available habitat, with any stunned fish collected using a 5 mm dip net (knotless mesh) • Use of dip nets where sample techniques listed above are unable to be used effectively (e.g., in water too shallow to deploy traps). <p>For further information refer to Geolink (2014) and Geolink (2015).</p>	<p>Compliant with Survey Guidelines for Australia's Threatened Fish (DSEWPaC, 2011).</p> <p>Survey method is compliant with the <i>Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities Working Draft (DEC 2004)</i>.</p>

4.7 Flora

Table 4-8 Threatened Flora Survey Methodologies

Species	Survey Method	Relevant Guideline
	<p>Roads and Maritime have engaged a range of suitably qualified and experienced ecologists to undertake vegetation surveys, habitat assessments and ecological surveys across the entire project area. These surveys have now been completed for Sections 1 to 11. The surveys occurred throughout 2014.</p> <p>Ecology surveys for each section included:</p> <ul style="list-style-type: none"> ▪ Vegetation community surveys ▪ Habitat tree assessments ▪ Threatened flora species assessments ▪ Weed surveys ▪ Habitat scoring for EPBC Act communities and species. <p>The survey methods adopted for each section were consistent, and are summarised below:</p> <p>Vegetation community surveys</p> <p>The location and extent of EIS mapped vegetation communities was verified during the field surveys through a combination of:</p> <ul style="list-style-type: none"> ▪ Analysis of aerial photography ▪ In-field capture of data on a GPS enabled tablet with the EIS vegetation mapping ▪ On-ground assessment of the plant community structure and floristic diversity to assess condition of vegetation ▪ Observations of recent disturbances and changes in land management practices were undertaken. <p>The entire project area was traversed in parallel strips by ecologists. During traverses, differences between mapped desktop communities and field verified vegetation communities were recorded. The discrepancies between the mapped EIS and ground-truthed vegetation were recorded and updated mapping provided.</p> <p>In addition to site reference data (polygon number, date, recorder etc.), the following information was captured within each mapping polygon:</p> <ul style="list-style-type: none"> • Dominant species, percent (%) cover and height range for four possible structural layers (emergent, upper, middle, ground) • additional native species • Ground layer characteristics (% litter cover, % bare ground, the presence of woody debris, regeneration canopy, trees with DBH of >70cm) • Weed species • Overall % cover of weed species (may be divided between structural layers if relevant) • Weed invasion into native vegetation 	<p>Survey method is compliant with the <i>Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities Working Draft (DEC 2004)</i>.</p> <p>Allocation of Plant Type Communities were undertaken in accordance with <i>'Targeted Vegetation Survey of Floodplains and Lower Slopes on the Far North Coast' (Sheringham et al.2008)</i>.</p>

Species	Survey Method	Relevant Guideline
<p><i>tetraphylla</i>)</p> <ul style="list-style-type: none"> • <i>Maundia</i> (<i>Maundia triglochoides</i>) • Weeping Paperbark (<i>Melaleuca irbyana</i>) • Yellow-flowered King of the Fairies (<i>Oberonia complanata</i>) • Soldiers Crest Orchid (<i>Oberonia titania</i>) • Square-stemmed Olax (<i>Olax angulate</i>) • Tall Knotweed (<i>Persicaria elatior</i>) • Singleton Mint Bush (<i>Prostanthera cineolifera</i>) • Moonee Quassia (<i>Quassia</i> sp. <i>Moonee Creek</i>) • <i>Rotala tripartita</i> • Siah's Backbone (<i>Streblus pendulinus</i>) • Smooth-barked Rose Apple (<i>Syzygium hodgekinsoniae</i>) 	<ul style="list-style-type: none"> • Extent of weed invasion into native vegetation • Disturbances. <p>Habitat quality scores for EPBC Act listed Species The aim of the habitat quality assessments was to calculate a habitat quality score polygon for each confirmed EPBC listed threatened species that will be significantly impacted by the project. A habitat quality survey was conducted to allocate a habitat quality score in accordance with the EPBC Offsets Policy and Offsets Assessment Guide to each mapped vegetation polygon for each EPBC Act listed threatened species where a significant impact has been identified during the EIS.</p> <p>All vegetation types were assessed with a rapid assessment of habitat quality scores proforma used to predict the vegetation types within the study area. Attributes were recorded in polygons that were considered or known to provide potential habitat for the relevant EPBC Act species and TEC. Polygons were assigned a score between 1 (lowest) and 10 (highest) based on three separate criteria; being, polygon condition (score of 1-3), polygon context (score of 1-3), and species stocking rate (score of 1-4).</p> <p>Habitat Tree and Hollow Tree Assessment Surveys for habitat trees and tree hollows were also undertaken within all sections in order to inform the Nest Box Management Plan. Details of the hollow bearing tree surveys are provided within the Nest Box Management Plan(s).</p> <p>Weed Survey Weed surveys were undertaken to identify and map weed infestations within the Study Area and record information pertaining to the height and density of infestations where they occurred. For the purposes of the survey, weeds were defined as Weeds of National Significance (WONS), National Environmental Alert List Weeds, noxious weeds requiring control under the Noxious Weeds Act 1993, and environmental and agricultural weeds relevant to the local area.</p> <p>Sections 1-11 Targeted Threatened Flora Surveys Jacobs were engaged by Roads and Maritime to undertake targeted surveys for threatened plants and baseline monitoring for the entire project. The purpose of the targeted surveys was primarily to collect baseline data to inform ongoing monitoring, confirm location and number of threatened plants within the project, mark plants within and surrounding the project and to inform the development of a translocation strategy. Additional objectives were to establish in-situ monitoring locations for each species/population adjacent to the project clearing boundary and collect pre-construction baseline data to be used as a basis for ongoing monitoring during construction and operation. Field surveys were conducted over a five-week period in Autumn 2014 (between the 18 March 2014 and 7 May 2014) and a single week in early spring (1-5 September 2014). A total of 82 monitoring locations were established which covers 92 threatened flora occurrences, with some plots supporting two or three threatened species. The placement of monitoring locations were approximated prior to field surveys.</p> <ul style="list-style-type: none"> ▪ A 20 x 20 metre plot size with a central 20 metre transect was used at each site 	

Species	Survey Method	Relevant Guideline
	<ul style="list-style-type: none"> ▪ A tape measure was laid out along transects to indicate the boundaries of the plot area, record vegetation cover and to use as a reference for plant locations. ▪ Habitat condition parameters recorded were consistent with the methods identified in the Plan (Roads and Maritime Services 2013b) ▪ Other information recorded included dominant flora species in each structural layer, prevailing site conditions and (i.e. soil moisture, climate, and water levels and flow) and landscape parameters (i.e. landform, drainage, slope and aspect). The cover of vegetation layers was recorded using the central 20 metre transect (refer to Figure 2-2) with the canopy and midstorey (greater than one metre high) cover was recorded as percentage foliage cover every five metres (four points) along the transect and groundcover attributes were recorded at every metre (20 points) as either forb, grass, shrub (less than one metre high), bare/water, litter or exotic. <p>For further information refer to the individual technical reports.</p> <p>Pre-clearance surveys will be undertaken just prior to construction and if any additional threatened flora species or populations are identified then the Flora Management Plan will be updated using an avoid, mitigate and offsetting approach.</p>	

4.8 Rainforest

Table 4-9 Threatened Ecological Communities Survey Methodologies

Species	Survey Method	Relevant Guideline
<p>Threatened Ecological Communities including:</p> <ul style="list-style-type: none"> • Lowland Rainforest in Sub-tropical Australia • Lowland Rainforest in NSW North Coast and Sydney Basin Bioregions • Littoral Rainforest and Coastal Vine Thickets of Eastern Australia • Littoral Rainforest in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions <p>The following threatened rainforest plant species were targeted during the rainforest surveys (species in bold represent those located within the Project boundary (direct and indirect impacts)::</p> <ul style="list-style-type: none"> • <i>Acronychia littoralis</i> (Scented Acronychia) • <i>Acalypha eremorum</i> (Acalypha) • <i>Archidendron hendersonii</i> (White Lace Flower) • <i>Belvisia mucronata</i> (Needle-leaf Fern) • <i>Cryptocarya foetida</i> (Stinking Cryptocarya) • <i>Davidsonia johnsonii</i> (Smooth Davidson's Plum) • <i>Endiandra hayesii</i> (Rusty Rose Walnut) • <i>Endiandra muelleri</i> subsp. <i>bracteata</i> (Green-leaved Rose Walnut) 	<p>Vegetation surveys for threatened rainforest communities and plants have been completed across Sections 1-11 to collect comprehensive up to date data on the location, health and number of threatened rainforest plants and communities within the project area. The surveys also marked plants, confirmed monitoring sites and collected baseline data to inform the development of the translocation strategy and monitoring program.</p> <p>In addition a targeted rainforest community and rainforest plant survey was conducted in Sections 10 and 11 of the project. The surveys were undertaken in February 2014 using the random meander method of Cropper (1993). Rainforest communities were mapped including walking the boundary of the community taking GPS points at regular 1m intervals and then later mapping the area using GIS.</p> <p>For further information on the targeted rainforest community and plants survey refer to EMM (2014).</p>	<p>Survey method is compliant with the <i>Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities Working Draft (DEC 2004)</i>.</p>

Species	Survey Method	Relevant Guideline
<ul style="list-style-type: none"> • Coatesia paniculata syn. Geijera paniculata (Axe-breaker) • Macadamia tetraphylla (Rough-shelled Bush Nut) • Ochrosia moorei (Southern Ochrosia) • Streblus pendulinus syn. S. brunonianus (Whalebone Tree) • Syzygium hodgkinsoniae (Red Lily Pilly) • Tinospora tinosporoides (Arrow Head Vine) 		

5. Changes to Management Plans, Mitigation and Management Measures

The draft TSMPs included in the SPIR and mitigation measures summarised in Appendix H (of the SPIR) are considered the baseline for the project's threatened species management and mitigation measures. The findings from targeted surveys and pre-construction baseline monitoring completed in 2013 and 2014 have been used to update the TSMPs. Changes have also been made to address expert and agency feedback. Updates may result in changes to the avoidance, mitigation and offset measures previously presented in the SPIR and draft TSMPs, and the level of impact of the project on these species.

A summary of changes proposed to avoidance, mitigation or offset measures and level of impact as a result of the change is presented in **Table 5-1**.

Table 5-1 Changes to Threatened Frog Management Plan Mitigation and Management Measures

Management Plan	Rev	Species	Project Section Affected	Section of the Relevant Management Plan	Description of Change	Impact of Change
Threatened Frog Management Plan	2	Wallum Sedge Frog <i>Litoria alongburensis</i>	7-11	Section 3.1.2 and Section 3.4	Based on the results of targeted threatened Wallum Sedge Frog surveys conducted throughout 2014, the area of potential habitat for this species has been refined (Lewis 2014). Potential habitat was originally identified in Sections 6-11 but this area has now been reduced to between Sections 7-11. This species has been confirmed to occur in Sections 8, 9 and 10 and it is considered unlikely to occur in Sections 7 and 11. As a result of agency comments further work has been completed to map breeding and foraging habitats for Wallum Sedge Frog based on targeted survey results. This will assist to quantify potential direct and indirect impacts to habitats and inform location of mitigation measures such as exclusion fencing and water quality management measures.	As a result of targeted surveys the area of potential impact for the Wallum Sedge Frog has reduced from six sections to five sections. Areas of breeding and foraging habitat within the construction footprint and proximity to the project have been mapped. The extent of direct impact on breeding habitat has been calculated at 2.35ha and foraging habitat at 10.4ha. These direct impacts cannot be avoided and are proposed to be offset and further information regarding offsets is provided in the Biodiversity Offset Strategy.
				Section 5.3.3 and Section 5.3.9	Based on the results of targeted threatened Wallum Sedge Frog surveys conducted throughout 2014 and habitat mapping for the Wallum Sedge Frog the locations of frog exclusion fencing has been refined. Temporary and operational frog fencing for the Wallum Sedge Frog is likely to be focused around areas in Section 9 around chainage 139500 where both sides of the carriageway require fencing (of at least 100 m beyond the edge of identified habitat). Section 10 will also contain frog fencing (including between ch. 148300 – 148750). A total of 850metres of frog fencing is proposed in Section 9 and 10. Habitat mapping for each of the three frog species has been included in the Threatened Frog Management Plan which will then inform mitigation measures such as fencing, connectivity structures and water quality management measures.	Greater detail has been included in Section 5.3.3 on the design and location of frog exclusion fencing for Wallum Sedge Frog. Exclusion fencing is a mitigation measure and will reduce impacts to threatened frogs from vehicle strike. An adaptive management approach will be applied to the implementation of temporary exclusion fencing, therefore the need for additional fencing will be assessed if additional frog species are identified during pre-construction or construction activities as per the unexpected finds procedures.
			9	Section 5.3k.10	This section has been updated to provide more information on crossing structures that will reduce impacts to Wallum Sedge Frog. This is supported by the results of monitoring surveys undertaken for threatened frog species at underpass sites along the Tugun Bypass project. During these surveys, Wallum Sedge Frogs were observed inside and around the entrances of underpasses suggesting movement between the east and the west of the structure (SMEC 2011). As detailed design has not been completed for the areas where Wallum Sedge Frog habitat has been identified, connectivity structures for this species are yet to be confirmed. Proposed connectivity structures that may be used by the Wallum Sedge Frog are a land bridge at ch.140000 and an underpass at ch.139500. Although the success of land bridges as a connectivity structure for this species is relatively unknown, research suggests that on wet nights this species tends to radiate out from the sedge swamps with free standing water in into dry heath areas. Design features such as small ponding areas and associated vegetation will therefore be considered during design to enhance usability. The use of this land bridge will be closely monitored during the standard frog monitoring schedule. The locations of connectivity structures for this species will be finalised after detailed design of Sections 3-11 and detailed in a future Fauna Connectivity Strategy for agency approval.	This species is known to radiate out from the sedge swamps with free standing water and into dry heath areas, and therefore is likely to move out onto appropriately vegetated land bridges. This will increase the availability of crossing opportunities for this species. Crossing structures, including underpasses and a land bridge are proposed to mitigate impacts to Wallum Sedge Frog populations. The final locations will be confirmed in a subsequent Fauna Connectivity Strategy prior to commencement of Sections 7-11.
	1 & 2	Giant Barred Frog <i>Mixophyes iteratus</i>	1 & 2	Section 3.1.2 and Section 3.4	Based on the results of targeted threatened frog surveys conducted in 2013 and 2014, the area of potential habitat for this species been refined (Lewis 2013 and Lewis 2014). Potential habitat was originally identified is Sections 1, 2 and 7 but this area of potential habitat has now been reduced to Sections 1 and 2. As a result of agency comments further work has been completed to map habitat for Giant Barred Frog based on targeted survey results. This will assist to quantify potential direct and indirect impacts to habitats and inform location of mitigation measures such as exclusion fencing and connectivity structures.	As a result of targeted surveys the area of potential impact for the Giant Barred Frog has reduced from three sections to two sections. Their habitat is limited to Section 1 and 2. Areas of breeding habitat within the construction footprint and proximity to the project have been mapped. This species performs all of its life cycle functions within the riparian zone and as such the different life cycle traits was not differentiated. The extent of direct impact on breeding habitat has been calculated at 4.85ha. These direct impacts cannot be avoided and are proposed to be offset and further information regarding offsets is provided in the Biodiversity Offset Strategy.
				Section 5.3.3 and 5.3.9	Based on the recommended fencing requirements for the Giant Barred Frog, all earth embankments/batters with a batter profile of less than 2:1 and within 200 m of the stream will require fencing to be installed between 100 - 200 m either side of the stream. A fence return of 5 m should be installed if the frog fencing does not extend for at least 50 m into unsuitable habitat (i.e. cleared land or non-riparian habitat). Consequently, the final design will be reviewed by an experienced ecologist to determine the requirement of operational frog fencing for Giant Barred Frog. Fence parameters include: <ul style="list-style-type: none"> Installed for up to 200 m either side of known threatened frog habitat including streams and breeding sites. Where the terrestrial habitat borders a stream that contains cleared land this could be reduced to 100 m. Fence height will extend to at least 900 mm above the ground and buried to a depth of between 50 and 100 mm. A return of wing of 3 to 5 m to minimise breaches. Constructed using UV resistant shade cloth which is permeable to water. Geotextile materials may also form an adequate substitute. Posts/pegs placed on the works side of the exclusion fence to prevent frogs using these structures to climb the fence. Include relevant signage to identify the area and inform construction personnel. 	Fencing for this species will need to reflect the specific distances and locations outlined within the Threatened Frog Management Plan. Exclusion fencing will reduce impacts to threatened frogs from vehicle strike. An adaptive management approach will be applied to the implementation of temporary exclusion fencing, therefore the need for additional fencing will be assessed if additional frog species are identified during pre-construction or construction activities as per the unexpected finds procedures.

Management Plan	Rev	Species	Project Section Affected	Section of the Relevant Management Plan	Description of Change	Impact of Change
					Frog fencing has been finalised for Sections 1 and 2 where the species is known to occur. Large areas of fencing are proposed in proximity to mapped habitats including chainage 3400, 8,500, 13,200, 15800 and 20500.	
		Green-thighed Frog <i>Litoria brevipalmata</i>	Sections 1-8	Sections 2.3.1, Section 2.3.2, Section 4.3.3, Section 7.2.1	<p>Additional information to summarise targeted surveys and findings for the Green-thighed frog have been included.</p> <p>Niche Environment and Heritage Pty Ltd (Niche) was commissioned by Roads and Maritime to fulfil pre-construction survey requirements for the Green-thighed Frog. The purpose of these pre-construction surveys was to enable preparation works along the length of the W2B project and to gathering data to inform the design of a Green-thighed Frog monitoring program to continue throughout the duration of works and post construction.</p> <p>More recently, the Roads and Maritime have engaged Lewis Ecological Surveys to undertake additional targeted surveys and also select some additional BACI monitoring sites in Sections 3-8 of the Project with the objective of locating an additional five paired sites. This follows sightings of Green-thighed Frog across all 10 of the Rufous Bellong pre construction monitoring sites located in and adjacent to Section 2 and 3 (Lewis 2014; unpublished data) and some historic records for this species from Section 7 (Lewis 2006). In this way, these later surveys from January-April 2015 represent the adaptive approach currently being adopted by the Roads and Maritime.</p> <p>This data will supplement monitoring efforts by Niche Pty Ltd in 2014.</p> <p>As a result of agency comments further work has been completed to map breeding and foraging habitats for Green-thighed Frog based on targeted survey results. This will assist to quantify potential direct and indirect impacts to habitats and inform location of mitigation measures such as exclusion fencing and water quality management measures.</p>	
				Section 5.3.3 and 5.3.9	<p>Based on the recommendations from the 2014 targeted surveys, the extent of operational fencing for Green-thighed Frog must extend at least 100 m beyond the edge/s of identified habitat. It is expected this distance will cover the movement distances of most post-breeding frogs and address any concerns with attracting frogs close to the carriageway.</p> <p>Locations of temporary and operational fencing for Sections 1 and 2 are confirmed and proposed fencing for Sections 3-11 provided. In Section 1 800m of fencing is proposed in proximity to chainage 5200 to 6000. In Section 2 950metres is proposed in proximity to 18850 and 19800 and another 300m at chainage 25000. Fencing locations are quite extensive for Green-thighed Frog to focus around areas of identified breeding habitats.</p> <p>Operational fencing for Green-thighed Frog has been proposed in areas where constructed breeding ponds have been proposed because there will be a long term attempt to attract frogs to an area close to the newly constructed carriageway. The extent of operational fencing for Green-thighed Frog will extend at least 100 m beyond the edge/s of identified habitat. This distance is expected to cover the movement distances of most post-breeding frogs and address any concerns with attracting frogs close to the carriageway.</p> <p>Based on the proposed constructed breeding ponds, two locations within Sections 1 & 2 have been identified for specific fencing requirements which are outlined below:</p> <p>Section 1 - Redbank Creek area somewhere between ch. 5500 to ch. 6700 and Dirty Range at a suitable location preferably adjacent to a fill section between ch. 11500 and ch. 12900.</p> <p>Section 2 - Halfway Creek (ch. 19000-19500), Bald Knob Tick Gate Road area (ch. 25000) and Franklins Road (ch. 28000).</p> <p>The use of operational frog fencing at other locations in Section 3-11 will be informed by the unexpected finds procedure and after considering the overall importance of the location to the local Green-thighed Frog population.</p>	
		All	All	Section 5.3.12	<p>As a result of comments made by the Department of Environment (DoE) regarding water quality impacts, further detail has been provided regarding specific water quality thresholds and mitigation measures. Additional information obtained from the Roads and Maritime <i>Managing urban stormwater: soils and construction volume 1</i> (Landcom, 2004), and <i>Managing urban stormwater: soils and construction – main road construction</i> (DECC, 2008), and with input from technical experts, the management plan now provides further guidance on water quality management with regards to threatened frog species. The thresholds now defined by the TFMP include:</p> <p>Green-thighed Frog and Giant Barred Frog habitat and compensatory ponds</p> <ul style="list-style-type: none"> • Total suspended solids: <50mg/L • pH: 6.5 – 8.5 • Oil and grease: no visible trace. <p>Wallum Sedge Frog habitat and compensatory ponds</p> <ul style="list-style-type: none"> • Total suspended solids: <50mg/L 	

Management Plan	Rev	Species	Project Section Affected	Section of the Relevant Management Plan	Description of Change	Impact of Change
					<ul style="list-style-type: none"> pH: <5.5 Oil and grease: no visible trace <p>Permanent water quality management and protection measures will be installed to protect adjacent waterways from sediment flows and pollutants generated by the project. These will include water quality ponds and grassed swales.</p>	
				Section 3.4	<p>Using information gathered during targeted surveys for each threatened frog species, direct habitat impact areas have been quantified and mapped. The following impact areas apply for each species (total of all breeding, foraging and dispersal habitat):</p> <ul style="list-style-type: none"> Giant Barred Frog: 4.85 ha. Green-thighed Frog: 238.91 ha. Wallum Sedge Frog: 12.75 ha. 	The provision of defined impact areas for breeding, foraging and dispersal habitat provides further detail of the direct impact to each species resulting from the project. As these impacts cannot be avoided Roads and Maritime proposes to offset these impacts to compensate for the loss under applicable offset policies. Further information regarding the proposed offsets for frog habitat is provided in the W2B Biodiversity Offset Strategy.
				Section 6.3.2 Section 6.4	Weed monitoring and management pertaining to the operational phase of the project has been included. The goal of weed management in the context of the TFMP is to ensure that there is no increase in the proliferation of invasive flora species in key frog habitat areas. This will be achieved through the implementation of a weed monitoring and management strategy and the education of all project personnel on the identification of key weed species.	The implementation of weed monitoring and management during the operational phase of the project will ensure that there are no long term weed related impacts to frog habitat resulting from ongoing project activities.
				Table 6-3	<p>RMS have removed a requirement to undertake monitoring of road mortality for threatened frog species due to issues associated with occupational health and safety. Also, it was assumed that the effectiveness of monitoring road kill for frog species would be limited due to the size of these animals and deterioration on the road. Frog fencing will be regularly monitored to ensure it has not been damaged and monitoring of frog crossing structures and populations will still be undertaken.</p> <p>This table of mitigation measures, triggers for corrective action and corrective actions has been updated to be clearer what the trigger is for a corrective action to be evaluated and implemented. Also corrective actions have been refined to be more specific regarding timing. Additional wording has been added for a corrective action regarding connectivity structures to state "If connectivity structures are deemed ineffective over three consecutive monitoring periods (refer to Section Error! Reference source not found.), offsets for associated frog habitat will be assessed".</p>	<p>Due to the effectiveness of performing road kill surveys on frogs being limited and health and safety issues, it is assumed that this will have little effect on success of the overall survey effort. The mitigation measure of frog fencing will still be retained and maintenance of frog fencing undertaken.</p> <p>If crossing structures are proven to be ineffective after three consecutive monitoring periods and there is a residual impact to threatened frog population movement from the project additional offsets will be provided to compensate for that impact.</p>
		All	All	Section 7	<p>Monitoring program has been updated to include recent changes to BACI sites, including five paired sites for Wallum Sedge Frog and potential for 10 paired sites for Green-thighed Frog. The location of current known BACI sites are mapped in Figures 3.1, 3.2 and 3.3.</p> <p>Wording has been updated to state "the monitoring program has been designed to continue until the mitigation measures are proven to be effective over three consecutive post-construction monitoring periods" to meet MCOA condition D8(k).</p>	Rather than specify monitoring will continue for a set period of time monitoring will now continue until such time the mitigation measures are proven to be effective over three consecutive monitoring periods.

Table 5-2 Changes to Threatened Mammal Management Plan Mitigation and Management Measures

Management Plan	Rev	Species	Project Section Affected	Section of the Relevant Management Plan	Description of Change	Impact of Change
Threatened Mammal Management Plan	2	Spotted-tail Quoll	Sections 1-3 and 6-11	Section 4.1.3	This species was previously associated with all sections of the project area. Based on the results of targeted surveys (Sandpiper 2011 and 2013), habitat identified as potentially sustaining the Spotted-tail Quoll has been reduced to two main areas, Sections 1-2 and Sections 6-7.	This reduces the total area of potential impact for this species from 11 sections to four sections of the project area.
		Long-nosed Potoroo	Sections 6, 7, 10 and 11	Section 2.2.4 and Table 4.1.4	This species was previously associated with Sections 1 to 3 and 6 to 11 of the project area. Based on the results of targeted surveys (Lewis Ecological 2014), habitat for the Long-nosed Potoroo was only found to be present in Sections 6- 7 and Section 10. The plan was updated to reflect the findings of Lewis Ecological 2014 and specify between what chainages this species is known to occur. Once the 2015 surveys are completed by Lewis Ecological, specific fencing requirements and locations will be included into the plan.	This reduces the total area of impact for this species from nine sections to three sections of the project area. This also identifies where this species occurs spatially and now provides initial indications of appropriate fencing locations for this species.
		Long-nosed Potoroo	Sections 6, 7, 10 and 11	Section 2.2.4	The overall survey effort for BACI sites was increased from 4 - 6 pair sites to 5 - 8 paired sites to better survey and monitor long-nosed potoroo populations which may be impacted by the Project.	This increases the number of monitoring sites and strength of the data collected allowing a better assessment of populations and potential impacts of the Project.
		Bat Species	All Sections	All Sections	Bats are no longer addressed in the Threatened Mammal Management Plan, and are instead addressed within the Threatened Bats Management Plan.	Impacts to bats are no longer addressed in this report. Having a designated Bat Management Plan ensures that all potential impacts to bats as a result of the Project are thoroughly assessed and appropriate mitigation and management measures are contained in one specific document.
		All	All Sections	Section 4.3	An additional mitigation commitment has been stated to minimise clearing through appropriate location of ancillary facilities and the implementation of a staged habitat removal process consistent with the Roads and Maritime Biodiversity Guidelines (RTA 2011).	This will reduce the impact on threatened mammal species by minimising unnecessary clearing of habitat limiting the likelihood of mortalities during the clearing process.
		All	All Sections	Section 6.3	An additional commitment has been made that all threatened mammals recovered from hollows, habitat trees or dens will successfully relocated to habitats proximate to their capture.	This will reduce the impact on threatened mammal species by reducing mortalities associated with the clearing process.
		All	All Sections	Section 6.3.3 and 7.2	Specific details of fauna exclusion fencing has been incorporated into this section which specifies exactly where, how much and what type of fauna exclusion fencing will be used (Fauna Connectivity Strategy Woolgoolga to Ballina (Sections 1 and 2)) December 2014. Sections 1 & 2 have been incorporated as per their final locations and Section 3-11 have been incorporated as draft locations and will be updated once final baseline studies have been concluded and more detailed design of project is completed.	This will ensure fencing requirements are consistent between plans and can be easily implemented and reviewed during construction and monitoring. Once fencing is complete, it will reduce the ability of threatened mammal species to access the road carriageway and subsequently reduce vehicle strike.
		All	Sections 1 & 2	Section 6.3.7	The quantity and locations of crossing structures for threatened mammals across the Stage 1 work areas have been refined. For Section 1, one rope bridge, three culverts and one land bridge have been included. For Section 2, five additional culverts have been included. Further, the inclusion of an action to retrofit additional structures or to provide an offset to compensate for the loss of connectivity has been incorporated in to the plan.	Once complete, the new structures will improve the ability of threatened mammal species to safely cross the project area therefore reducing the final impact of the project on these species. Should it be identified through monitoring that connectivity structures are ineffective RMS will need to consider the retrofitting of additional structures or providing an offset for these species.
		All	All	Sections 5 - 8	The specification of mitigation measures, performance thresholds and corrective actions have been refined and specified within all performance indicator and corrective actions tables.	Refining relevant performance thresholds and corrective actions for mitigation and management will improve responsiveness to any unexpected negative impacts on threatened mammal species.
		All	All	Section 8	Detailed methodologies of the require survey effort for BACI sites have been outlined within the plan and not only referred to within appendices.	This clearly defines the role and responsibilities of any engaged contractor whom will be undertaking monitoring events.
		Rufous Bettong and Brush-tail Phascogale	Sections 1, 2, 3, 6 and 7	Section 8.1	Rufous Bettong and Brush-tail Phascogale baseline monitoring guidelines have been included into the plan to specify what monitoring methodologies were used at each site and the tolerance levels for deviation from the BACI control site in order to detect impacts on species (Lewis Ecological 2014).	The inclusion of these guidelines specifies what is considered to be a trigger point for corrective actions to be implemented.
		All	All	Section 8.3.4	The management plan has been updated to address management measures should monitoring demonstrate wild dogs, cats or foxes to be preying threatened mammals or inhibiting mammal movement through the crossing structures.	Roads and Maritime are required to engage with the Northern Rivers Catchment Management Authority, OEH (Parks and Wildlife Grafton), and Rural Lands Protection Board (North East) and adjacent landowners to identify and implement strategies to reduce this predation risk.

Table 5-3 Changes to Koala Management Plan Mitigation and Management Measures

Management Plan	Rev	Species	Project Section Affected	Section of the Relevant Management Plan	Description of Change	Impact of Change
Koala Management Plan	2	Koala (<i>Phascolarctos cinereus</i>)	Sections 1 and 2	Section 1 and Section 2	<p>The introduction has been updated to reference this version of the Koala Management Plan addresses Section 1 and 2 only. It also identifies the agencies that have reviewed the plan including DoE, EPA and DP&E.</p> <p>Section 2 has updated information on the distribution of koala records, habitat quality classes for the species, distribution of vegetation types containing preferred koala food trees and dedicated connectivity structures.</p>	The document now focuses on potential impacts and mitigation measures relating to koalas for Sections 1 and 2. It has been found Section 1 contains approx. 194ha of koala habitat (primary, secondary and tertiary habitat) and Section 2 143ha. Very few koala records have been found in these sections suggesting there are very low population densities.
			All	Section 2.2	<p>Ecological surveys have assessed the distribution of the Koala and its habitat throughout Sections 1 and 2. The methods used are summarised.</p> <p>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.</p> <p>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.</p>	<p>Updated impact calculations for koalas in Section 1 and 2 have now been completed.</p> <p>Section 1 there is 194ha of habitat with an average HQ score of 6.45.</p> <p>Section 2 there is 143ha of habitat with an average HQ score of 7.39.</p>
			Section 1 and 2	Section 5.3.3	Temporary fencing is not proposed for koalas in Section 1 and 2 because of the expected low likelihood of koalas entering the highway upgrade footprint during construction activities.	This is not likely to have an impact on koalas due to the low likelihood of koalas being present in these localities.
			Section 1 and 2	Section 5.3.4	Permanent fauna exclusion fencing will be installed at locations along the carriageway identified in the Fauna Connectivity Strategy. As Section 1 and 2 have low koala population densities floppy top fencing will not be applied. Instead a modified rabbit proof fence has been developed which is minimum 1200mm high mesh fence secured with concrete posts and pegged into the ground. If koala road kills do occur during operation, the fence, or parts thereof, will be retro-fitted with smooth metal sheeting as an additional deterrent for koalas.	This is not likely to have an impact on koalas due to the low likelihood of koalas being present in these localities.
			Sections 1 and 2	Section 5.3.8	<p>Information has been updated re crossing structures for Section 1 and 2 which will assist with koala movement. Crossing structures to support koalas are detailed in Table 5-1 and are consistent with the Fauna Connectivity Strategy.</p> <p>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.</p> <p>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.</p>	These crossing structures, furniture, strategic plantings and fencing will reduce impacts to koalas and assist to maintain genetic interchange in koala populations.
			Section 1 and Section 2	Section 7	<p>It is noted that 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.</p> <p>Monitoring locations have been refined based on the fauna connectivity structures targeted for the Koala and as detailed in the Connectivity Strategy for Section 1 and 2. Twelve monitoring locations have been finalised where motion sensor cameras will be installed at each end of the underpass structure. Scat, track and scratch searches in adjoining habitat will also be completed.</p>	Twelve monitoring locations are now proposed, five within Sections 1 and seven in Section 2. These additional monitoring sites will support Roads and Maritime to evaluate the effectiveness of mitigation measures for Koala conservation. Further monitoring locations in remaining sections will be identified in the subsequent updates to the Koala Management Plan.

Table 5-4 Changes to Threatened Glider Management Plan Mitigation and Management Measures

Management Plan	Rev	Species	Project Section Affected	Section of the Relevant Management Plan	Description of Change	Impact of Change
Threatened Glider Management Plan	2	All Threatened Glider Species	All	Figure 2.1	Based on the results of targeted threatened glider surveys (Sandpiper 2012, 2014 and 2015) and the NSW wildlife atlas, mapping of threatened glider records was prepared. This mapping better spatially demonstrates glider populations with relation to the initially proposed mitigation measures and final mitigation measures such as glider poles, rope bridges, vegetated medians and land bridges (Sections 3-11 will be updated once final surveys have been completed and mitigation measures are finalised).	
		All Threatened Glider Species	Sections 1, 2, 3, 4, 6, 7, 9 and 10	Section 6.3.5	Based on the results of the targeted threatened glider surveys conducted between March and May (Sandpiper 2014), the quantity and location of arboreal connectivity structures has been refined. This includes the refinement of four rope bridge locations, two lengths of vegetated median, and one ~400 m section of glider poles, in Sections 1 & 2. Within Sections 3, 4, 6, 7, 9 and 10 three of the proposed crossings have been omitted due to recommendations detailed within Sandpipers initial 2015 survey findings and one supplementary crossing recommended in Section 7 within the New Italy area.	
		All Threatened Glider Species	All	Section 6.4	An additional mitigation measure has been defined regarding the development of procedures for training construction personnel on the application of the CEMP. As a part of this commitment it will be a requirement that all construction personnel undergo training on all relevant aspects of the CEMP prior to the commencement of works. The refinement of glider mortality as a trigger for corrective actions to be implemented has been reduced to one death. Should one death of a glider occur during clearing activities then a review will be undertaken and corrective actions put in place. Corrective actions for this trigger now require a review of the clearing mitigation measures and liaison with EPA.	
		All Threatened Glider Species	All	Section 7.3.1	Management measures concerning threatened glider vehicle strike mortality have been refined. Those initially described, such as fauna exclusion fencing, were deemed ineffective for threatened glider species and have been replaced by more targeted measures such as the creation of a landscape that promotes the use of crossing structures.	
		All Threatened Glider Species	Sections 1, 2, 3, 6 and 7	Section 8.4	The monitoring methodology and performance thresholds for threatened glider species have been refined. The results of the monitoring of constructed crossings, control sites and incidental sightings measured against new performance thresholds will identify any vehicle strike hot-spots.	
		All Threatened Glider Species	Sections 1, 2, 3, 4, 6, 7, 9 and 10	Section 7.3.3	The recommended revegetation monitoring and maintenance schedule commitments associated with revegetation of glider habitat have been reduced from 5 years to 3 years.	
		All Threatened Glider Species	Sections 1, 2, 3, 4, 6, 7, 9 and 10	Section 7.3.3	As an additional commitment, the contractor will be responsible for replacing missing or dead plants within one month of detection. They must be of similar size and quality and identical species to that lost. Replacement plantings are to be watered for the first 12 weeks.	
		All Threatened Glider Species	Sections 1, 2, 3, 4, 6, 7, 9 and 10	Section 7.3.3	The schedule for habitat revegetation monitoring and maintenance has been redefined. Initially being once a year, the schedule has been updated to once a month for the 1 st year, every 6 months for the next 2 years and then annually for up to 3 years.	
		All Threatened Glider Species	Sections 1, 2, 3, 4, 6, 7, 9 and 10	Section 8.7.3	The performance threshold for habitat revegetation monitoring and maintenance has been revised from a flat <30% mortality rate to <10% in the first year and <20% after 3 years.	
		All Threatened Glider Species	1&2	Section 8.5	Monitoring sites for threatened glider species have been finalised for Sections 1 & 2 based on surveys conducted by Sandpiper between March and May 2014. Baseline data from these sites has also been collected.	
All Threatened Glider	Sections 1, 2, 3, 4, 6, 7, 9 and 10	Table 8.2	Performance indicators and corrective actions for the monitoring of arboreal crossing structures and widened medians have been updated to reflect a commitment to review crossing structure effectiveness and the installation of other crossing structures, glide poles, rope bridges and revegetation, particularly should any mortality hotspots be identified. Further, this			

Management Plan	Rev	Species	Project Section Affected	Section of the Relevant Management Plan	Description of Change	Impact of Change
		Species			table has been updated to include the requirement to offset glider habitat should it become fragmented.	
		All Threatened Glider Species	Sections 1, 2, 3, 4, 6, 7, 9 and 10	Section 8.3.3	The arboreal crossing structure monitoring program schedule for the project has been refined. Initially stated as continuing until the success of the mitigation measure has been confirmed, monitoring will now be undertaken until the success of the mitigation measures have been proven, or five years (whichever is sooner). After this point, the need for further monitoring will be reviewed in consultation with EPA.	This provides a definitive period over which monitoring of arboreal crossings will be conducted. If deemed ineffective beyond this period the existing arboreal crossings will be reviewed to identify ways to further reduce the impact of the project on threatened glider species.
		All Threatened Glider Species	All	Table 8.3	Additional performance thresholds and corrective actions for road mortality monitoring have been identified. These address instances where higher mortality rates are recorded at impact sites, where there is no significant difference between mortality rates at impact and control sites or where there is a high number of incidental records of threatened glider mortality away from crossing structures.	These performance thresholds have identified additional criteria against which mitigation measures can be measured. If these thresholds are triggered, corrective actions are prescribed to reduce the impact to threatened glider species.

Table 5-5 Changes to Coastal Emu Management Plan Mitigation and Management Measures

Management Plan	Rev	Species	Project Section Affected	Section of the Relevant Management Plan	Description of Change	Impact of Change
Coastal Emu Management Plan	2	Coastal Emu (<i>Dromaius novaehollandiae</i>)	Sections 3 and 4	Section 2.4	Targeted emu surveys for the project have commenced, with baseline (pre-construction) surveys having been undertaken since December 2013 (continuing quarterly until construction commences). The results of these surveys are now provided within the Coastal Emu Management Plan. The results of the baseline surveys build on information presented in the EIS and SPIR. Results from baseline surveys and pilot studies have been used to inform monitoring site locations, and proposed survey techniques for the Coastal Emu.	The incorporation of results of the emu surveys allows for more targeted management measures which will increase the effectiveness of the management effort and decrease the impact of the project on the coastal emu.
				Section 3.4, Section 4.3.1, Section 5.2, Section 5.3, Section 7 and Appendix D	An emu fencing strategy has been prepared which outlines the requirements for temporary and permanent fencing in areas frequented by emus or considered within the range of the emu population. Fencing requirements have been updated within the Coastal Emu Management Plan as a result of emu baseline surveys, and the specifications of the Emu Fencing Strategy.	A dedicated emu fencing strategy will increase the effectiveness of fencing structures for emu exclusion and directing emu movement.
				Section 5.3 (Figure 5-1)	Refinement of Construction Management monitoring period following completion of construction 'Stage 1'. The proposed monitoring of 'Stage 1' management measures previously specified 12 months. Monitoring period has now been refined to 6 months with a review of the need for further monitoring thereafter.	The early detection and application of corrective actions will decrease the impact of construction activities on the coastal emu.
				Section 7.2.1	Indicative locations and details of monitoring transects were provided within the Rev 1 document. Based on discussions with property owners, and findings of the pilot studies final monitoring locations have been refined. 31 survey transects were originally proposed, 20 survey transects (13 impact and 7 control) totalling approximately 27 km of transects are now proposed for ongoing monitoring. A detailed proposed survey methodology (including proposed survey timings, and active and passive search methodologies) has also been included.	Given the importance of having particular characteristics suitable for the detection of emu present on transects, it is important that the same transects are sampled for each monitoring event. Limiting monitoring locations to those with the most suitable characteristics ensures that a greater accuracy of detection can be achieved.
				Section 7.2.3	Expert peer reviewer Professor Stephen Davies recommended the use of aerial survey to supplement ground-based surveys in determining emu distribution and abundance. A pilot study has since been undertaken and the aims, methods and results of this study are now provided within the Coastal Emu Management Plan.	The results of the aerial survey trial determined that ground-based search methods were more effective at identifying emu distribution and abundance than aerial surveys. As such aerial surveys are no longer proposed.
				Section 3.4, Section 4.4, Section 6.4, Section 7.3.2 and Section 7.4.2	The specification of performance thresholds has been refined and corrective actions have been specified.	Refining relevant performance thresholds and corrective actions for management and mitigation will improve responsiveness to any unexpected negative impacts on the Coastal Emu.

Table 5-6 Changes to Threatened Bats Management Plan Mitigation and Management Measures

Management Plan	Rev	Species	Project Section Affected	Section of the Relevant Management Plan	Description of Change	Impact of Change
Threatened Bats Management Plan	1	All threatened microbat species; being, Little Bentwing-bat (<i>Miniopterus australis</i>), Eastern Bentwing-bat (<i>Miniopterus schreibersii oceanensis</i>), Southern large-footed Myotis (<i>Myotis macropus</i>), and Large-eared Pied Bat (<i>Chalinolobus dwyeri</i>)	ALL	ALL	<p>Threatened Bat management and mitigation measures were originally incorporated within the Threatened Mammal Management Plan. This plan stated that, "if cave-roosting bats are identified from the pre-clearance surveys, additional monitoring of bats may occur and a project specific Bat Management Plan would be prepared". Due to the identification of threatened bats during baseline monitoring surveys, a dedicated Threatened Bats Management Plan for Sections 1 and 2 of the Project has been produced (GeoLINK, 2014). This plan documents management and mitigation measures relating specifically to bats within Sections 1 and 2 of the Project area. This plan has since been approved by the DP&E.</p> <p>Additional surveys are proposed across Sections 3, 4 (part), 5 (part), 6, 7, 8, 9, 10 and 11 to inform detailed design. A Threatened Bat Management Plan is currently being prepared.</p>	<p>A dedicated Threatened Bats Management Plan ensures that all management and mitigation measures relating to microbats are thoroughly considered and management and mitigation measures are contained in one document.</p> <p>As this is the first iteration of the Threatened Bats Management Plan no further changes are discussed within this table; changes within subsequent revisions will be documented.</p>

Table 5-7 Changes to Threatened Invertebrates Management Plan Mitigation and Management Measures

Management Plan	Rev	Species	Project Section Affected	Section of the Relevant Management Plan	Description of Change	Impact of Change
Threatened Invertebrate Management Plan	2	Southern Pink Underwing Moth (<i>Phyllodes imperialis</i>) and Atlas Rainforest Ground Beetle (<i>Nurus atlas</i>)	Sections 10 and 11	Section 1.2, & 1.3.2, Section 2.2, Section 3 & 3.2, Section 5 & Section 8	Pre-construction surveys within Section 10 and 11 have now been undertaken within known and potential habitat for threatened invertebrates the Southern Pink Underwing Moth (<i>Phyllodes imperialis</i>) and Atlas Rainforest Ground Beetle (<i>Nurus atlas</i>). The Threatened Invertebrate Management Plan has been updated to reflect the results of the most recent surveys undertaken between March and April 2014 (BAAM, 2014).	Pre-construction surveys have been completed and numerous portions of the report required updating to reflect the inclusion of these surveys, their methods, results and recommendations.
	2	Southern Pink Underwing Moth (<i>Phyllodes imperialis</i>) and Atlas Rainforest Ground Beetle (<i>Nurus atlas</i>)	Sections 10 and 11	Section 6, 7 & Section 8	Pre-construction surveys did not result in any positive records of either species inside the project boundary. However records were found at the nominated control sites. The paucity of records was reviewed and resulted in recommendations by the consultant for future monitoring surveys to instead span a much greater portion of suitable seasons for both species. These changes would reduce the intra-seasonal variation in environmental conditions and increase coverage of higher invertebrate activity.	Monitoring frequency for threatened invertebrates has been updated. Instead of biannual monitoring, monitoring will now be conducted over a five month period annually. Annual monitoring surveys for threatened invertebrates would be conducted during the construction period and for three years post-construction. Monitoring will now occur one night per month, for five months, during the warmest part of the year (November through to March). T would account for the species breeding and dispersal periods and more diverse seasonal conditions which is likely to yield more meaningful monitoring results.
	2	Southern Pink Underwing Moth (<i>Phyllodes imperialis</i>)	Sections 10 and 11	Section 2.2.2, Section 3.1 & 3.2, Section 5 & Section 8	Adaptation of the survey methodology for Southern Pink Underwing Moth habitat assessment scoring. Pre-construction surveys have added another criteria for scoring purposes increasing the scoring range from 0-5 to 0-6 and thus subsequent mapping updates of habitat quality has been incorporated. Further, future monitoring surveys have now included the increased scoring components.	Habitat quality mapping for the Southern Pink Underwing Moth has been updated to reflect this increase in survey effort. Monitoring methodologies have also been updated to include the extra criteria for monitoring and habitat quality scoring purposes. This methodology provides a more tailored approach to assessing habitat for the moth.
	2	Southern Pink Underwing Moth (<i>Phyllodes imperialis</i>) and Atlas Rainforest Ground Beetle (<i>Nurus atlas</i>)	Sections 10 and 11	Section 4.2, Section 4.5, Section 6.3.5, Section 6.4, Section 7.3.1, & Section 7.4	Amendment of mitigation measures for lighting. These amendments were focused on including expert comments with regards to the height, type and distance of lighting from potential and known habitats.	All lighting within 500m of known or potential habitat which is necessary for the project will consider the use of non-standard forms of lighting. Any bright lighting that has the potential to be directly visible from areas of threatened invertebrate habitat will be shielded, installed a minimum of 150 m away from habitat and as low as safely possible to avoid unnecessary light spill, as described in Chapter 3.2 of the TIMP.

Table 5-8 Changes to Threatened Fish Management Plan Mitigation and Management Measures

Management Plan	Rev	Species	Project Section Affected	Section of the Relevant Management Plan	Description of Change	Impact of Change
Threatened Fish Management Plan	2	Oxleyan Pygmy Perch (<i>Nannoperca oxleyana</i>)	Sections 6, 7, 8 and 9	Section 1.2, Section 3.2.1, Section 5.3.1, Section 8.2	Targeted threatened species surveys have now been undertaken along all section of the project area. The Threatened Fish Management Plan has been updated to reflect the results of the most recent surveys undertaken within Sections 6 to 9 (Iluka Road to the Richmond River) (GeoLink 2013, 2014). Previous surveys confirmed the presence of Oxleyan Pygmy Perch (<i>Nannoperca oxleyana</i>) within Sections 6, 7 and 8 of the project. Recent surveys extended the confirmed range to include Section 9 but failed to record any individuals of the species in Section 6.	Targeted survey findings have resulted in the extension of the confirmed Oxleyan Pygmy Perch distribution within the Project area to include one additional section; being, Section 9. This has increased the area of known habitat and impacts for the Oxleyan Pygmy Perch from three sections to four sections.
	2	Oxleyan Pygmy Perch (<i>Nannoperca oxleyana</i>)	Sections 6, 7, 8 and 9	Section 3.3, Section 6.1, Section 7, Section 8.2.2	A detailed review of available literature allowed for a refinement of the key threats and their specific impacts to the Oxleyan Pygmy Perch. The Threatened Fish Management Plan has been updated to include additional impacts to this species and their proposed management and/or mitigation.	A thorough understanding of the key threats and their specific impacts to the Oxleyan Pygmy Perch allows for a refinement of management and mitigation practices to reduce potential impacts to this species as a result of the Project.
	2	The Purple Spotted Gudgeon (<i>Mogurnda adspersa</i>)	Sections 1 - 3 and 6 - 10	ALL	Whilst potential habitat for the Purple Spotted Gudgeon was identified in Sections 1 - 3 and 6 - 10 of the project, this species has not been detected during the targeted surveys. This species has therefore not been included in Version 2 of the Threatened Fish Management Plan. DPI (Fisheries) confirmed their agreement with this approach in an email sent on the 15/01/2015 from James Sakker Regional Assessment Officer (Pacific Highway Upgrade). All sections relating to the Purple Spotted Gudgeon have been removed from the Threatened Fish Management Plan. It should be noted that mitigation and management measures to be implemented for the Oxleyan Pygmy Perch will benefit the Purple Spotted Gudgeon should it occur.	The Purple Spotted Gudgeon is no longer considered within the Threatened Fish Management Plan (TFMP). Baseline information on the Purple Spotted Gudgeon has been retained and if the species is detected in subsequent aquatic surveys, the TFMP will be updated accordingly. Should specimens be recorded in subsequent targeted Oxleyan Pygmy Perch surveys or during the construction phase then the management approach will be re-assessed.
	2	Oxleyan Pygmy Perch (<i>Nannoperca oxleyana</i>)	Sections 6, 7, 8 and 9	Section 5.4	The specification of performance thresholds and corrective actions have been refined. Table 5-1 Mitigation measures, performance measures and corrective actions, has been updated to reflect current Project progress and to specify monitoring timing and frequency. Areas by chainage number have been identified for specific water quality management actions to further minimise impacts to the Oxleyan Pygmy Perch.	Refining relevant performance thresholds and corrective actions for management and mitigation will improve responsiveness to any unexpected negative impacts to threatened fish species. The addition of specific timing and timeframes for monitoring removes ambiguity and increases the effectiveness of monitoring events. By providing definitive areas for specific water quality measures will help ensure appropriate water quality management actions are implemented for Oxleyan Pygmy Perch.
	2	Oxleyan Pygmy Perch (<i>Nannoperca oxleyana</i>)	Sections 6, 7, 8 and 9	8	Targeted threatened fish surveys covering two seasons (compliant with the MCoA) have now been undertaken throughout Sections 6, 7, 8 and 9. Based on the results of these surveys, only monitoring sites where Oxleyan Pygmy Perch have been recorded to date will be carried forward in the monitoring program, as well as 14 control sites to observe population variation outside the project area.	Targeted surveys have resulted in the consolidation of threatened fish monitoring sites. Remaining sites (including control sites) are representative of the habitats that Oxleyan Pygmy Perch are known to occur in.
	2	Oxleyan Pygmy Perch (<i>Nannoperca oxleyana</i>)	Sections 6, 7, 8 and 9	ALL	To avoid confusion, the definition of the spawning period for Oxleyan Pygmy Perch has been revised throughout to be consistent with the definition provided in the MCoA – October to April.	Reduces confusion between terminology for Oxleyan Pygmy Perch breeding and spawning seasons. Oxleyan Pygmy perch spawning period now referenced throughout.

Table 5-9 Changes to Threatened Flora Management Plan Mitigation and Management Measures

Management Plan	Rev	Species	Project Section Affected	Section of the Relevant Management Plan	Description of Change	Impact of Change
Threatened Flora Management Plan	Threatened Flora Management Plan (Sections 1 to 11) To be submitted					
	3	All	All Sections	Section 1	The Threatened Flora Management Plan (TFMP) will address all threatened flora species listed under the EPBC Act and TSC Act for Sections 1-11. Previously in Version 1 some rainforest species were excluded. It was considered that this made it difficult to know which flora species were excluded from the TFMP. Therefore for completeness all listed flora will be addressed in the TFMP and those species that are classified as "rainforest" plants and addressed in the Threatened Rainforest Management Plan will be clearly noted.	This doesn't have an impact on threatened flora but it does ensure that the TFMP is a comprehensive document that lists all threatened plants confirmed in the project boundary and details the likely direct and indirect impacts. It will provide a central point of reference to contractors also to reduce the likelihood of species being missed.
	3	All	All Sections	Section 2	The TFMP now lists and summarises all of the targeted flora surveys that have been completed for Sections 1 to 11. A description of the survey methods and results for each survey is described in Section 2.	The targeted surveys are important as their results have been analysed and informed updates to the potential direct and indirect impacts to threatened plants as a result of the project. Targeted surveys have also found new species and populations previously not recorded. The surveys have also improved knowledge of threatened plant abundance and distribution within the project boundary and individuals have been tagged in the field where practicable.
	3	<i>Angophora robur</i>	Sections 3 and 4	Section 2	<p>Information has been included in the TFMP to describe the results of targeted survey findings for <i>A. robur</i>. It is detailed that post the original targeted surveys in early 2014 more detailed surveys were completed by Jacobs. The Jacobs surveys took specimens of <i>A. robur</i> and sent them to the NSW Herbarium. It is known that <i>Angophora robur</i> intergrades with two other common (not threatened) <i>Angophora</i> species occurring in the locality, comprising <i>Angophora subvelutina</i> and <i>Angophora woodsiana</i>.</p> <p>Following the identification of suspected intergrades at the Tyndale early works site in 2014, further investigation was warranted to identify the distribution and abundance of <i>A. robur</i> and associated intergrades in the locality, to inform the biodiversity impact assessment and offset requirements. Specimens were collected throughout the locality and sent to the NSW Herbarium for identification. Results from the Herbarium found a total of ten <i>A. robur</i> with no influence from other <i>Angophora</i> species were positively identified between Pillar Valley and Tyndale. A further five <i>A. robur</i> with some possible influence suspected from <i>A. subvelutina</i> and seven <i>A. robur</i> with influence from <i>A. subvelutina</i> were identified.</p> <p>The distribution of pure <i>A. robur</i> and associated intergrades with <i>A. subvelutina</i> is consistent with the <i>A. robur</i> mapping undertaken for the Pacific Highway Upgrades Environmental Impact Assessment, with pure <i>A. robur</i> confirmed in the project boundary at the southern and northern extent of the species. Considering the extensive distribution of <i>A. robur</i> in the locality and project area and the difficulties with accurately identifying and delineating the distribution of intergrades it is recommended that the current mapping of the species distribution is maintained. A similar situation with potential intergrades has been encountered on some of the proposed offset properties and therefore a similar methodology to mapping the distribution of the <i>A. robur</i> is recommended on offset properties so that impacts and potential offsets can be readily compared using a consistent approach.</p>	<p>A conservative approach has been taken to identifying the direct and indirect impacts to <i>A. robur</i> as a result of the project. Direct and Indirect impacts are summarised in Table 4.1 and Table 4.2.</p> <p>Considering the extensive distribution of <i>A. robur</i> in the locality and project area and the difficulties with accurately identifying and delineating the distribution of intergrades it is recommended that the vast majority of current mapping of the species distribution is maintained. One area in Tyndale cutting (Section 4) that is the subject of early works (wave 1) was extensively surveyed and confirmed <i>A. robur</i> will not be impacted by these works.</p>
	3	All	All Sections	Section 4	Using the results of targeted flora surveys and the most up to date project boundary Roads and Maritime has undertaken an updated assessment of potential direct and indirect impacts to threatened plants. Direct impacts have been determined by those individuals and populations that occur within the clearing footprint. Indirect impacts have been determined by the extent of individuals/populations that are within a 10m buffer from the clearing footprint or 20m buffer if they are aquatic or shade dependent species.	A number of changes have occurred to the extent of direct and indirect impacts. These are listed in Table 4.1 and Table 4.2 of the TFMP. Changes to individual plants are summarised below.
	3	All	All Sections	Section 3	<p>Fifteen threatened non-rainforest plants were addressed in the original TFMP. The updated TFMP (Version 3) now addresses 25 threatened plant species, some of which are rainforest plants. Those species that are new additions to the TFMP are highlighted in "Bold".</p> <ul style="list-style-type: none"> Sandstone Rough-barked Apple (<i>Angophora robur</i>) White Lace Flower (<i>Archidendron hendersonii</i>) Hairy Joint Grass (<i>Arthraxon hispidus</i>) Stinking Cryptocarya (<i>Cryptocarya foetida</i>) Water Nutgrass (<i>Cyperus aquatilis</i>) Davidson's Plum (<i>Davidsonia jerseyana</i>) Square-stemmed Spike-rush (<i>Eleocharis tetraquetra</i>) Green-leaved Rose Walnut (<i>Endiandra muelleri subsp. bracteata</i>) Square-fruited Ironbark (<i>Eucalyptus tetrapleura</i>) 	As a result of targeted pre-construction surveys there are 23 threatened flora species confirmed that may be directly and/or indirectly impacted by the project. These species have been recorded in the field. Roads and Maritime will be applying appropriate mitigation measures to reduce impacts to these threatened flora species including translocation, implementing clearing protocols and managing in-situ populations from indirect impacts such as dust and runoff as outlined in the TFMP and Threatened Rainforest Management Plan

				<ul style="list-style-type: none"> • Four-tailed Grevillea (<i>Grevillea quadricauda</i>) • Lindernia (<i>Lindernia alsinoides</i>) • Slender Screw Fern (<i>Lindsaea incisa</i>) • Rough shelled bush nut (<i>Macadamia tetraphylla</i>) • Maundia (<i>Maundia triglochoides</i>) • Weeping Paperbark (<i>Melaleuca irbyana</i>) • Yellow-flowered King of the Fairies (<i>Oberonia complanata</i>) • Soldiers Crest Orchid (<i>Oberonia titania</i>) • Square-stemmed Olax (<i>Olax angulate</i>) • Tall Knotweed (<i>Persicaria elatior</i>) • Southern Swamp Orchid (<i>Phaius australis</i>) • Singleton Mint Bush (<i>Prostanthera cineolifera</i>) • Moonee Quassia (<i>Quassia sp. Moonee Creek</i>) • <i>Rotala tripartita</i> • Siah's Backbone (<i>Streblus pendulinus</i>); and • Red Lilly Pilly (<i>Syzygium hodgkinsoniae</i>) 																			
3	All	All Sections	Section 3	<p>Three additional species were identified during surveys undertaken in 2014. These species will therefore be addressed in the latest version of the TFMP (Version 3). These species are:</p> <ol style="list-style-type: none"> 1. Lindernia (<i>Lindernia alsinoides</i>) - the species has not been recorded in the project area previously; however, habitat conditions during the early 2014 survey period were optimal for this species. Individuals were recorded in Sections 1 and 2, with a large population being recorded in areas of swampy habitat shallowly inundating along Red Bank Creek and tributaries in Section 1. 2. Knotweed (<i>Persicaria elatior</i>) – the species was recorded in Section 4 and 5 which was not previously identified in the project area. Habitat conditions were suitable for the species during the survey period. 3. <i>Rotala tripartita</i>- the species was recorded within Section 6 in an area of wetland habitat. This species was not previously identified in the project area in the EIS. Specimens were confirmed by the National Herbarium of NSW. Two individuals were found outside the project clearing footprint. 	<p>As a result of targeted surveys in 2014 three new threatened flora species were identified. Appropriate mitigation measures will be implemented to reduce impacts to these new threatened flora species which may include translocation, implementing clearing protocols and managing in-situ populations from indirect impacts. Impacts which are unavoidable are proposed to be offset and detailed in the Biodiversity Offset Strategy.</p> <p>Estimated impacts to these species are presented in Table 4.1 and Table 4.2 of the TFMP.</p>																		
3	All	All	Section 3.2	<p>Results from the targeted threatened flora surveys undertaken in 2014, have informed updated impact calculations for those species addressed in Version 1 of the TFMP. It is noted that the units used to estimate impact are not always directly comparable between the versions. A summary of the changes to estimated impacts for each species is summarised in the table below</p> <table border="1"> <thead> <tr> <th>Species</th> <th>Original Estimation of Impact (Version 1)</th> <th>Current Estimation of Direct Impact (All Sections) (Version 3)</th> </tr> </thead> <tbody> <tr> <td>Scented Acronychia (<i>Acronychia littoralis</i>)</td> <td>1 (125 stems)</td> <td>Not impacted. Species confirmed as <i>A. wilcoxiana</i>.</td> </tr> <tr> <td>Sandstone Rough Barked Apple (<i>Angophora robur</i>)</td> <td>7,056 individuals (84.1 Ha)</td> <td>7,549 individuals (91.64ha)</td> </tr> <tr> <td>White lace flower (<i>Archidendron hendersonii</i>)</td> <td>30 individuals</td> <td>1 individual</td> </tr> <tr> <td>Hairy joint grass (<i>Arthraxon hispidus</i>)</td> <td>5.5 hectares</td> <td>1.47hectares</td> </tr> <tr> <td>Stinking Cryptocarya (<i>Cryptocarya foetida</i>)</td> <td>13 individuals</td> <td>41 individuals (some of these are juveniles of which their ID needs to be confirmed)</td> </tr> </tbody> </table>	Species	Original Estimation of Impact (Version 1)	Current Estimation of Direct Impact (All Sections) (Version 3)	Scented Acronychia (<i>Acronychia littoralis</i>)	1 (125 stems)	Not impacted. Species confirmed as <i>A. wilcoxiana</i> .	Sandstone Rough Barked Apple (<i>Angophora robur</i>)	7,056 individuals (84.1 Ha)	7,549 individuals (91.64ha)	White lace flower (<i>Archidendron hendersonii</i>)	30 individuals	1 individual	Hairy joint grass (<i>Arthraxon hispidus</i>)	5.5 hectares	1.47hectares	Stinking Cryptocarya (<i>Cryptocarya foetida</i>)	13 individuals	41 individuals (some of these are juveniles of which their ID needs to be confirmed)	<p>As a result of targeted flora surveys undertaken in 2014, population and impact information has been updated in the TFMP. As a result of this new information, direct and indirect impacts may have increased or decreased, depending on the species. The targeted surveys have in most instances found additional occurrences of threatened plants across the project. Some new species have also been recorded and are described.</p> <p>The most up to date direct and indirect impacts are presented in Table 4.1 and Table 4.2 of the TFMP.</p> <p>Together with the CEMP, this plan has been prepared to avoid, minimise and mitigate impacts on threatened flora species located within the Project Boundary. Where counts of threatened flora species have increased within the construction footprint (e.g. singleton mint bush (<i>Prostanthera cineolifera</i>)) as a result of recent survey efforts, offsets will be provided and requirements updated in the Biodiversity Offset Strategy.</p> <p>However during detailed design an investigation will occur to identify if construction areas can be reduced to further avoid impacting these species.</p> <p>Roads and Maritime has identified a number of mitigation measures to reduce impacts on in-situ populations which include exclusion zones during clearing, weed management in areas in proximity to the population, sediment and erosion control measures and managing dust. An evaluation will also be undertaken as to whether any individuals can be translocated prior to clearing and/or seed and cuttings taken for propagation and later planting into adjacent areas or an offset site. For Sections 1 and 2 Roads and Maritime has prepared a Translocation Strategy that has been finalised and submitted for approval.</p>
Species	Original Estimation of Impact (Version 1)	Current Estimation of Direct Impact (All Sections) (Version 3)																					
Scented Acronychia (<i>Acronychia littoralis</i>)	1 (125 stems)	Not impacted. Species confirmed as <i>A. wilcoxiana</i> .																					
Sandstone Rough Barked Apple (<i>Angophora robur</i>)	7,056 individuals (84.1 Ha)	7,549 individuals (91.64ha)																					
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Hairy joint grass (<i>Arthraxon hispidus</i>)	5.5 hectares	1.47hectares																					
Stinking Cryptocarya (<i>Cryptocarya foetida</i>)	13 individuals	41 individuals (some of these are juveniles of which their ID needs to be confirmed)																					

					Water Nutgrass (<i>Cyperus aquatilis</i>)	112 individuals	128 individuals (0.024ha)
					Square-stemmed spike rush (<i>Eleocharis tetraquetra</i>)	6 data points representing a number of individuals	253 individuals (0.815ha)
					Rusty Rose Walnut (<i>Endiandra hayesii</i>)	7	No impact. Identified in subsequent surveys as <i>E. pubens</i>
					Green-leaved Rose Walnut (<i>Endiandra muelleri</i> subsp. <i>Bracteata</i>)	2	3 individuals
					Square-fruited Ironbark (<i>Eucalyptus tetrapleura</i>)	1,213 individuals	823 individuals (20.285ha)
					Four-tailed grevillea (<i>Grevillea quadricauda</i>)	7 individuals	3 individuals
					Lindernia (<i>Lindernia alsinoides</i>)	Not found	1,811 individuals
					Slender screw fern (<i>Lindsaea incisa</i>)	0.4 hectares	0.383ha
					Rough-shelled Bush Nut (<i>Macadamia tetraphylla</i>)	1	10 individuals
					Maundia (<i>Maundia triglochinosoides</i>)	0.2 hectares	53 individuals (0.189ha)
					Swamp tea tree (<i>Melaleuca irbyana</i>)	514 individuals	1,721 individuals (2.761ha)
					Yellow-flowered King of the Fairies (<i>Oberonia complanata</i>)	0 individuals	18 individuals (0.033ha)
					Soldiers Crest Orchid (<i>Oberonia titania</i>)	0 individuals	0 individuals
					Square-stemmed olax (<i>Olox angulata</i>)	1 individual	0 individual
					Knotweed (<i>Persicaria elatior</i>)	Not found	76 individuals (0.2ha)
					Singleton mint bush (<i>Prostanthera cineolifera</i>)	250 individuals	609 individuals (0.424ha)
					Moonee quassia (<i>Quassia</i> sp. <i>Moonee Creek</i>)	136 stems	73 individuals (0.08ha)
					<i>Rotala tripartita</i>	Not found	0 individuals
					Siah's Backbone (<i>Streblus pendulinus</i>)	9 individuals	4 individuals
					Smooth-barked Rose Apple (<i>Syzygium hodgkinsoniae</i>)	1 individuals	6 individuals
3	All threatened flora species	All	Section 5.3.4	<p>An additional commitment has been made by RMS in relation to seed collection in the situation where a threatened plant species is being replanted or translocated into a cleared site. Revegetation of native vegetation compatible with that species' habitat requirements is necessary to ensure its survival. Therefore RMS have extended seed collection to include other flora species that grow in association with that threatened species. These other native species which provide suitable habitat for the threatened species are also to be translocated to the same location where feasible. It should be noted some threatened species may require to be planted into an established vegetation community that provides suitable microhabitats such as shade; therefore the additional seed collection wouldn't be necessary in that case. The seed collection and propagation activities would aim to raise individual threatened species as tubestock suitable for the re-introduction activities and to offset any potential die-off.</p>			

3	All threatened flora species	All	Section 6.4	As per expert comment TFIMP35, the specification of performance thresholds have been refined.	Refining relevant performance thresholds for management and mitigations actions will improve responsiveness to any unexpected negative impacts on threatened flora species.
3	All threatened flora species	All	Section 6.3.6	<p>Changes have been made to requirements addressing revegetation of disturbed areas post construction in proximity to in situ threatened plants. The landscape design would provide specific details for the re-establishment of native vegetation within areas disturbed by construction, such as batters and bare areas to provide protection for <i>in situ</i> threatened species. Methods for topsoiling, seeding, planting and weed control would be in accordance with the <i>Biodiversity Guidelines: Protecting and managing biodiversity on RTA Projects</i> (RTA 2011).</p> <p>Specific detail regarding revegetation including areas for revegetation, species to be used and maintenance will be described in the Urban Design and Landscape Plan for the project.</p> <p>The design would contain specific revegetation measures adjacent to threatened plant locations to ensure these sites are adequately buffered with fast growing native species to prevent weeds becoming dominant. The designs would provide details of the maintenance schedule of the landscaped areas into operation.</p> <p>Revegetation would commence as soon as practical upon completion of the construction activities within each section of the project.</p> <p>An additional change is a requirement that states "Revegetation maintenance in areas near recorded threatened flora species would be planned in consultation with a sub-contractor who possesses the following skills:</p> <ul style="list-style-type: none"> Experienced in identification of the local flora and particularly subject threatened species, so that damage to individuals of threatened species and native species in general does not occur during maintenance activities (these plants will be monitored); and Experienced with using bush regeneration and planting to restore and maintain threatened flora habitat". 	Further detail regarding revegetation has been included and a requirement that an experienced person in identifying local flora and bush regeneration is involved in the maintenance of revegetation areas near threatened plants. This will ensure harm is minimised to these plants during maintenance activities and risks such as particular weeds can be identified and addressed.
3	All threatened flora species	All	Section 6.4	<p>An additional performance objective, mitigation measures and corrective actions has been added to address the illegal collection of threatened orchids from the project area.</p> <p>Roads and Maritime will restrict the availability of information identifying where orchids occur within the project area, and in close proximity to the project area. Site access will also be limited to areas where orchids naturally occur and may be being managed <i>in situ</i>.</p>	These measures will increase protection of threatened orchids from illegal collection.
3	All threatened flora species	All	Section 8	<p>The Monitoring Section has now been updated to include a summary of the threatened flora monitoring sites that have been established in 2014. Monitoring of retained <i>in situ</i> threatened flora species/populations would be undertaken twice a year (in autumn and spring) during construction and then annually during operation until the mitigation measures presented in this plan have been proven successful for three consecutive monitoring periods (i.e. three years).</p> <p><i>In situ</i> monitoring sites and control monitoring sites have been finalised for the project during targeted flora surveys by Jacobs in 2014 (Jacobs, 2014a). There are 69 <i>in situ</i> monitoring locations and 23 control sites in total. The locations of these monitoring sites are provided in the Jacobs report. Monitoring locations for <i>in situ</i> threatened flora populations directly adjacent to the clearing boundary were established to collect baseline data for ongoing monitoring of plant health and habitat condition during construction and operation of the project.</p> <p>The life history attributes of each species being monitored were also considered when determining the number of <i>in situ</i> and control plots for each species. Smaller wetland species that are potentially more susceptible to indirect impacts and climatic/seasonal conditions have a larger number of <i>in situ</i> and control plots where possible and larger trees and shrubs less susceptible to indirect impacts and climatic variability had less plots established particularly control plots.</p> <p>Control sites comprise areas of threatened flora populations and their habitat that is remote from the impacts associated with the project. Control sites are located in relatively natural habitats with limited disturbance and threatening processes. Locations chosen generally comprise known threatened flora populations outside of the edge affected area.</p> <p>Baseline data was collected at the <i>in situ</i> and control monitoring locations as part of the targeted surveys. Information collected includes condition scores on a scale from 0 to 5, leaf condition, flower/fruit presence, length of new shoots, disease symptoms, recruitment, weed abundance and composition cover and height.</p> <p>The purpose of the control site is to monitor natural variation within populations and habitats which are not attributable to the impacts associated with the project. This natural variation may be from prevailing climatic conditions such as droughts and floods, widespread insect attack (i.e. dieback for lerps, locust plagues) and other natural phenomenon. Control sites provide a basis for determining if the source of potential impacts to a threatened species and their habitat are from the project or due to natural events unrelated to the project.</p>	The <i>in situ</i> monitoring sites will allow Roads and Maritime to monitor the in situ threatened plants and ensure they are not being directly or indirectly impacted by the project. Control sites provide a basis for determining if the source of potential impacts to a threatened species and their habitat are from the project or due to natural events unrelated to the project.

Threatened Flora Management Plan (Version 2.1) (Sections 1, 2 and Soft Soil Work Areas) Submitted for Approval						
4	All threatened flora species	Sections 1, 2 and soft soil works areas	Section 1.1	An overview map was prepared to show the locations of Sections 1, 2 and soft soil works areas.	The map provides further locational context to the readers. This amendment does not have an impact on the content of the TFMP or recommendations provided throughout.	
4	Threatened orchids	Sections 1, 2 and soft soil works areas	Section 6	Removed reference to orchids within this version of the plan as Sections 1, 2 and soft soil work areas do not contain threatened orchids.	This amendment does not have an impact on the management of threatened flora species within Sections 1, 2 and soft soil work areas as surveys have revealed that there are no threatened orchids located in this area of the project, and thus recommendations for the management of threatened orchids are irrelevant. However, should threatened orchids be detected during pre-clearance surveys, recommendations for their management will need to be provided.	
4	<i>Angophora robur</i>	Sections 1, 2 and soft soil works areas	Section 2.3	Section 2.3 of the report has been amended to provide further explanation concerning the identification of <i>Angophora robur</i> within Stage 1 works. The report amendment discusses confirmation of <i>Angophora robur</i> via genetic testing undertaken by Jacobs within the early works area at Tyndale. The majority of species were confirmed as hybrids with one <i>Angophora robur</i> confirmed.	This amendment confirms that other than these specific locations where <i>Angophora robur</i> has been genetically tested and confirmed, the rest of the potential <i>Angophora robur</i> occurrences (possible hybrids) will be assumed to be <i>Angophora robur</i> . RMS does not intend to undertake further genetic testing and therefore all potential <i>Angophora robur</i> will be treated as being the species and all occurrences impacted will be offset.	
4	All threatened flora species	Sections 1, 2 and soft soil works areas	Section 7.3	Monitoring timeframes for <i>in situ</i> threatened flora species have been amended from limiting monitoring to five years to reflecting the requirements of project approval condition MCoA D8 (k), specifically that monitoring is undertaken until such time as the mitigation measure can be demonstrated to be effective over 3 monitoring periods.	This amendment means that RMS's monitoring is not restricted to any particular timeframe but instead requires that ongoing mitigation for <i>in situ</i> threatened flora species/populations will be undertaken until mitigation measures, including corrective actions, are found to be effective for three consecutive monitoring events.	
4	All threatened flora species	Sections 1, 2 and soft soil works areas	Sections 5.4, 6.4 and 7.4	The terms 'performance thresholds' and 'corrective actions' have been amended to 'trigger for corrective actions' and 'corrective actions'. This change was required to make clear to the reader when the need for a specific corrective action is triggered. As a result, the text within the table now reflects the specific negative outcomes which trigger corrective actions.	This report amendment is negligible and simply specifies in greater clarity the conditions under which corrective actions are required. The corrective actions noted have remained largely unchanged.	
4	All threatened flora species	Sections 1, 2 and soft soil works areas	Section 5.3	Descriptions regarding ancillary activities have been included to explain how the placement of ancillary activities will avoid, minimise and mitigate impacts on threatened flora species within the Project Boundary.	The inclusion of these descriptions have a negligible impact on the management of threatened flora species within the Project Boundary and simply enforces the fact that it is not expected that threatened flora species will be impacted as ancillary activities will be placed in cleared areas, more than 50 m away from waterways and on relatively stable land. These measures along with other measures will avoid impacts on threatened flora species. Further to the Ancillary Sites that were detailed, assessed and approved in the EIS/SPIR documentation, Ancillary Sites required for Stage 1 activities are subject to further consideration by the individual Contractors for these works. Any Ancillary Sites are required to be assessed and approved through the approval requirements of MCoA B73, B74, B75, and Ancillary Facilities Management Plan required by MCoA D21.	
4	All threatened flora species	Sections 1, 2 and soft soil works areas	Section 8.2	Further detail has been provided to describe the monitoring requirements of <i>in situ</i> threatened flora species. This change has been included to explain what is being done to ensure the condition of <i>in situ</i> threatened flora species is monitored so that corrective actions can be implemented in a timely manner to prevent significant impacts (if required).	The amendments included in the plan have a negligible impact on the management of threatened flora species within the Project Boundary. As per the plan, monitoring is to be conducted: <ul style="list-style-type: none"> • Every three months during the first year of construction; • Every six months during the second year of construction; and • Every 12 months thereafter for a minimum of three years post-construction (subject to achieving three consecutive monitoring periods as per MCoA D8 (k)). Further, a monitoring report is to be prepared annually. All monitoring and reporting is to be independently overseen by the project ecologist.	
4	All threatened flora species	Sections 1, 2 and soft soil works areas	Sections 5.4, 6.4 and 7.4	Corrective actions have been amended to include timeframes for when actions must be implemented. These amendments were based on the timeframes stipulated in the CEMP.	These amendments will provide further direction to the Project team regarding timing for when corrective actions are required to be implemented in the field during construction.	

4	All threatened flora species	Sections 1, 2 and soft soil works areas	Section 6.2	The plan has been amended to include key goals from the CEMP relating to dust and water and soil quality that is proposed to be achieved to protect threatened flora species during construction.	The amendments have a negligible impact on the management of threatened flora species in the Project Boundary, particularly as the measures included are outlined as per the Project CEMP.
4	All threatened flora species	Sections 1, 2 and soft soil works areas	Section 6.3.6	The plan has been updated to include specific measures for managing impacts associated with erosion and sediment control.	<p>The erosion and sediment control commitments included in the plan are outlined as per the Project CEMP. The plan now states that the CEMP will:</p> <ul style="list-style-type: none"> • Inform the preparation of site specific erosion and sediment control plans and measures to be implemented, including: <ul style="list-style-type: none"> ○ Silt fences ○ Sand bags ○ Mulch materials and straw bales ○ Sedimentation basins ○ Clean water diversion berms • Identify maintenance activities, inspections and responsibilities for ensuring the effectiveness of erosion and sediment control measures and continual improvement.
4	All threatened flora species	Sections 1, 2 and soft soil works areas	Section 7.4	Corrective actions have been updated in Table 7.3 to provide further clarity concerning triggers for corrective actions in the event that threatened flora species populations decline. The amendments also help to justify the trigger of >20% which aims to account for natural seasonal variations and associated population fluctuations.	<p>The amendments have provided additional clarity regarding the implementation of corrective actions associated with Phase 1 and Phase 2 works. The plan has been amended to align with the following:</p> <ul style="list-style-type: none"> • Phase 1 performance objective is that there are no mortalities of in situ threatened plants during construction and for three consecutive monitoring periods post construction. This is to say that should there be any mortalities during this time from the pre-clearance baseline (which could be for over three years taking into account how long construction may go for) corrective actions will be assessed and applied if appropriate. • The Phase 2 performance objective is then to take into account that there may be some natural attrition of threatened flora over the longer term due to natural seasonal conditions. Populations may go up or down. Therefore it is proposed that if there is a decline in species numbers >20% from the baseline over one monitoring event then corrective action will be assessed and applied if appropriate.

Table 5-10 Changes to Rainforest Management Plan Mitigation and Management Measures

Management Plan	Rev	Species	Project Section Affected	Section of the Relevant Management Plan	Description of Change	Impact of Change																																
Threatened Rainforest Management Plan	2	All rainforest plant species	1, 2, 3, 10 & 11	Section 4	<p>Section 4 was added to the TRMP to include details and results of targeted surveys undertaken in 2014 by Biosis, Ecosure, Geolink, Jacobs, EMM, Australian Museum Consulting and Melaleuca Group, specific to threatened rainforest plants and communities. In particular EMM were commissioned by Roads and Maritime to conduct targeted surveys for rainforest communities and rainforest plant species in Section 10 and 11. The results of all surveys were evaluated and informed determinations of the residual direct and indirect impacts to rainforest species and communities described in Section 5 of the TRMP.</p> <p>Field surveys for rainforest plant species were undertaken between 24 and 28 February 2014, in areas of vegetation mapped in the EIS as Lowland Rainforest and Littoral Rainforest within and up to 100 m of the project boundary in Sections 10 and 11. The purpose of the searches was to:</p> <ul style="list-style-type: none"> Record the location and condition of threatened rainforest plants Ground-truth previously mapped areas of rainforest Tag each threatened plant with a unique identifier Identify suitable sites for establishment of monitoring plots. 	<p>Additional information has now been included regarding the survey methodologies, distribution of rainforest plants and communities and direct and indirect impacts. The plan also clearly distinguishes between those rainforest community patches that are State listed and those that are listed under the EPBC Act.</p> <p>Mapping is also included in the TRMP to identify the location of threatened rainforest plants and rainforest communities in proximity to the project.</p>																																
	2	All rainforest plant species	4, 8, 10 and 11	All	<p>It should be noted that the latest TRMP addresses seven threatened rainforest plant species. These rainforest species were confirmed as either having a direct or indirect impact as a result of the project and as a result of 2014 targeted surveys.</p> <p>The original TRMP addressed eight rainforest plants as being directly or indirectly impacted. One species has been reclassified being <i>Acronychia littoralis</i> (Scented <i>Acronychia</i>) therefore has not been included as a threatened rainforest plant for assessment.</p> <p>Other threatened plant species found in the Project boundary are detailed in the Threatened Flora Management Plan. It should also be noted that the rainforest species addressed in this Rainforest Plan are also included in the Threatened Flora Management Plan for completeness.</p>	<p>The plan addresses threatened rainforest species that occur within the construction footprint or within 20 metres of the construction footprint. Rainforest species included in this TRMP are those that also occur in proximity to rainforest communities so that these individual plants and rainforest communities can be managed and monitored as a whole. The remaining threatened plants are addressed in the Threatened Flora Management Plan.</p>																																
	2	<i>Acronychia littoralis</i>	All	All	<p><i>Acronychia littoralis</i> has been deleted from threatened plants upon advice that all surveyed <i>Acronychia littoralis</i> within the project area are <i>A. wilcoxiana</i> (Baker Ecological Nov 2014)</p>	<p>Project no longer impacts <i>Acronychia littoralis</i>.</p>																																
	2	All	Sections 1, 2, 3, 10 and 11	Section 5	<p>Results from the targeted threatened flora surveys and rainforest community surveys undertaken in 2014, have informed updated impact calculations for those rainforest species and communities addressed in Version 1 of the TRMP. A summary of the changes to estimated impacts for each species and community type is summarised in the table below. The updated impacts are described in Table 5.2 and Table 5.3. All direct impacts occur only in Section 10.</p> <table border="1"> <thead> <tr> <th>Rainforest Species</th> <th>Original Estimation of Direct Impact (Version 1)</th> <th>Current Estimation of Direct Impact (Version 2)</th> </tr> </thead> <tbody> <tr> <td><i>Acronychia littoralis</i> (Scented <i>Acronychia</i>)</td> <td>1 (125 stems)</td> <td>0 This species was confirmed as <i>A. wilcoxiana</i></td> </tr> <tr> <td><i>Archidendron hendersonii</i> (White Lace Flower)</td> <td>0</td> <td>1</td> </tr> <tr> <td><i>Cryptocarya foetida</i> (Stinking <i>Cryptocarya</i>)</td> <td>13</td> <td>41</td> </tr> <tr> <td><i>Endiandra hayesii</i> (Rusty Rose Walnut)</td> <td>3</td> <td>0</td> </tr> <tr> <td><i>Endiandra muelleri</i> subsp. <i>bracteata</i> (Green-leaved Rose Walnut)</td> <td>0</td> <td>3</td> </tr> <tr> <td><i>Macadamia tetraphylla</i> (Rough-shelled Bush Nut)</td> <td>1</td> <td>10</td> </tr> <tr> <td><i>Streblus pendulinus</i> syn. <i>S. brunonianus</i> (Whalebone Tree)</td> <td>8</td> <td>4</td> </tr> <tr> <td><i>Syzygium hodgkinsoniae</i> (Red Lilly Pilly)</td> <td>0</td> <td>6</td> </tr> <tr> <th>Rainforest Communities</th> <th>Original Estimation of Impact (Version 1)</th> <th>Current Estimation of Direct Impact (Version 2)</th> </tr> <tr> <td>Lowland Rainforest in Sub-tropical Australia (EPBC listed)</td> <td>Occurring in Sections 10 and 11 Total impact 2ha</td> <td>Occurs only in Sections 10 and 11 Total impact 1.88ha</td> </tr> </tbody> </table>	Rainforest Species	Original Estimation of Direct Impact (Version 1)	Current Estimation of Direct Impact (Version 2)	<i>Acronychia littoralis</i> (Scented <i>Acronychia</i>)	1 (125 stems)	0 This species was confirmed as <i>A. wilcoxiana</i>	<i>Archidendron hendersonii</i> (White Lace Flower)	0	1	<i>Cryptocarya foetida</i> (Stinking <i>Cryptocarya</i>)	13	41	<i>Endiandra hayesii</i> (Rusty Rose Walnut)	3	0	<i>Endiandra muelleri</i> subsp. <i>bracteata</i> (Green-leaved Rose Walnut)	0	3	<i>Macadamia tetraphylla</i> (Rough-shelled Bush Nut)	1	10	<i>Streblus pendulinus</i> syn. <i>S. brunonianus</i> (Whalebone Tree)	8	4	<i>Syzygium hodgkinsoniae</i> (Red Lilly Pilly)	0	6	Rainforest Communities	Original Estimation of Impact (Version 1)	Current Estimation of Direct Impact (Version 2)	Lowland Rainforest in Sub-tropical Australia (EPBC listed)	Occurring in Sections 10 and 11 Total impact 2ha	Occurs only in Sections 10 and 11 Total impact 1.88ha
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					pairing of plots was Plot 10 and Plot 11. Because of the restricted distribution of Littoral Rainforest within the upgrade, no Littoral Rainforest impact site could be found to pair with Plot 10 (Littoral Rainforest control site). Plot 11 was therefore located in habitat similar to Plot 10, being a flat area with sandy/loamy soil, surrounded by paddocks and small in area. The sites were also located to encompass as many of the threatened plants recorded in the earlier surveys as possible, however, plot locations were also dependent on landholder agreement.	
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6. Species Management Plan Updates

As part of the SPIR TSMPs were prepared for those threatened fauna and flora species and ecological communities that were considered to have the highest risk of impact from the project, and a 'significant' impact was likely to occur from construction and operation of the project. As part of finalising TSMPs for the SPIR experts were commissioned by Roads and Maritime to review the TSMPs and provide comment. Some of these expert comments were addressed in Version 1 of the TSMP published as part of the SPIR.

Post project approval Roads and Maritime have commissioned a range of supplementary targeted surveys focused on those threatened species and ecological communities contained in the TSMPs, and to address information gaps by gathering additional data tailored to that particular species or ecological community. The survey methodologies for targeted surveys are summarised in Section 4 of this report.

Priorities for targeted surveys to date have been to address Stage 1 of the project as they will be the first areas where construction is to commence in 2015. Additional surveys are then being completed for remaining sections and stages as described in the Staging Report.

Updates to TSMPs will occur in stages to reflect the staged nature of construction of the project and also the staggered nature of completing targeted threatened flora surveys. The updating of the TSMPs will address any remaining expert and regulator comments as well as incorporating the results of targeted surveys. The overall process for updating TSMPs is illustrated in **Figure 6-1**.

Delivery schedules regarding the estimated timing for delivery of pre-construction targeted surveys and reports is provided in **Appendix B** of the BMF. These will be updated as required by Roads and Maritime and will be submitted to regulatory agencies for their information. Examples of TSMPs to be updated include:

- Threatened Flora Management Plan – Next update will include Sections 3-11.
- Threatened Mammal Management Plan – Next update will include results of baseline monitoring for Long-nosed Potoroo.
- Threatened Bats Management Plan – Next update will include Sections 3-11.
- Koala Management Plan – **Update 2**: For all remaining sections to meet the requirements of Condition D8 excluding the populations referred to in MCoA D9 (Coolgardie/Bagotville, Broadwater and Woombah/Iluka). **Update 3** – To meet the requirements of Condition D9 including populations at Coolgardie/Bagotville, Broadwater and Woombah/Iluka.

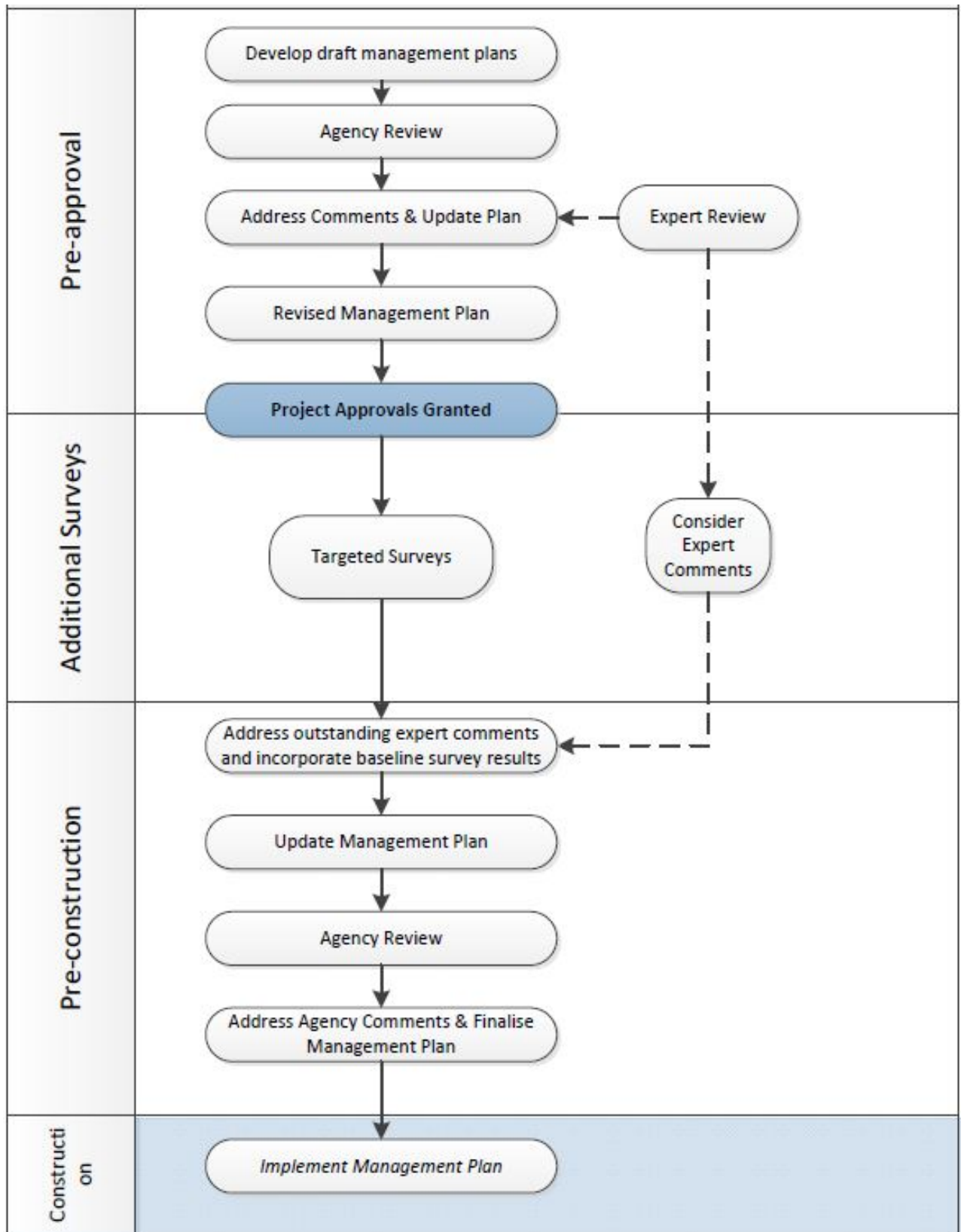


Figure 6-1 Threatened Species Management Plan Update Process

7. References

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Appendix A – Agency Consultation

Department of Primary Industries (DPI) Fisheries

The department has advised they do not require any revisions to the Mitigation Framework.

Environment Protection Authority

Document Version	Review Date	Ref CoA/ Document section	Summary of Comments	Section of Report Addressing Comments
0	6/3/15	Glossary and Abbreviations, page 2	The EPA is not included here and should be added.	EPA added to the Glossary and Abbreviations section
		Section 1.4 Agency Consultation, page 8	As per the updated Conditions of Approval (Modification 1 approved on 15/1/15) references to OEH should be changed to EPA especially in regard to consultation. EPA is correctly referenced in the majority of the tables.	Referencing updated as per the comment and the updated approval conditions.
		Section 1.5, page 9	The EPA acknowledges and supports the document updating and notification process that is proposed.	Noted. No response required.

Department of Planning and Environment

Document Version	Review Date	Ref CoA/ Document section	Summary of Comments	Section of Report Addressing Comments
0	18/3/15	General	The text of the conditions quoted in the document (see eg Table 3-1) does not directly quote those in the Minister's signed instrument of approval. While the document purports to provide summaries of required content of those conditions, the summaries provided are not of a kind that warrants diverting from the actual text of the conditions. The full content of the conditions should be provided. See also comment 5 below.	Text has been updated in Table 3-1 to directly quote conditions not vary wording.
		CoA D1(c)	The condition requires, where the level of impact or mitigation differs from the EIS/SPIR, evidence to show those measures would achieve the same or improved biodiversity outcome. The document has identified changes to biodiversity impacts and required mitigation measures. However, this requirement of D1(c) has not been adequately addressed. The document should be revised to address this requirement.	Section 5 of the BMF updated where required to demonstrate where an impact or mitigation measure differs from the SPIR to demonstrate how the same or improved biodiversity outcome would be achieved. This includes referencing the Offset Strategy if there are additional impacts that can't be avoided.

Document Version	Review Date	Ref CoA/ Document section	Summary of Comments	Section of Report Addressing Comments
		Glossary and Abbreviations	Add EPA – NSW Environment Protection Authority Delete RCRPMP – no other threatened species management plans are referenced in the glossary.	EPA has been added and RCRPMP deleted from Glossary and Abbreviations section.
		Section 1.1	Update the description of the project – Devils Pulpit is now complete, opening to traffic in March 2014.	Project description in Section 1.1 updated as per comment.
0	18/3/15	Section 1.2 (and the whole document)	The Woolgoolga to Ballina project approval was modified on 15 January 2015 to replace all references in the approval to the Office of Environment and Heritage (OEH) with the Environment Protection Authority (EPA), except in relation to the Heritage Branch of OEH. The document should refer to the modified conditions of approval.	OEH replaced with EPA, except in relation to the Heritage Branch of OEH throughout BMF.
		Figure 1-1 Project Approval process	Stakeholder consultation should be changed to “EIS Exhibition – Stakeholder Consultation” and the date changed to “December 2012 – February 2013”.	Text updated in Figure 1-1 as per comment.
		Table 3-1 Conditions of State Approval relating to BMF	The Table should include MCoA D4 offset sites for certain EPBC listed species and communities. MCoA D6 – Nest Box Plan – add date of DP&E approval of the Plan. MCoA D9 – the Koala Management Plan is to be submitted in three stages: <ul style="list-style-type: none"> • Stage 1 – has been submitted to agencies for review • Second update to include sections 3 to 8 • Third update to include section 10. The Stage 1 Koala Management Plan should refer to sections 1 and 2 of the project. Section 9 and 11 are not covered by any of the above updates of the Koala Management Plan. It is noted that Koalas have been recorded in Broadwater (section 9 of the project). Will the final Koala MP apply to sections 9 and 11?	MCoA D4 added to Table 3-1 and discussed how it is being met. Date of approval added to Nest Box Plan in MCoA D6 in Table 3-1 . MCoA D9 – text updated to reflect that the Koala Management Plan is to be submitted in three stages. Text updated to reflect which sections the updates to the Koala Management Plans will apply to: <ol style="list-style-type: none"> 1. The Stage 1 Koala Management Plan (Sections 1 and 2) has been submitted for agency review, with responses received by both EPA and DoE. 2. A second update will then occur to the management plan to include Sections 3 to 8 and 11 ((excluding section 5 – this is the Iluka population). 3. A third update is then proposed to incorporate the results of additional surveys regarding population viability assessments for Sections 5, 9 and 10.
		Table 3-1	Discussion of the Staging Report should be reviewed on the basis that the report does not require Secretary’s approval under condition A7.	MCoA A7 updated to reflect comment

Document Version	Review Date	Ref CoA/ Document section	Summary of Comments	Section of Report Addressing Comments
		Table 3-2 Conditions of Federal Approval relating to the BMF	Condition 8 – Koala Management Plan: see comment 7 above.	Table 3-2 updated as per MCoA D9 comment above.
0	18/3/15	Chapter 4	Survey work is reported variably as 'consistent with', 'compliant with' or 'in accordance with' the various field survey methods and guidelines. Is there a distinction between these terms? It should be noted that condition D1(a) requires (where relevant) discussion of compliance.	The "Relevant Guideline" column in the Section 4 tables have been updated to use 'compliant with'.
		Chapter 5	Noting condition D1(b), more information should be provided to summarise how all changes—including the performance criteria and corrective actions as well—are justified by survey results.	Additional information included for each plan in Section 5 where plans have been updated, including where this change was justified as a result of pre-construction surveys.
		Chapter 5	Further to the above, referencing of the relevant surveys that have informed the changes is done to varying degrees of effectiveness in this chapter. For instance, some changes are described citing the relevant surveys (see Table 5-7 row 1), others refer to specific surveys without citation (see Table 5-7 row 2), and some make unclear references to past comments (see Table 5-7 row 4). Review of this aspect will aid in ensuring the Framework clearly details RMS's process to finalise the required biodiversity strategies, plans and programs.	References to surveys have been updated in Section 5 where required to clearly identify the referenced survey.
		Chapter 5	Additionally, the reporting of changes in the Framework should ensure the changes to the plan can be identified. Again, this is done to varying degrees of effectiveness. For instance, the discussion of changes to monitoring under the Threatened Rainforest Management Plan is more generic than those provided for other plans.	Additional detail has been provided in Section 5 for the Frog Plan, Mammals Plan and Rainforest Plan.
		Table 5-8	Provide confirmation that DPI Fisheries has agreed to the deletion of all sections in the Fish Management Plan on the Purple Spotted Gudgeon.	Advice received in an email from DPI Fisheries on the 15/1/2015 agrees to the removal of the Purple Spotted Gudgeon from the Fish Management Plan, which has been referenced in Table 5.8.
		Appendix B	Update the Project Documentation Schedule based on the expected timeframes for submission of these documents when the final BMF is submitted for approval.	An up-to-date project documentation schedule has been provided in Appendix B.

Commonwealth Department of the Environment

Document Version	Review Date	Ref CoA/ Document section	Summary of Comments	Section of Report Addressing Comments
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Document Version	Review Date	Ref CoA/ Document section	Summary of Comments	Section of Report Addressing Comments
0	March 2015	General	<p>The Department notes that comments made on the threatened species management plans and the connectivity strategy to date and changes that will result from those comments will need to be incorporated into this plan prior to its finalisation.</p> <p>Alternatively, clear commitments to clear identification of impacts, further avoidance, and further rectification of mitigation measures to address the new findings, including revisiting the location and design of proposed crossings, will need to be included in this document.</p>	<p>The most recent agency comments and changes made to the plans as a result have been summarised in the BMF in Section 5.</p> <p>Changes regarding mitigation measures including crossing structures and fencing, monitoring, extent of habitat etc have been included.</p>
		General - conditions	<p>Regarding the condition of approval that this Framework is intended to meet, the Department considers that the following requirements are yet to be met in the Framework:</p> <ul style="list-style-type: none"> No demonstrated avoidance based on the additional survey information, insufficient discussion of changes to proposed mitigation, in particular for crossing structures – It is of particular concern that no changes to crossing structure location and design are committed to in this document as a result of the findings of these surveys. <p>No demonstration that a same or improved biodiversity outcome would be met for all species for which the level of impact has changed, as is required.</p>	<p>This document in Chapter 4 summarises the targeted surveys and pre-construction baseline surveys that have been completed and informed the TSMPs. Chapter 5 then summarises how the plan has been updated to include this information and if it has resulted in changes to mitigation measures.</p> <p>Roads and Maritime is committed to the avoidance, mitigation and offset hierarchy.</p> <p>Roads and Maritime have completed detailed design for Section 1 and 2 and therefore some impacts will be unavoidable as the widening of the existing highway or new highway cannot avoid some areas. Therefore these residual impacts are described in the applicable plan and are proposed to be offset. Offsets are summarised in the Biodiversity Offset Strategy.</p> <p>Crossing structures have been finalised for Sections 1 and 2 and these have been described in the Fauna Connectivity Strategy submitted for approval and are also summarised in applicable TSMPs. For example as a result of targeted glider surveys some changes have been made to crossing structures being a refinement of four rope bridges, two lengths of vegetated median and a ~400 m section of glider poles within Section 1 & 2. Also as a result of baseline surveys informing frog habitat mapping, frog exclusion fencing has now been proposed for Sections 1-11.</p> <p>Where values occur in Sections 3-11 there may be further scope for biodiversity values to be avoided during detailed design however for the purposes of assessing potential impacts the current road design has been adopted to determine direct impacts.</p>
0	March 2015	General	<p>Please discuss whether the additional surveys now undertaken are sufficient to identify the impacts of the action, as is required by condition D8. This is particularly relevant noting the number of new species or occurrences species that now been recorded, and the increase in the predicted impacts to a number of species.</p>	<p>The targeted surveys and pre-construction baseline surveys are complete for Sections 1 and 2 and nearing completion for Sections 3-11. Surveys and survey methods are summarised in Section 4. These surveys in addition to extensive surveys completed as part of</p>

Document Version	Review Date	Ref CoA/ Document section	Summary of Comments	Section of Report Addressing Comments
				the EIS and SPIR are sufficient to identify the threatened species and communities that occur within the project boundary and identify appropriate mitigation measures. The baseline surveys are to establish suitable BACI sites to inform future monitoring and identify if mitigation measures are effective, or whether the project is having an impact on populations or communities. Surveys have been completed over various seasons and timeframes, and for vegetation communities and threatened flora in particular some areas have been surveyed more than twice. Therefore providing a comprehensive database of vegetation communities and threatened plant species in the project boundary.
0	March 2015	Page 4	Please advise when the Staging Report will be provided to the Department.	An up-to-date project documentation schedule has been provided in Appendix B . The Staging Report was submitted to the Secretary of NSW Department of Planning and Environment and Cwth Minister of Department of the Environment on 24 March 2015.
		Page 8	In accordance with the conditions, DPI Fisheries must also be consulted with. Please update to demonstrate that this consultation has taken place.	Appendix B has been updated to reflect DPI Fisheries has been consulted and stated they do not have any comments. Section 1.4 identifies DPI Fisheries was a part of consultation on the Mitigation Framework.
		Section 4 (no page numbers)	Please clarify that this table only represents work done to date, not all the surveys that are still required.	Clarification has been provided in the text before Table 4-1 that the surveys in the table are only the ones undertaken to-date.
		Section 4.2	Please provide further clarification regarding where the survey methodologies outlined here have been applied (i.e. what coverage of suitable habitat has now been achieved with these surveys)	The survey methodologies in Section 4 have been updated to clearly identify sections where surveys have been undertaken, for all species.
		Page 32 –	Please clarify how the Long-nosed potoroo surveys meet the requirements of a minimum of 10 cameras per hectare, as listed in the mammal survey guideline, and please detail how many nights surveys were undertaken for and whether this meets the requirements as outlined in the guideline.	<p>The Potoroo survey methodology has been assessed against the EPBC survey guidelines and wording updated in Section 4.2.</p> <p>EPBC Survey Guideline recommends for sites up to 5ha is:</p> <ul style="list-style-type: none"> • cameras should be deployed for at least 14 nights, and • approximately 10 cameras should be deployed per hectare. <p>Note: Surveys commissioned by RMS for the Long-nosed potoroo (<i>Potorous tridactylus tridactylus</i>) included both identification of suitable habitat along the project and identifying suitable locations</p>

Document Version	Review Date	Ref CoA/ Document section	Summary of Comments	Section of Report Addressing Comments
				<p>for BACI monitoring sites. Methodologies employed for the determination of suitable BACI site locations and the gathering of initial baseline survey data were considered adequate for their purposes.</p> <p>Survey methods included camera traps, spotlighting, road kill transects and vehicle traverses. The survey method specifically for camera trapping efforts, was guided by recent scientific surveys for the Long-nosed potoroo which achieved detection levels of 95% over 6-8 nights (Taylor et al. 2013).</p> <p>The methods adopted by Lewis Ecological did not fully meet the above requirements. The survey method included camera traps (Scoutguard™ 560 k zero glow) using a nine trap grid with 100 m spacing over a 300 m x 300 m area (9 ha). This area was considered adequate in the context that it is approximately twice the home range of Potoroo (2-5 ha) in north east NSW (see Bali et al. 2003). Moreover, it enabled smaller areas of suitable habitat to be sampled which otherwise could not have been sampled.</p> <p>Cameras were positioned in a horizontal manner approximately 0.5-1.5 m above ground and the timer set for activation between 1730-0600 hrs using video mode lasting 10 seconds with a 1 minute delay option between triggering events over a four night period (n=36 trap nights per site) with 1368 camera trap nights in total. All camera trap sites were baited with peanut butter, honey and oats scented with vanilla essence in freshly disturbed soil.</p> <p>Again this method was considered adequate for the purposes of establishing BACI sites. Also a reduced number of trap nights was recommended due to a higher success rate being demonstrated in the first 6-8 nights (Taylor et al. 2013).</p> <p>It should be noted that initial surveys detected Long-nosed potoroos at 9 of 38 sites where habitat was suitable for this species with high activity levels achieved at most sites. Further surveys will be conducted in 2015 to refine methods, establish additional BACI sites and gather more baseline data.</p>
0	March 2015	Page 44	Please clarify how the additional surveys required for wallum sedge frog described on this page compare to the surveys described in table 4.1 of the Framework and confirm	Information to address the comment has been inserted into Table 4-1 for the wallum sedge frog. Additional survey information for the

Document Version	Review Date	Ref CoA/ Document section	Summary of Comments	Section of Report Addressing Comments
			when the results of this survey will be provided.	summer 2014/2015 survey is due to be reported by mid-May 2015. The additional baseline monitoring information for Wallum Sedge Frog will inform the monitoring program going forward.
		Page 50	A clear commitment is required here to update relevant flora plans to clearly state impacts, further avoidance, mitigation and offsets where required	Commitment added to update flora plans based on survey findings and avoid, mitigate and offset where required.
		Page 50	The Department notes the large jump in the number of Singleton Mint Bush to be impacted as a result of the further surveys undertaken. Further information is required as to how this species is being effectively avoided, mitigated and offset.	<p>Text updated in Section 5 to update the findings for threatened plant species as a result of targeted surveys in Sections 1-11.</p> <p>Singleton Mintbush (<i>Prostanthera cineolifera</i>) was found to be confined to the banks of Tabbimoble Creek amongst stands of Paperbark Swamp Forest of the Coastal Lowlands of the North Coast. The majority of records were found on the west side of the highway. The species was confirmed by AECOM in June 2014 and subsequently by Jacobs in September 2014.</p> <p>Singleton Mint Bush was recorded in Section 6 only. Based on survey findings and the current construction footprint it is estimated 609 individuals or 0.24ha of habitat will be directly impacted. An additional 260 individuals may be indirectly impacted as they occur within 10metres of the construction footprint.</p> <p>The 0.24ha may not be able to be avoided due to the road design requirements and therefore these are proposed to be offset. However during detailed design an investigation will occur to identify if construction areas can be reduced to further avoid impacting this species.</p> <p>Roads and Maritime has identified a number of mitigation measures to reduce impacts on the in-situ population which includes exclusion zones during clearing, weed management in areas in proximity to the population, sediment and erosion control measures and managing dust. An evaluation will also be undertaken as to whether any individuals can be translocated prior to clearing and/or seed and cuttings taken for propogation and later planting into adjacent areas or an offset site. This will be detailed in a subsequent Translocation Strategy for Sections 3-11.</p>

Appendix B – Project Documentation Schedule