



Roads &
Maritime

PACIFIC HIGHWAY UPGRADE

Woolgoolga to Ballina Biodiversity Offset Strategy

December 2015

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DECEMBER 2015

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Executive summary

The Australian and NSW governments have been jointly upgrading the Pacific Highway since 1996. There is a shared commitment from both governments to finish its upgrading to a four-lane divided highway as soon as possible.

The Woolgoolga to Ballina upgrade project will upgrade to a four lane divided road, around 155 kilometres of highway between Arrawarra and Ballina. The project therefore forms a major part of the overall upgrade program and when constructed, will complete the four-lane divided road program.

The Woolgoolga to Ballina upgrade project has direct impacts to around 900 hectares of native vegetation. Roads and Maritime is required to investigate suitable biodiversity offsets for the Woolgoolga to Ballina upgrade project in order to meet the objectives of:

- An outcome that maintains or improves biodiversity values
- Successfully securing the long-term (in perpetuity) protection and management of lands containing threatened species and ecological communities and habitat for threatened species (key habitat)
- Meeting the minimum requirements for offsets as specified in the conditions of approval
- The process for setting the scope and quantum of the biodiversity offsets is transparent and justifiable on environmental, social and economic grounds ie Value for Money.

This document sets out the process and principles of how biodiversity impacts of the Woolgoolga to Ballina Upgrade will be offset to meet the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) Environmental Offsets Policy and the NSW Department of Planning and Environment (DP&E) conditions of approval relating to biodiversity offsetting. Staged Threatened Biodiversity Offset Status Reports and a final Biodiversity Offset Package will be prepared separate to this report which will detail proposed offset properties, their associated management actions and long-term (in perpetuity) conservation protection mechanisms.

In summary, based on available information and assessment to date, a total of 3623 hectares of native vegetation is required to meet both State and Commonwealth offset requirements and will be managed in perpetuity under legal conservation agreements which will be detailed for each property as part of the Threatened Biodiversity Offset Status Reports and the Biodiversity Offset Package.

Contents

| | | |
|-----|--|----|
| 1 | Introduction | 1 |
| 1.1 | Project description | 1 |
| 1.2 | Purpose of the report | 2 |
| 1.3 | Objectives of the Biodiversity Offset Strategy..... | 2 |
| 1.4 | Consultation..... | 3 |
| 1.5 | Data sources..... | 3 |
| 1.6 | Structure of the report..... | 4 |
| 2 | Project Conditions of Approval | 6 |
| 2.1 | NSW Conditions of Approval | 6 |
| 2.2 | Commonwealth Conditions of Approval..... | 10 |
| 2.3 | Biodiversity Offset Framework..... | 12 |
| 3 | Project impacts | 15 |
| 3.1 | Impacts to vegetation..... | 15 |
| 3.2 | Impacts to threatened ecological communities..... | 17 |
| 3.3 | Impacts to threatened species..... | 19 |
| 3.4 | Impacts to Matters of National Environmental Significance (MNES)..... | 28 |
| 3.5 | Barrier impacts..... | 30 |
| 3.6 | Habitat fragmentation | 32 |
| 3.7 | Hollow-bearing trees..... | 33 |
| 4 | Management of biodiversity impacts | 35 |
| 4.1 | Avoiding impacts..... | 35 |
| 4.2 | Mitigating impacts | 35 |
| 5 | Offsetting biodiversity impacts | 40 |
| 5.1 | Principles for obtaining biodiversity offsets..... | 40 |
| 5.2 | Policy requirements | 40 |
| 5.3 | Calculating offset requirements | 46 |
| 5.4 | Decision making framework..... | 62 |
| 6 | Biodiversity offset investigations..... | 64 |
| 6.1 | Status of investigations into potential offset properties..... | 64 |
| 6.2 | Potential offset sites..... | 64 |
| 7 | Implementation of offsets..... | 66 |
| 7.1 | Offset protection mechanisms | 66 |
| 7.2 | Timeframe for delivery of offset | 71 |
| 7.3 | Identification of potential indirect offsets or compensatory measures for consideration... | 72 |
| 7.4 | Management of changes in biodiversity impacts | 72 |
| 8 | Conclusion | 75 |
| 9 | References | 76 |

Tables

| | |
|--|----|
| Table 1. NSW Minister’s Conditions of Approval..... | 6 |
| Table 2. Commonwealth Conditions of Approval | 10 |
| Table 3. Summary of vegetation impacts for the project..... | 15 |
| Table 4. Threatened ecological communities (TECs) impacted by the project | 18 |
| Table 5. Threatened fauna species potentially impacted by the project | 19 |
| Table 6. Threatened flora species potentially impacted by the project | 23 |
| Table 7. Impacts on threatened flora species. | 25 |
| Table 8. Impacts on MNES | 28 |
| Table 9. Location and area of quality-scored habitat within identified Koala populations | 30 |
| Table 10. Hollow bearing tree impacts..... | 33 |
| Table 11. Content of Roads and Maritime Biodiversity Guidelines for developing project CEMPs and FFMPs..... | 38 |
| Table 12. Comparison of NSW Biodiversity Offset principles to Major Project offset principles | 45 |
| Table 13. Impacts and offsets for native vegetation communities..... | 46 |
| Table 14. Threatened fauna species recorded or considered likely to occur in the project boundary where habitat surrogates can be reliably used to predict use by threatened species. | 49 |
| Table 15. Threatened fauna species recorded or considered likely to occur in the project boundary that require species credits | 53 |
| Table 16. Threatened fauna habitat requirements specified in the TSPD (OEH 2015) for species with no habitat constraints defined..... | 57 |
| Table 17. Threatened fauna recorded in the project boundary for which no credit type is defined | 58 |
| Table 18. Potential impacts on MNES and indicative offset requirements..... | 60 |
| Table 19. Comparison of available offset protection mechanisms | 71 |
| Table 20. Indicative timeframes for implementation of offsets | 72 |

Appendices

| |
|---|
| Appendix A. Woolgoolga to Ballina project map |
| Appendix B. Consultation |
| Appendix C. Offset calculations |
| Appendix D. MNES habitat mapping |

Acronyms

| | |
|----------|---|
| DoE | Commonwealth Department of the Environment |
| DP&E | NSW Department of Planning and Environment |
| DPI | NSW Department of Primary Industries |
| DSEWPC | Former Commonwealth Department of Sustainability, Environment, Water, Population and Communities (now the Commonwealth Department of the Environment) |
| EIS | Environmental Impact Statement |
| EP&A Act | NSW <i>Environment Assessment and Planning Act 1979</i> |
| EPA | NSW Environment Protection Authority |
| EPBC Act | Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i> |
| FFMP | Flora and Fauna Management Plan |
| HQS | Habitat Quality Score |
| MCoA | NSW Minister's Conditions of Approval |
| MNES | Matter of National Environmental Significance |
| NCT | Nature Conservation Trust of NSW |
| OEH | NSW Office of Environment and Heritage |
| OPP | Oxleyan Pygmy Perch |
| SPIR | Submissions/Preferred Infrastructure Report |
| SSI | State Significant Infrastructure under Part 5.1 of the NSW <i>Environmental Planning and Assessment Act 1979</i> |
| TSC Act | NSW <i>Threatened Species Conservation Act 1995</i> |
| TSPD | NSW Threatened Species Profile Database |

1 Introduction

The Pacific Highway corridor is a major contributor to Australia's economic activity. The road is a vital piece of the nation's infrastructure and is included in the National Land Transport Network. The eastern seaboard of NSW is also one of the fastest growing areas in the country.

The Australian and NSW governments have been jointly upgrading the Pacific Highway since 1996. There is a shared commitment from both governments to finish its upgrading to a four-lane divided highway as soon as possible.

The Woolgoolga to Ballina upgrade project will upgrade around 155 kilometres of highway between Arararra and Ballina to a four lane divided road. The project therefore forms a major part of the overall upgrade program and when constructed, will complete the four-lane divided road program.

Planning for all projects within the Pacific Highway Upgrade program has generally followed the following hierarchy of principles in regard to biodiversity values along the road corridor:

1. Avoid impacts
2. Minimise impacts
3. Mitigate impacts

Where impacts are unavoidable, mitigation and management measures are incorporated into the project to reduce impacts. In some instances there are residual impacts that cannot be adequately mitigated. Residual impacts identified for the Woolgoolga to Ballina upgrade project include:

- A loss of native vegetation, including threatened ecological communities (TECs) and threatened flora species and their habitat.
- A loss and modification of habitat for a variety of native fauna, including protected and threatened species.

Where offsets are required, Roads and Maritime will prepare a Biodiversity Offset Package for the project that identifies the method for determining the offset amount and location and the most effective options for implementing the offsets as required by the project approval conditions and in accordance with current State and Commonwealth principles and policies for biodiversity offsets.

1.1 Project description

The Woolgoolga to Ballina project will upgrade about 155 kilometres of highway. The project starts around six kilometres north of Woolgoolga (north of Coffs Harbour) and ends around six kilometres south of Ballina (refer to context map in Appendix A).

The upgrade does not include the Glenugie and Devils Pulpit sections of highway, which have been completed.

The key features of the upgrade include:

- Upgrading about 155 kilometres of the Pacific Highway to a motorway standard (Class M) or arterial road (Class A) highway with a four-lane dual carriageway (two lanes in each direction) that can be upgraded to three lanes each way, if required in the future
- ‘Grade-separated’ (or split level) interchanges. These will be 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 and properties
- Structures designed to encourage fauna over and under the upgraded highway where it crosses key fauna habitat or wildlife corridors
- Rest areas located at about 50 kilometre intervals south of Tyndale, north of Mororo Road and north of the Richmond River
- A heavy vehicle checking station near Halfway Creek.

1.2 Purpose of the report

This report has been prepared to address the Commonwealth and State conditions of approval as detailed in Section 2 below, specifically the requirement to prepare a Biodiversity Offset Strategy.

This Biodiversity Offset Strategy has been developed from the previous draft Biodiversity Offset Strategies prepared as part of the environmental assessment documentation for Woolgoolga to Ballina Pacific Highway Upgrade:

- Pacific Highway Upgrade Woolgoolga to Ballina Working Paper: Biodiversity Assessment Appendix C – Biodiversity Offset Strategy (Roads and Maritime Services November 2012)
- Pacific Highway Upgrade Woolgoolga to Ballina Submissions/Preferred Infrastructure Report Appendix J Supplementary Biodiversity Assessment: Appendix H – Woolgoolga to Ballina Biodiversity Offset Strategy (Draft) (Roads and Maritime Services November 2013).

1.3 Objectives of the Biodiversity Offset Strategy

The objective of the Biodiversity Offset Strategy is to identify a package of offsets that aims to achieve a neutral or net beneficial biodiversity outcome for all threatened species and endangered ecological communities likely to be impacted directly or indirectly during construction and operation of the project. In order to achieve this objective the Biodiversity Offset Strategy:

- Confirms the amount and condition of each vegetation type/habitat to be cleared;
- Calculates the offsets required to address both State and Commonwealth requirements;
- Identifies and compares available offset measures that will provide in-perpetuity protection and identifies the decision making framework that will be used to select the final suite of offset measures;
- Discusses potential offset sites already identified; and

- Outlines the process for incorporating additional offset requirements from unexpected impacts.

The measures used to gauge success of this objective will be:

- An outcome that maintains or improves biodiversity values
- Successfully securing the long-term (in perpetuity) protection and management of lands containing threatened species and ecological communities and habitat for threatened species (key habitat)
- Meeting the requirements for offsets as specified in the conditions of approval
- The process for setting the scope and quantum of the biodiversity offsets is transparent and justifiable on environmental, social and economic grounds i.e. value for money.

1.4 Consultation

As part of the preparation of the Biodiversity Offset Strategy, the Draft Biodiversity Offset Strategy was provided to NSW Department of Planning and Environment, NSW Department of Primary Industries – Fisheries, NSW Environment Protection Authority, and Commonwealth Department of Environment for their review on 23 March 2015.

Comments received from these agencies and responses to issues raised are included in Appendix B of this report. In summary, key issues raised during the review relate to:

- The process for offsets reporting requirements and distinction between Biodiversity Offset Strategy and Biodiversity Offset Status report, and how these will be staged.
- Clarification of the impacts on threatened ecological communities, particularly the distinction between Commonwealth and NSW definitions of threatened ecological communities.
- Clarification of methods for calculating direct and indirect impacts on biodiversity values.
- Further discussion of Koala habitat to be impacted, and how impacts on Koala habitat relate to specific NSW and Commonwealth conditions of consent.
- Clarification of biodiversity mitigation measures.
- Provision of additional detail on the proposed biodiversity offset mechanisms.
- Further detail on measures to address changes to project impacts, and the process for review and update of the strategy.

1.5 Data sources

Impacts on threatened species and communities listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the NSW *Threatened Species Conservation Act 1995* (TSC Act) have been determined based on a range of ecological data collected from the project study area.

The biodiversity impacts of the project were identified and assessed in the Biodiversity Working Paper for the Environmental Impact Statement (Roads and Maritime Services 2012a); the assessment was further refined in the Supplementary Biodiversity Assessment for the Submissions / Preferred Infrastructure Report (SPIR) (Roads and Maritime Services 2013).

The SPIR identified primary and secondary 'habitat critical to the survival of Koala' would be cleared throughout the Project footprint. This was derived from 160 habitat assessment plots, each 0.1 hectares in size and distributed throughout a similar number of vegetation polygons, in which absence of the required percentage composition (30% and 50% of primary and secondary Koala food trees) was interpreted as absence of primary and secondary Koala habitat within the entire vegetation polygon. This methodology was based on Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC, 2012) Interim Koala referral advice for proponents.

Pre-construction vegetation surveys of the study area were undertaken in 2014 on a section by section basis by Aecom (2014b), Australian Museum Consulting (2014a), Biosis (2014c and 2014d), Ecosure (2014c), Geolink (2014b and 2014c) and Melaleuca Group (2014b). The surveys involved identification and mapping of vegetation communities, and habitat quality scoring for Matters of National Environmental Significance (MNES) in accordance with the EPBC Offsets Policy.

Targeted surveys for threatened flora species listed under the EPBC Act and TSC Act were undertaken in 2014 by EMM (2014) for rainforest habitats and by Jacobs (2014) for the remainder of the project area. The data from all threatened flora surveys undertaken for the project was collated by AMEC (2015) for the Threatened Flora Management Plan, and threatened flora impacts have been verified with reference to this plan.

Habitat quality scores assigned to threatened fauna species habitat during vegetation surveys were reviewed and for some species revised based on more detailed targeted surveys (Long-nosed Potoroo, Wallum Sedge Frog, Giant Barred Frog and Oxleyan Pygmy Perch). Further details on the process for assigning habitat quality scores are provided in Appendix C.

Impacts on biodiversity values were determined through GIS analysis using the following shapefiles:

- Vegetation communities, threatened ecological communities and most of the habitat quality-scored fauna MNES: CD_VegetationCommunities_Polygons_20150723 (with some HQS updates to be incorporated into the subsequent version)
- Direct impact boundary: CD_ClearingBoundary_TendDocLimit_v3_20150507
- Threatened flora impacts: FL_ThreatenedFloraSurveyDatabase_20150810
- Habitat mapping based on detailed targeted surveys or specific habitat areas:
 - LongNosedPotoroo_HQS_20150219
 - GiantBarredFrog_HQS_20150309
 - WallumSedgeFrog_HQS_20150309
 - OxleyanPygmyPerch_HQS_20150324

1.6 Structure of the report

This report has been structured to provide information in the following order:

- Section 1 – Introduction
- Section 2 – Project Conditions of Approval
- Section 3 – Project impacts
- Section 4 – Management of biodiversity impacts
- Section 5 – Offsetting biodiversity impacts

Section 6 – Biodiversity offset investigations
Section 7 – Implementation of offsets
Section 8 – Conclusion

Appendices

Appendix A – Woolgoolga to Ballina project map
Appendix B – Consultation
Appendix C – EPBC Offset calculations
Appendix D – MNES habitat quality mapping

2 Project Conditions of Approval

The Woolgoolga to Ballina Pacific Highway Upgrade is approved as State Significant Infrastructure under Part 5.1 of the New South Wales *Environmental Planning and Assessment Act 1979* (SSI-4963, approval dated 24 June 2014).

The project was referred to the former Commonwealth Department of Sustainability, Environment, Water, Population and Communities (DSEWPC) (now the Commonwealth Department of the Environment) on 15 May 2012. The referral (EPBC 2012/6394) concluded that the project has the potential to have a significant impact on matters of national environmental significance (MNES), and approval from the Commonwealth Minister was necessary.

The Commonwealth Government Minister for Sustainability, Environment, Water, Population and Communities confirmed:

- The project would be a controlled action, and would require assessment and approval by the Commonwealth Government Minister for Sustainability, Environment, Water, Population and Communities
- The preparation and submission of the EIS is an accredited assessment process for the purpose of the approval by the Commonwealth Minister
- The Commonwealth Minister would need to issue a separate approval for the project to the State Minister's approval as it is a controlled action.

The project was approved with conditions by the Commonwealth Minister for the Environment on 14 August 2014.

Details of the specific conditions placed on the project by both approvals, and where they are addressed in this strategy are outlined below.

2.1 NSW Conditions of Approval

The NSW Minister's Conditions of Approval (MCoAs) include requirements to develop and implement a Biodiversity Offset Strategy and Package in accordance with MCoA D3 and D5 detailed in Table 1. MCoA D4 requires submission of offset sites for 5 priority MNES prior to them being impacted. This will be achieved by staged Threatened Biodiversity Offset Status Reports. The Update 2 Threatened Biodiversity Offset Status Report will cover Section 1, Section 2 and soft-soil works. Additional Threatened Biodiversity Offset Status Reports will be submitted to cover Sections 3-11 prior to the commencement of construction in these sections.

Table 1. NSW Minister's Conditions of Approval

| MCoA# | Condition | Relevant chapter |
|-------|--|------------------|
| D3 | 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 OEH, DPI (Fisheries) and DoE, to the satisfaction of the Secretary. | This Report |
| D3 | Unless otherwise agreed to by the OEH, DPI (Fisheries) and DoE, | 5.3 |

| MCoA# | Condition | Relevant chapter |
|-------|--|--------------------|
| | offsets shall be provided on a like-for-like basis and at a minimum ratio of 4:1 for native vegetation (including salt marsh) impacted by the SSI or as required by the <i>Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy</i> (Commonwealth of Australia 2012a) and <i>Offsets Assessment Guide</i> (Commonwealth of Australia 2012b), whichever is the greater. | |
| D3 | The Strategy shall include, but not necessarily be limited to: | |
| D3(a) | (a) the objectives and outcomes that would be sought through a biodiversity offset package, including to achieve a neutral or net beneficial outcome for all threatened species and endangered ecological communities likely to be impacted directly or indirectly during both the construction and operation of the SSI; | 1.2, 1.3 and 2.3.3 |
| D3(b) | (b) confirmation of the vegetation type/habitat (in hectares) to be cleared and their condition, and the size of offsets required (in hectares); | 3 and 5 |
| D3(c) | (c) details of the available offset measures that have been selected to compensate for the loss of existing native vegetation (including mangroves, salt marsh and riparian vegetation), threatened and vulnerable species and Endangered Ecological Communities and their habitats, and identification of potential offset sites; | 6 |
| D3(d) | (d) consideration of contingency measures for offsets to address potential changes to impacted areas as a result of detailed design changes; | 7.4 |
| D3(e) | (e) a process for addressing and incorporating offset measures arising from changes in biodiversity impacts (where these changes are generally consistent with the biodiversity impacts identified for the SSI in documents listed under condition A2), including: <ul style="list-style-type: none"> (i) changes to the SSI footprint due to detailed design; (ii) changes to predicted impacts as a result of changes to mitigation measures; (iii) the identification of additional species/habitat through pre-clearance surveys and construction; and (iv) additional impact associated with the establishment of ancillary facilities; | 7.4 |
| D3(f) | (f) the decision-making framework that would be used to select the final suite of offset measures to achieve the objectives and outcomes established within the Strategy, including the ranking of offset measures; and | 7 |
| D3(g) | (g) options for securing and management of biodiversity offsets in perpetuity. | 6 and 7 |
| D3 | The Applicant may elect to satisfy the requirements of this condition by identifying a suitable offset strategy which addresses impacts from multiple Pacific Highway Upgrade projects within the North Coast bioregion. Any such strategy, including an agreement made with OEH and DoE, shall be approved by the Secretary within a timeframe | |

| MCoA# | Condition | Relevant chapter |
|-------|---|---|
| | agreed to by the Secretary. | |
| D3 | 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. | |
| D4 | <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 OEH, 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> <ul style="list-style-type: none"> (i) Koala populations in Coolgardie/Bagotville, Broadwater and Woombah/Iluka; (ii) Moonee Quassia (<i>Quassia</i> sp. Moonee Creek); (iii) Sandstone Rough-Barked Apple (<i>Angophora robur</i>); (iv) Singleton Mint Bush (<i>Prostanthera cineolifera</i>); and (v) Lowland Rainforest in Sub-tropical Australia; <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> | N/A As these MNES will be impacted at different times, this information will be provided in a series of Threatened Biodiversity Offset Status Reports, the first to cover Sections 1 and 2 and soft-soil works. |
| D5 | <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 OEH, 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</p> | N/A subject to separate report |

| MCoA# | Condition | Relevant chapter |
|-------|--|------------------|
| | <p>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> <ul style="list-style-type: none"> (i) the monitoring of the condition of species and ecological communities at offset locations; (ii) the methodology for the monitoring program(s), including the number and location of offset monitoring sites, and the sampling frequency at these sites; (iii) provisions for the annual reporting of the monitoring results for a set period of time as determined in consultation with the OEH, DPI (Fisheries) and DoE; and (iv) the monitoring and reporting on the effectiveness of these measures, and progress against the performance and completion criteria; <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</p> | |

| MCoA# | Condition | Relevant chapter |
|-------|---|------------------|
| | <p>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> <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><i>Note:</i> <i>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).</i></p> | |

2.2 Commonwealth Conditions of Approval

The Commonwealth Conditions of Approval (EPBC 2012/6394) require the preparation and implementation of a Biodiversity Offset Strategy and Package. This report addresses the Commonwealth Conditions of Approval EPBC - 15, 16, 17 and 18 as detailed in Table 2.

Table 2. Commonwealth Conditions of Approval

| EPBC CoA# | Condition | Relevant chapter |
|-----------|--|------------------|
| EPBC 15 | The approval holder must prepare and implement a Biodiversity Offset Strategy and Biodiversity Offset package that compensates for any residual significant impacts on threatened species and communities . The Biodiversity Offset Strategy and Biodiversity Offset Package must meet the requirements of the EPBC Offsets Policy and must be submitted to the Minister for approval. | 5, Appendix C |
| EPBC 16 | The Biodiversity Offset Strategy and Biodiversity Offset Package must be prepared in accordance with the requirements of NSW approval conditions D3, D4 and D5 . | 2.1 |

| EPBC CoA# | Condition | Relevant chapter |
|-------------|--|---|
| EPBC 17 | <p>The Biodiversity Offset Strategy required by condition 15 of the approval and the information required by NSW approval condition D4 (Biodiversity Offset Status Report) must be submitted for the Minister's approval no later than three (3) months after the commencement of Stage 1 works (Sections 1 and 2 and soft-soil works) of the action; and Stage 2 works (sections 3 to 11) must not commence until the Biodiversity Offset Strategy required by Condition 15 of the approval and the information required by NSW approval condition D4 (Biodiversity Offset Status Report) have been approved by the Minister.¹</p> | <p>This report completely meets the first part of this condition.</p> <p>Concurrently the Update 2 Threatened Biodiversity Offset Status Report will be submitted to cover early stage works (Sections 1 and 2 and soft soil works) to partly address the second part of this condition. Additional status reports will be submitted prior to commencement of construction in Sections 3-11 to fully meet this condition.</p> |
| EPBC 18 | <p>The Biodiversity Offset Package required by Condition 15 must be approved by the Minister and the approved Biodiversity Offset Package must be implemented within 24 months of the approval of the Biodiversity Offset Strategy.</p> | <p>N/A subject to separate report</p> |
| Definitions | <p>Threatened species and ecological communities – this includes the following threatened species and communities listed under the EPBC Act:</p> <p>Littoral Rainforest and Coastal Vine Thickets of Eastern Australia</p> <p>Lowland Rainforest of Subtropical Australia</p> <p>The Sandstone Rough-Barked Apple (<i>Angophora robur</i>)</p> <p>The Square-fruited Ironbark (<i>Eucalyptus tetrapleura</i>)</p> <p>The Hairy Joint Grass (<i>Arthraxon hispidus</i>)</p> <p>The Singleton Mint Bush (<i>Prostanthera cineolifera</i>)</p> <p>The Moonee Quassia (<i>Quassia</i> sp. Moonee Creek)</p> | <p>0, 5.3.3, and Appendix C</p> |

| EPBC CoA# | Condition | Relevant chapter |
|-----------|--|------------------|
| | Stinking Cryptocarya (<i>Cryptocarya foetida</i>) The Rusty Rose Walnut (<i>Endiandra hayesii</i>) The Scented Acronychia (<i>Acronychia littoralis</i>) The Rough-shelled Bush nut (<i>Macadamia tetraphylla</i>) The Koala (combined populations of Queensland, NSW and the ACT) (<i>Phascolarctos cinereus</i>) The Pink Underwing Moth (<i>Phyllodes imperialis</i>) The Spotted-tail Quoll (<i>Dasyurus maculatus maculatus</i>) The Long-nosed Potoroo (<i>Potorous tridactylus tridactylus</i>) The Grey-headed Flying-fox (<i>Pteropus poliocephalus</i>) The Swift Parrot (<i>Lathamus discolor</i>) The Regent Honeyeater (<i>Anthochaera phrygia</i>) The Giant Barred Frog (<i>Mixophyes iteratus</i>) The Wallum Sedge Frog (<i>Litoria olongburensis</i>), and The Oxleyan Pygmy Perch (<i>Nannoperca oxleyana</i>) | |

1. Variation to EPBC Approval dated 16 September 2015.

2.3 Biodiversity Offset Framework

There are three major deliverables required under the conditions of approval:

- the *Biodiversity Offset Strategy* (D3)
- the *Biodiversity Offset Status Report* (D4)
- the *Biodiversity Offset Package* (D5).

In addition to the requirements above, MCoA D1 requires the development of an overarching Biodiversity Mitigation Framework which details the process for finalising all biodiversity strategies, plans and programs required under the approval. This Biodiversity Offset Strategy sits within the Biodiversity Mitigation Framework and informs and guides the Biodiversity Offset Package for the project. This framework is subject to a separate report and is not discussed further in this report.

The relationship between the approval and offset requirements are detailed in Figure 1, and further details of the Biodiversity Offset Strategy, Status Report and Package are detailed in Sections 5 to 7 below.

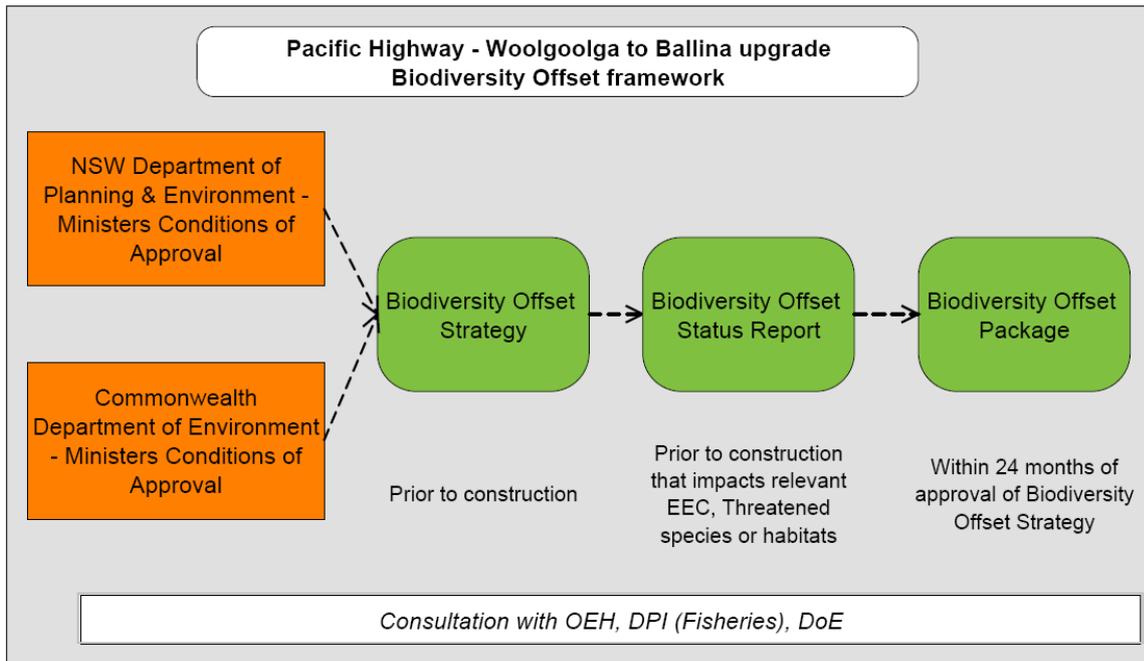


Figure 1. Biodiversity offset framework for Woolgoolga to Ballina upgrade

2.3.1 Biodiversity Offset Strategy

The Biodiversity Offset Strategy identifies available options for offsetting the biodiversity impacts of the project and includes, but is not limited to:

- Confirmation of the vegetation communities/ habitat (in hectares) to be offset and the size of offsets required (in hectares)
- Details of the available offset measures that have been identified to compensate for the biodiversity impacts of the project
- The decision-making framework that will be used to select the final suite of offset measures to achieve the aims and objectives of the Strategy, including the ranking of offset measures
- A process for addressing and incorporating offset measures for changes to project impacts, including:
 - Changes to footprint due to design changes
 - Changes to predicted impacts resulting from changes to mitigation measures
 - Identification of additional species/habitat through pre-clearance surveys
 - Additional impacts associated with ancillary facilities
 - Reduced impacts from further design refinements
- Options for the securing of biodiversity values in perpetuity.

2.3.2 Threatened Biodiversity Offset Status Reports

The Threatened Biodiversity Offset Status Reports identify details of the offset sites proposed for offsetting the biodiversity impacts of the project on:

- Koala populations in Coolgardie / Bagotville, Broadwater and Woombah / Iluka

- Moonee Quassia (*Quassia* sp. Moonee Creek)
- Sandstone Rough-Barked Apple (*Angophora robur*)
- Singleton Mint Bush (*Prostanthera cineolifera*)
- Lowland Rainforest in Sub-tropical Australia.

The offset status reports are required to:

- Demonstrate the adequacy of the proposed site(s) in terms of habitat suitability and presence of relevant species
- Consideration of how offsets will achieve the outcomes required by the EPBC Environmental Offsets Policy
- Details of how the offset site(s) will be secured and managed in perpetuity.

The Threatened Biodiversity Offset Status Reports are required to be developed in consultation with EPA, DPI (Fisheries) and DoE and submitted to, and approved by, the Secretary of DP& E and Minister of the Environment (Commonwealth) prior to construction that would impact on the MNES listed. An extension was provided for the species impacted by Sections 1 and 2 and early stage works, Moonee Quassia and Sandstone Rough-Barked Apple. Additional Threatened Biodiversity Offset Status Reports will be provided for the other MNES listed prior to commencement of construction that will impact them.

2.3.3 Biodiversity Offset Package

The Biodiversity Offset Package identifies the final suite of offset measures to be implemented for the project within two years of the approval of the Biodiversity Offset Strategy. The Biodiversity Offset Package provides details of:

- The final suite of the biodiversity offset measures selected for the project demonstrating how it achieves the requirements and aims of the Biodiversity Offset Strategy (including specified offset ratios or calculations)
- The final selected means of securing the biodiversity values of the offset package in perpetuity including ongoing management, monitoring and maintenance requirements
- Timing and responsibilities for the implementation of the provisions of the package over time.

Once the Offset Package is approved, Roads and Maritime is required to implement the package according to the timeframes set out in the Package.

3 Project impacts

Potential impacts on flora and fauna have been minimised and avoided where possible throughout the route selection and development of the concept design for the Woolgoolga to Ballina project. A summary of the direct impacts on vegetation, fauna habitat, and threatened species are provided in Sections 3.1 to 3.6 below. More detailed information on the ecological impacts for the Woolgoolga to Ballina project is provided in the Biodiversity Working Paper for the Environmental Impact Statement (Roads and Maritime Services 2012a), and the Supplementary Biodiversity Assessment for the Submissions / Preferred Infrastructure Report (SPIR) (Roads and Maritime Services 2013).

The project traverses a mix of floodplains, low hills and ranges as well as coastal environmental features including wide valleys, channels, swamps and terraces typical of the alluvial plains of the Clarence and Richmond rivers (Morgan 2001, Mitchell 2003). This also includes the low hills and plains of the Manning River, Macleay River and Evans River. Several coastal ranges occur in the east of the study area, the most prominent being the Summervale Range, incorporating Shark Creek and Pillar Valley ranges in the south and the coastal Ballina and Blackwall Ranges between Wardell and Ballina. Remaining areas have been formed by coastal barriers such as dunes, swamps and lagoons on Quaternary coastal sands with an elevation up to 25 metres.

Throughout many of these areas extensive clearing for agriculture, logging and residential development has been prevalent. Detailed information on the existing physical and biological attributes of the study area are provided in the Biodiversity Working paper for the EIS, with additional information provided in the Supplementary Biodiversity Assessment for the SPIR.

3.1 Impacts to vegetation

The project traverses a broad range of landscapes and the clearing footprint, including ancillary facilities and a 10 metre wide construction buffer, will require removal of about 900 hectares of native remnant vegetation, with the remaining 857.29 hectares mapped as cleared and disturbed. In total, 34 Biometric Vegetation Types have been identified in the project area, as listed in Table 3.

The total area of native vegetation to be removed for the project has reduced from the 931.7 hectares assessed in the SPIR. This is largely a result of changes in the project footprint following detailed design of Sections 1 and 2 of the project; it is possible that design refinements in Sections 3 to 11 may result in further reductions in native vegetation impacts.

Table 3. Summary of vegetation impacts for the project

| Vegetation formation (Keith 2004) [^] | Biometric Vegetation Type | Direct impacts (ha) |
|--|---|---------------------|
| Dry Sclerophyll Forest | <i>Angophora paludosa</i> shrubby forest and woodland on sandstones or sands of the North Coast | 0.61 |
| Dry Sclerophyll Forest | <i>Angophora robur</i> shrubby forest and woodland on sandstones of the North Coast | 7.39 |
| Dry Sclerophyll Forest | Blackbutt - Bloodwood dry heathy open forest on sandstones of the northern North Coast | 82.40 |

| Vegetation formation (Keith 2004)^ | Biometric Vegetation Type | Direct impacts (ha) |
|------------------------------------|---|---------------------|
| Dry Sclerophyll Forest | Coast Cypress Pine shrubby open forest of the North Coast Bioregion | 2.04 |
| Dry Sclerophyll Forest | Forest Red Gum grassy open forest of the coastal ranges of the North Coast | 15.07 |
| Dry Sclerophyll Forest | Grey Gum - Grey Ironbark open forest of the Clarence Lowlands of the North Coast | 62.72 |
| Dry Sclerophyll Forest | Narrow-leaved Ironbark dry open forest of the North Coast | 5.47 |
| Dry Sclerophyll Forest | Needlebark Stringybark - Red Bloodwood heathy woodland on sandstones of the Lower Clarence of the North Coast | 17.13 |
| Dry Sclerophyll Forest | Orange Gum (<i>Eucalyptus bancroftii</i>) open forest of the North Coast | 9.26 |
| Dry Sclerophyll Forest | Scribbly Gum - Needlebark Stringybark heathy open forest of coastal lowlands of the northern North Coast | 69.73 |
| Dry Sclerophyll Forest | Scribbly Gum - Red Bloodwood heathy open forest of the coastal lowlands of the North Coast | 35.17 |
| Dry Sclerophyll Forest | Spotted Gum - Grey Box - Grey Ironbark dry open forest of the Clarence Valley lowlands of the North Coast | 11.34 |
| Dry Sclerophyll Forest | Spotted Gum - Grey Ironbark - Pink Bloodwood open forest of the Clarence Valley lowlands of the North Coast | 143.40 |
| Dry Sclerophyll Forest | Tallowwood dry grassy forest of the far northern ranges of the North Coast | 1.42 |
| Freshwater wetland | Coastal floodplain sedgelands, rushlands, and forblands | 3.84 |
| Grassy Woodland | Forest Red Gum - Swamp Box of the Clarence Valley lowlands of the North Coast | 45.56 |
| Grassy Woodland | Narrow-Leaved Red Gum woodlands of the lowlands of the North Coast | 25.83 |
| Grassy Woodland | Swamp Box swamp forest of the coastal lowlands of the North Coast | 18.02 |
| Heathlands | Coastal heath on sands of the North Coast | 19.93 |
| Rainforest | Black Bean - Weeping Lilly Pilly riparian rainforest of the North Coast | 0.97 |
| Rainforest | Tuckeroo - Riberry - Yellow Tulipwood littoral rainforest of the North Coast | 0.2 |
| Rainforest | White Booyong - Fig Subtropical Rainforest of the North Coast | 2.91 |
| Saline wetland | Mangrove - Grey Mangrove low closed forest of the NSW Coastal Bioregions | 1.26 |
| Swamp | Paperbark swamp forest of the coastal lowlands of the North | 88.65 |

| Vegetation formation (Keith 2004)^ | Biometric Vegetation Type | Direct impacts (ha) |
|---|---|----------------------------|
| Sclerophyll Forest | Coast | |
| Swamp Sclerophyll Forest | Swamp Mahogany swamp forest of the coastal lowlands of the North Coast | 44.25 |
| Swamp Sclerophyll Forest | Swamp Oak swamp forest of the coastal lowlands of the North Coast | 39.07 |
| Wet Sclerophyll Forest | Blackbutt - Pink Bloodwood shrubby open forest of the coastal lowlands of the North Coast | 5.38 |
| Wet Sclerophyll Forest | Blackbutt – Tallowwood dry grassy open forest of the central parts North Coast | 0.50 |
| Wet Sclerophyll Forest | Blackbutt grassy open forest of the Lower Clarence Valley of the North Coast | 21.75 |
| Wet Sclerophyll Forest | Brush Box Tallowwood shrubby open forest of the northern ranges of the North Coast | 0.55 |
| Wet Sclerophyll Forest | Flooded Gum – Tallowwood - Brush Box moist open forest of the coastal ranges of the North Coast | 7.09 |
| Wet Sclerophyll Forest | Pink Bloodwood -Tallowwood moist open forest of the far northern ranges of the North Coast | 31.00 |
| Wet Sclerophyll Forest | Red Mahogany open forest of the coastal lowlands of the North Coast | 37.78 |
| Wet Sclerophyll Forest | Turpentine moist open forest of the coastal hills and ranges of the North Coast | 42.70 |
| Total native vegetation impacts | | 900.39 |
| Cleared and modified | N/A | 857.29 |

[^]Keith, D. (2004). Ocean shores to desert dunes: the native vegetation of New South Wales and the ACT. Department of Environment and Conservation. Hurstville. NSW.

Note: these figures are subject to minor changes during detailed design of sections 3-11.

3.2 Impacts to threatened ecological communities

The project impacts on areas of seven threatened ecological communities (TECs) listed under the TSC Act and two TECs listed under the EPBC Act, as listed in Table 4.

The TECs Littoral Rainforest and Coastal Vine Thickets of Eastern Australia and Lowland Rainforest of Subtropical Australia, as listed under the EPBC Act, only include patches that meet certain size, condition and species composition thresholds. The small area of Littoral Rainforest that falls within the project clearing boundary is part of a larger patch which meets the criteria for

the TEC under the TSC Act and the EPBC Act; however there are several patches of Lowland Rainforest which meet the TSC Act criteria for the TEC but not the EPBC Act condition thresholds. As such, only a proportion of the Lowland Rainforest to be cleared meets the definition of the TEC Lowland Rainforest of Subtropical Australia as listed under the EPBC Act. Further details on the identification and mapping of Lowland Rainforest of Subtropical Australia are provided in Appendix C.

Table 4. Threatened ecological communities (TECs) impacted by the project

| Threatened ecological community (TSC Act) | Threatened ecological community (EPBC Act) | Direct impacts (ha) |
|--|--|---|
| Littoral Rainforest in the New South Wales North Coast, Sydney Basin and South East Corner Bioregion (Endangered) | Littoral Rainforest and Coastal Vine Thickets of Eastern Australia (Critically Endangered) | 0.20 |
| Lowland Rainforest on Floodplain in the New South Wales North Coast Bioregion (Endangered) | Lowland Rainforest of Subtropical Australia (Critically Endangered) | 3.37 ha as defined under TSC Act, including 1.88 ha as defined under EPBC Act |
| Coastal Cypress Pine Forest in the NSW North Coast Bioregion (Endangered) | N/A | 2.04 |
| Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregion (Endangered) | N/A | 5.92 |
| Subtropical Coastal Floodplain Forest of the NSW North Coast Bioregion (Endangered) | N/A | 63.59 |
| Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (Endangered) | N/A | 39.07 |
| Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (Endangered) | N/A | 136.68 |
| Total | | 252.87 |

3.3 Impacts to threatened species

There will be direct impacts on a number of threatened flora and fauna species recorded or potentially occurring in the project area. Direct impacts are likely on the known and potential habitat of 44 threatened flora species, 65 threatened vertebrate fauna species and three threatened invertebrate species, as well as three threatened fish species. Threatened flora and fauna species potentially impacted by the project are listed below in Table 5, including species recorded and potentially occurring in the project area.

Table 5. Threatened fauna species potentially impacted by the project

| Scientific name | Common name | TSC Act / FM Act Status | EPBC Act Status | Project sections: presence confirmed | Project sections: potential habitat | Significant impact'? |
|---------------------------------------|------------------------|-------------------------|-----------------|--------------------------------------|-------------------------------------|----------------------|
| Threatened fauna | | | | | | |
| Birds | | | | | | |
| <i>Amaurornis molucana</i> | Pale-vented Bush Hen | V | - | | 9-10 | No |
| <i>Anseranas semipalmata</i> | Magpie Goose | V | - | 3 | 2-6, 8-11 | No |
| <i>Botaurus poiciloptilus</i> | Australasian Bittern | E | E | 3 | 1-4, 7-11 | No |
| <i>Burhinus grallarius</i> | Bush Stone-curlew | E | - | 1,2 | 1-3 | No |
| <i>Calyptorhynchus lathami</i> | Glossy Black-cockatoo | V | - | 1, 3, 7, 10 | 1-7 | No |
| <i>Climacteris picumnus</i> | Brown Treecreeper | V | - | 2, 6, 7 | 1-7 | No |
| <i>Coracina lineata</i> | Barred Cuckoo-shrike | V | - | | 1-2, 6-11 | No |
| <i>Cyclopsitta diophthalma coxeni</i> | Double-eyed Fig-Parrot | CE | E | | 9-11 | No |
| <i>Daphoenositta chrysoptera</i> | Varied Sittella | V | | 1-8 | 1-8 | No |
| <i>Dromaius novaehollandiae</i> | Coastal Emu | EP | - | 3, 4-5 | 3-5 | Yes |
| <i>Ephippiorhynchus asiaticus</i> | Black-necked stork | E | - | | 1-11 | No |
| <i>Erythrotriorchis radiatus</i> | Red Goshawk | CE | V | | 1-11 | No |
| <i>Glossopsitta pusilla</i> | Little Lorikeet | V | - | | 1-11 | No |
| <i>Grus rubicundus</i> | Brolga | V | - | 1-3, 5 | 1-11 | No |

| Scientific name | Common name | TSC Act / FM Act Status | EPBC Act Status | Project sections: presence confirmed | Project sections: potential habitat | Significant impact ¹ ? |
|---|---|-------------------------|-----------------|--------------------------------------|-------------------------------------|-----------------------------------|
| <i>Hieraaetus morphnoides</i> | Little Eagle | V | - | | 1-11 | No |
| <i>Irediparra gallinacea</i> | Comb-Crested Jacana | V | - | | 3-9 | No |
| <i>Ixobrychus flavicollis</i> | Black Bittern | V | - | | 1-3, 6-7, 9 | No |
| <i>Lathamus discolor</i> | Swift Parrot | E | E, M | | 1-11 | Yes |
| <i>Lichenostomus fasciocularis</i> | Mangrove Honeyeater | V | | | 4-5, 8-10 | No |
| <i>Lophoictinia isura</i> | Square-tailed Kite | V | - | | 1-11 | No |
| <i>Melithreptus gularis gularis</i> | Black-chinned Honeyeater (eastern subsp.) | V | - | 3 | 1-3, 6-7 | No |
| <i>Ninox connivens</i> | Barking Owl | V | - | | 1-11 | No |
| <i>Ninox strenua</i> | Powerful Owl | V | - | | 1-11 | No |
| <i>Pandion haliaetus</i> | Eastern Osprey | V | M | | 1-11 | No |
| <i>Pezoporus wallicus wallicus</i> | Ground Parrot (eastern subsp.) | V | - | | 8-10 | No |
| <i>Pomatostomus temporalis temporalis</i> | Grey-crowned Babbler (eastern subsp.) | V | - | 2, 3, 5, 6, 8 | 1-4, 6-10 | No |
| <i>Ptilinopus magnificus</i> | Wompoo Fruit-dove | V | - | | 1-2, 6-11 | No |
| <i>Ptilinopus regina</i> | Rose-crowned Fruit Dove | V | - | | 1-2, 8-11 | No |
| <i>Ptilinopus superbus</i> | Superb Fruit Dove | V | - | | 1-2, 8-11 | No |
| <i>Rostratula australis</i> | Australian Painted Snipe | V | V | | 1-11 | No |
| <i>Stictonetta naevosa</i> | Freckled Duck | V | - | | 3-5 | No |
| <i>Tyto longimembris</i> | Eastern Grass Owl | V | - | 9 | 1-11 | No |
| <i>Tyto novaehollandiae</i> | Masked Owl | V | - | 11 | 1-11 | No |

| Scientific name | Common name | TSC Act / FM Act Status | EPBC Act Status | Project sections: presence confirmed | Project sections: potential habitat | Significant impact ¹ ? |
|---|---------------------------|-------------------------|-----------------|--------------------------------------|-------------------------------------|-----------------------------------|
| <i>Tyto tenebricosa</i> | Sooty Owl | V | - | 2 | 1-2 | No |
| <i>Anthochaera phrygia</i> | Regent Honeyeater | CE | E, M | | 1-11 | Yes |
| Mammals | | | | | | |
| <i>Aepyprymnus rufescens</i> | Rufous Bettong | V | - | 1-3 | 1-8 | Yes |
| <i>Cercartetus nanus</i> | Eastern Pygmy-Possum | V | - | | 1-11 | Yes |
| <i>Chalinolobus dwyeri</i> | Large-eared Pied Bat | V | V | | 1-7 | No |
| <i>Chalinolobus nigrogriseus</i> | Hoary Wattled Bat | V | | 1-3, 6-8 | 1-11 | Yes |
| <i>Dasyurus maculatus maculatus</i> (SE population) | Spotted-tailed Quoll | V | E | | 1-11 | Yes |
| <i>Falsistrellus tasmaniensis</i> | Eastern False Pipistrelle | V | | 1, 2, 3 | 1-11 | Yes |
| <i>Kerivoula papuensis</i> | Golden-tipped Bat | V | | 9-11 | 1-11 | Yes |
| <i>Miniopterus australis</i> | Little Bentwing-bat | V | | 1-11 | 1-11 | No |
| <i>Miniopterus schreibersii oceanensis</i> | Eastern Bentwing-bat | V | | 1, 2, 6, 8, 9, 11 | 1-11 | No |
| <i>Mormopterus beccarii</i> | Beccari's Freetail-Bat | V | | | 1-11 | Yes |
| <i>Mormopterus norfolkensis</i> | Eastern Freetail-Bat | V | | 6-8, 9-11 | 1-11 | Yes |
| <i>Myotis macropus</i> | Southern Myotis | V | | 1, 2, 6-11 | 1-11 | No |
| <i>Nyctophilus bifax</i> | Eastern Long-Eared Bat | V | | 6-8, 9-11 | 1-11 | Yes |
| <i>Petaurus australis</i> | Yellow-bellied Glider | V | - | 1-3, 6-8 | 1-9 | Yes |
| <i>Petaurus norfolcensis</i> | Squirrel Glider | V | - | 1-11 | 1-11 | Yes |
| <i>Phascogale tapoatafa</i> | Brush-tailed Phascogale | V | - | 2, 4, 6-8 | 1-9 | Yes |

| Scientific name | Common name | TSC Act / FM Act Status | EPBC Act Status | Project sections: presence confirmed | Project sections: potential habitat | Significant impact ¹ ? |
|---|--------------------------------|-------------------------|-----------------|---|-------------------------------------|-----------------------------------|
| <i>Phascolarctos cinereus</i> | Koala | V | V | 1, 3, 5, 7, 9, 10 Important populations in Sections 9 and 10 | 1-11 | Yes |
| <i>Planigale maculata</i> | Common Planigale | V | - | 1-2 | 1-11 | Yes |
| <i>Potorous tridactylus tridactylus</i> | Long-nosed Potoroo | V | V | | 1-3, 6-11 | Yes |
| <i>Pteropus poliocephalus</i> | Grey-headed Flying-Fox | V | V | 1-11 | 1-11 | Yes |
| <i>Saccolaimus flaviventris</i> | Yellow-bellied Sheath-tail Bat | V | | 9-11 | 1-11 | Yes |
| <i>Scoteanax rueppellii</i> | Greater Broad-nosed Bat | V | | 9-11 | 1-11 | Yes |
| <i>Syconycteris australis</i> | Common Blossom-Bat | V | - | | 8-11 | No |
| <i>Vespadelus troughtoni</i> | Eastern Cave Bat | V | | 6-8, 9-11 | 1-11 | No |
| Reptiles | | | | | | |
| <i>Hoplocephalus bitorquatus</i> | Pale-headed Snake | V | - | | 1-3, 6-8 | Yes |
| <i>Hoplocephalus stephensii</i> | Stephens' banded snake | V | - | 3 | 1-3, 6-8 | Yes |
| Fish | | | | | | |
| <i>Maccullochella ikei</i> | Eastern Freshwater Cod | E | E | | 3-5 | No |
| <i>Mogurnda adspersa</i> | Purple-spotted Gudgeon | E | | | 1-2, 6-11 | No |
| <i>Nannoperca oxleyana</i> | Oxleyan Pygmy Perch | E | E | 7-9 | 6-9 | Yes |
| Amphibians | | | | | | |
| <i>Crinia tinnula</i> | Wallum Froglet | V | - | 1-3, 6-11 | 1-11 | No |
| <i>Litoria brevipalmata</i> | Green-thighed Frog | V | | 2, 6, 7 | 1-10 | Yes |
| <i>Litoria olongburensis</i> | Wallum Sedge Frog | V | V | 8, 9, 10 | 1-11 | Yes |

| Scientific name | Common name | TSC Act / FM Act Status | EPBC Act Status | Project sections: presence confirmed | Project sections: potential habitat | Significant impact ¹ ? |
|---|--------------------------------|-------------------------|-----------------|--------------------------------------|-------------------------------------|-----------------------------------|
| <i>Mixophyes iteratus</i> | Giant Barred Frog | E | E | 1, 4, 7 | 1-4, 6-10 | Yes |
| Invertebrates | | | | | | |
| <i>Nurus atlas</i> | Atlas Rainforest Ground Beetle | E | | 10 | 9-11 | Yes |
| <i>Petalura litorea</i> | Coastal Petaltail | E | | | 7-10 | No |
| <i>Phyllodes imperialis</i> southern subsp. | Pink Underwing Moth | E | E | 10 | 9-11 | Yes |

CE – Critically Endangered, E – Endangered, V – Vulnerable, M – Migratory

1. Significant impact as determined in the EIS/SPIR documents, through subsequent impact assessment or as determined by the Australian Government Minister for the Environment.

Table 6. Threatened flora species potentially impacted by the project

| Scientific name | Common name | TSC Act Status | EPBC Act Status | Project sections: presence confirmed ¹ | Significant impact? ² |
|---|------------------------------|----------------|-----------------|---|----------------------------------|
| <i>Acronychia littoralis</i> | Scented Acronychia | V | E | No impact | No ³ |
| <i>Allocasuarina defungens</i> | Dwarf Heath | E | E | | No |
| <i>Angophora robur</i> | Sandstone Rough Barked Apple | V | V | 3-4 | Yes |
| <i>Archidendron hendersonii</i> | White Lace Flower | V | - | 10, 11 | Yes |
| <i>Arthraxon hispidus</i> | Hairy Joint-grass | V | V | 1, 8, 10 | Yes |
| <i>Centranthera cochinchinensis</i> | Swamp Foxglove | E | - | No impact | No |
| <i>Corynocarpus rupestris</i> subsp. <i>rupestris</i> | Glenugie Karaka | V | V | No impact | No |
| <i>Cryptocarya foetida</i> | Stinking Cryptocarya | V | V | 10 | Yes |
| <i>Cyperus aquatilis</i> | Water Nutgrass | E | - | 1,2,6-7 | Yes |
| <i>Davidsonia</i> | Davidson's | E | E | No Impact | No |

| Scientific name | Common name | TSC Act Status | EPBC Act Status | Project sections: presence confirmed ¹ | Significant impact? ² |
|--|-------------------------------------|----------------|-----------------|---|----------------------------------|
| <i>jerseyana</i> | Plum | | | | |
| <i>Davidsonia johnsonii</i> | Smooth Davidson's Plum | E | E | No Impact | No |
| <i>Dendrobium melaleucaphilum</i> | Spider Orchid | E | - | No Impact | No |
| <i>Desmodium acanthocladum</i> | Thorny Pea | V | V | No impact | No |
| <i>Diploglottis campbellii</i> | Small-leaved Tamarind | E | E | No impact | No |
| <i>Eleocharis tetraquetra</i> | Square-stemmed Spike-rush | E | | 1 | Yes |
| <i>Endiandra hayesii</i> | Rusty Rose Walnut | V | V | No impact | No ³ |
| <i>Endiandra muelleri subsp. bracteata</i> | Green-leaved Rose Walnut | E | - | 4, 10 | Yes |
| <i>Eucalyptus tetrapleura</i> | Square fruited Ironbark | V | V | 2 | Yes |
| <i>Grevillea quadricauda</i> | Four-tailed Grevillea | V | V | 3 | Yes |
| <i>Isoglossa eranthemoides</i> | Isoglossa | E | E | No impact | No |
| <i>Lindernia alsinoides</i> | Noah's False Chickweed | V | | 1, 2 | Yes |
| <i>Lindsaea incisa</i> | Slender Screw Fern | E | - | 1, 2, 3, 6 | Yes |
| <i>Macadamia tetraphylla</i> | Rough-shelled Bush Nut | V | V | 8,10 | Yes |
| <i>Marsdenia longiloba</i> | Slender Marsdenia | E | V | 10 | No |
| <i>Maundia triglochinos</i> | - | V | - | 1, 2, 3, 7 | Yes |
| <i>Melaleuca irbyana</i> | Weeping Paperbark | E | - | 7 | Yes |
| <i>Melichrus hirsutus</i> | Hairy Melichrus | E | E | No impact | No |
| <i>Olax angulata</i> | Square-stemmed Olax | V | - | 2 | No |
| <i>Oberonia complanata</i> | Yellow flowered King of the Fairies | E | - | 8 | Yes |

| Scientific name | Common name | TSC Act Status | EPBC Act Status | Project sections: presence confirmed ¹ | Significant impact? ² |
|-----------------------------------|----------------------------------|----------------|-----------------|---|----------------------------------|
| <i>Oberonia titania</i> | Red flowered King of the Fairies | V | - | 10 | No |
| <i>Ochrosia moorei</i> | Southern Ochrosia | E | E | No impact | No |
| <i>Parsonsia dorrigoensis</i> | Milky Silkpod | V | E | No impact | No |
| <i>Peristeranthus hillii</i> | | V | - | No impact | No |
| <i>Persicaria elatior</i> | Knotweed | V | V | 4, 5 | Yes |
| <i>Phaius australis</i> | Southern Swamp Orchid | E | E | No impact | No |
| <i>Prostanthera cineolifera</i> | Singleton Mint Bush | V | V | 6 | Yes |
| <i>Prostanthera palustris</i> | Swamp Mint Bush | V | V | No impact | No |
| <i>Quassia sp. 'Moonee Creek'</i> | Moonee Quassia | E | E | 1 | Yes |
| <i>Rotala tripartita</i> | | E | - | No impact | No |
| <i>Sophora fraseri</i> | Brush Sophora | V | V | No impact | No |
| <i>Streblus pendulinus</i> | Siah's Backbone | - | E | 4, 8, 10 | No |
| <i>Syzygium hodgkinsoniae</i> | Red Lily Pilly | V | V | 10 | Yes |
| <i>Tinospora tinosporoides</i> | Arrow Head Vine | V | V | No impact | No |
| <i>Tylophora woollsii</i> | Wooll's Tylophora | E | E | No impact | No |

E – Endangered, V – Vulnerable

1. With 20m buffer applied for rainforest plants.
2. Significant impact as determined in the EIS/SPIR documents, through subsequent impact assessment or as determined by the Australian Government Minister for the Environment.
3. Conservatively determined as subject to significant impacts in the EIS/SPIR assessments, but subsequently confirmed to be different species.

Threatened flora populations recorded in the study area include *Angophora robur*, *Arthraxon hispidus*, *Eucalyptus tetrapleura*, *Melaleuca irbyana*, *Maundia triglochinosides*, *Cyperus aquatilis*, and *Lindsaea incisa*. A number of populations of threatened flora species will be subject to impacts from the project; species with confirmed populations in the project area which will be directly or indirectly impacted, and the extent of impacts, are provided in Table 7.

Table 7. Impacts on threatened flora species.

| Species | TSC Act | EPBC Act | Direct Impacts | | Indirect impacts (within 10 m) | | Indirect impacts (within 10 m to 20 m) | |
|--|---------|----------|----------------|-----------|--------------------------------|-----------|--|-----------|
| | | | Count | Area (ha) | Count | Area (ha) | Count | Area (ha) |
| <i>Angophora robur</i> Sandstone Rough Barked Apple | V | V | 6551 | 91.676 | 1149 | 21.153 | 1216 | 19.997 |
| <i>Archidendron hendersonii</i> White Lace Flower | V | | 1 | - | 4 | - | 18 | - |
| <i>Arthraxon hispidus</i> Hairy Joint-grass | V | V | 388 | 1.5 | 49 | 0.717 | 61 | 0.895 |
| <i>Cryptocarya foetida</i> Stinking Cryptocarya | V | V | 41 | - | 1 | - | 6 | - |
| <i>Cyperus aquatilis</i> Water Nutgrass | E | - | 128 | 0.024 | 2 | - | 1 | - |
| <i>Eleocharis tetraquetra</i> Square-stemmed Spike-rush | E | - | 253 | 0.815 | 43 | 0.118 | 48 | 0.12 |
| <i>Endiandra muelleri subsp. bracteata</i> Green-leaved Rose Walnut | E | - | 3 | - | 10 | - | 5 | - |
| <i>Eucalyptus tetrapleura</i> Square fruited Ironbark | V | V | 822 | 20.97 | 193 | 6.337 | 115 | 4.87 |
| <i>Grevillea quadricauda</i> Four-tailed Grevillea | V | V | 3 | - | 35 | 0.017 | 14 | - |
| <i>Lindernia alsinoides</i> Noah's False Chickweed | V | - | 1811 | - | 18 | - | 95 | - |
| <i>Lindsaea incisa</i> Slender Screw Fern | E | - | - | 0.383 | - | 0.058 | - | 0.151 |
| <i>Macadamia tetraphylla</i> Rough-shelled | V | V | 10 | - | 2 | - | 3 | - |

| Species | TSC Act | EPBC Act | Direct Impacts | | Indirect impacts (within 10 m) | | Indirect impacts (within 10 m to 20 m) | |
|---|---------|----------|----------------|-----------|--------------------------------|-----------|--|-----------|
| | | | Count | Area (ha) | Count | Area (ha) | Count | Area (ha) |
| Bush Nut | | | | | | | | |
| <i>Maundia triglochinooides</i> | V | - | 53 | 0.189 | 66 | 0.11 | 19 | 0.073 |
| <i>Melaleuca irbyana</i> Weeping Paperbark | E | - | 1582 | 2.761 | 132 | 0.322 | 41 | 0.203 |
| <i>Oberonia complanata</i> Yellow flowered King of the Fairies | E | - | 18 | 0.033 | 1 | 0.013 | 6 | - |
| <i>Oberonia titania</i> Soldiers Crest Orchid | V | - | - | - | - | - | 13 | - |
| <i>Persicaria elatior</i> Knotweed | V | V | 76 | 0.2 | 28 | 0.069 | 69 | 0.09 |
| <i>Prostanthera cineolifera</i> Singleton Mint Bush | V | V | 609 | 0.424 | 260 | 0.188 | 106 | 0.229 |
| <i>Quassia sp.</i> 'Moonee Creek' Moonee Quassia | E | E | 73 | 0.08 | 137 | 0.105 | 250 | 0.126 |
| <i>Rotala tripartita</i> | E | - | - | - | - | - | 2 | - |
| <i>Streblus pendulinus</i> Siah's Backbone | - | E | 4 | - | 1 | - | 5 | - |
| <i>Syzygium hodgkinsoniae</i> Red Lily Pilly | V | V | 6 | - | 4 | - | - | - |

E – Endangered, V – Vulnerable

3.4 Impacts to Matters of National Environmental Significance (MNES)

Of the threatened species and communities discussed in Sections 3.2 and 3.3, 21 are MNES defined as “threatened species and communities” under the Commonwealth approval. Residual significant impacts on these MNES require offsets in accordance with the EPBC Environmental Offsets Policy 2012. Roads and Maritime is taking a conservative approach and intends to provide offsets for identified impacts, not just residual significant impacts. The subject MNES and impacts from the project are detailed in Table 8. The extent of impacts to each MNES have been calculated based on detailed information from threatened species surveys and habitat quality mapping undertaken in 2014. The calculation of impacts to MNES is discussed further in Appendix C and figures showing the extent of occurrence or potential habitat for each MNES are provided in Appendix D.

According to previous advice from DoE (pers comm Department of Environment NSW Assessment Team, 20 November 2014) threatened flora offsets should preferentially be based on area of habitat lost rather than number of individuals, given the potential for understatement of the number of individuals impacted. The size and extent of populations of threatened flora in the project study area have been assessed based on multiple detailed surveys of the project study area (as listed in section 1.5). Each threatened flora MNES was reviewed to determine whether it was more appropriate to calculate impacts and associated offsets using the area of occupied habitat or the number of individuals recorded; details of the rationale for assessing impacts and offsets for each species are provided in Appendix C.

For threatened flora species in rainforest habitats, as well as *Arthraxon hispidus*, a buffer of 20 metres from the edge of clearing was applied to capture indirect impacts as a result of clearing for the project for the purposes of offsetting. An impact buffer of 10 metres was also applied for *Quassia* sp. Moonee Creek as there is a high density of stems located immediately adjacent and downslope of the edge of the project.

Two of the threatened flora species listed in the Commonwealth approval, *Acronychia littoralis* (Scented Acronychia) and *Endiandra muelleri* (Rusty Rose Walnut) are no longer considered to occur within the project area, based on threatened species surveys and further review of specimens by specialist botanists and the Queensland Herbarium.

Table 8. Impacts on MNES

| Protected matter (MNES) | Common name | EPBC Act status | Impacts | |
|--|--|-----------------|--|-----------------------------|
| | | | Area (ha) | No. of individuals impacted |
| Threatened ecological communities | | | | |
| | Littoral Rainforest and Coastal Vine Thickets of Eastern Australia | CE | 0.46 ha (0.2 ha direct impacts and 0.26 indirect impacts) | N/A |
| | Lowland Rainforest of Subtropical Australia | CE | 3.25 ha (1.88 ha direct impacts and 1.37 ha indirect impacts) | N/A |
| Threatened flora species | | | | |

| Protected matter (MNES) | Common name | EPBC Act status | Impacts | |
|---|------------------------------|-----------------|------------------------|--|
| | | | Area (ha) | No. of individuals impacted |
| <i>Acronychia littoralis</i> | Scented Acronychia | E | N/A | N/A |
| <i>Angophora robur</i> | Sandstone Rough Barked Apple | V | 91.68 ha | 6551 |
| <i>Arthraxon hispidus</i> | Hairy Joint-grass | V | 3.11 ha | N/A |
| <i>Cryptocarya foetida</i> | Stinking Cryptocarya | V | N/A | 48 (41 directly impacted and 7 indirectly impacted) |
| <i>Endiandra hayesii</i> | Rusty Rose Walnut | V | N/A | N/A |
| <i>Eucalyptus tetrapleura</i> | Square-fruited Ironbark | V | 20.97 ha | 822 |
| <i>Macadamia tetraphylla</i> | Rough Shelled Bush Nut | V | N/A | 15 (10 directly impacted and 5 indirectly impacted) |
| <i>Prostanthera cineolifera</i> | Singleton Mint Bush | V | 0.42 ha | 609 |
| <i>Quassia</i> sp. 'Moonee Creek' | Moonee Quassia | E | N/A | 210 stems (73 directly impacted and 137 indirectly impacted) |
| Threatened fauna species | | | | |
| <i>Anthochaera phrygia</i> | Regent Honeyeater | E, M | 722.73 ha | N/A |
| <i>Dasyurus maculatus maculatus</i> (SE population) | Spotted-tailed Quoll | E | 795.8 ha | N/A |
| <i>Lathamus discolor</i> | Swift Parrot | E, M | 773.24 ha | N/A |
| <i>Litoria olongburensis</i> | Wallum Sedge Frog | V | 12.73 ha | N/A |
| <i>Mixophyes iteratus</i> | Giant Barred Frog | E | 4.91 ha | N/A |
| <i>Nannoperca oxleyana</i> | Oxleyan Pygmy Perch | E | 8.68 ha | N/A |
| <i>Phascolarctos cinereus</i> | Koala | V | 884.73 ha ¹ | N/A |
| <i>Phyllodes imperialis</i> southern subsp. | Pink Underwing Moth | E | 2.61 ha | N/A |
| <i>Potorous tridactylus tridactylus</i> | Long-nosed Potoroo | V | 49.32 ha | N/A |
| <i>Pteropus poliocephalus</i> | Grey-headed Flying-fox | V | 845.91 ha | N/A |

CE – Critically Endangered, E – Endangered, V – Vulnerable, M - Migratory

1. Comprises the total amount of primary, secondary and tertiary habitat impacted by the project.

It is understood that the most recent Threatened Invertebrate Management Plan (Roads and

Maritime July 2015) has identified that a greater area of foraging habitat for the Pink Underwing Moth (*Phyllodes imperialis* southern subsp.) will be removed. Any increase in impacts for this species will be addressed through the Biodiversity Offset Package.

3.4.1 Koala populations

The area of habitat to be removed that was assigned habitat quality scores for Koala, as detailed in Table 8, is larger than the 375 hectares estimated as ‘habitat critical to the survival of the Koala’ (DSEWPaC 2012) in the SPIR. This is because Roads and Maritime Services decided to take a more conservative approach to estimating the area of Koala habitat that would be removed as part of the Project. RMS assumed that all Biometric Vegetation Types that nominally contain Koala food tree species (regardless of percentage tree cover) or provide resting or connecting habitat were included in determining habitat quality scores. As such these calculations included all possible koala habitat ie ‘tertiary koala habitat’ in these calculations and forms the basis for determining offsets under the EPBC Act Biodiversity Offsets Policy.

The area of primary and secondary Koala habitat to be cleared, as per the definition in the SPIR and limited to 375 hectares under MCoA B1, is approximately 361 hectares. This area may decrease as a result of detailed design.

MCoA D4 requires that offset sites are identified to compensate for impacts on Koala populations at Coolgardie/Bagotville, Broadwater and Woombah/Iluka. In order to determine the extent of impacts on these Koala populations, the populations were geographically defined in relation to the project, in consultation with Dr Rod Kavanagh (Niche Environment and Heritage), as located approximately between project chainages. The areas of each population within the project boundary were mapped, and habitat quality mapping undertaken in 2014 was used to calculate the extent and quality of Koala habitat within these areas (Table 9)

Table 9. Location and area of quality-scored habitat within identified Koala populations

| Koala population | Location (project chainages) | Area of mapped habitat (ha) |
|-------------------------|-------------------------------------|------------------------------------|
| Iluka/Woombah | 94200 – 98400 | 22.96 |
| Broadwater | 135500 – 145650 | 37.84 |
| Coolgardie/Bagotville | 1460000 – 159600 | 39.23 |
| Total | | 100.03 |

Further details of the Koala populations and habitat quality scoring are provided in Appendix C. Maps of the populations are provided in Appendix D.

3.5 Barrier impacts

The project has potential to isolate remnant vegetation patches and create barriers to the movement of small ground-dwelling mammals, reptiles and amphibians and potentially discrete arboreal mammal populations on a both a patch and landscape scale.

The project design includes a four-lane divided carriageway. The width of the project boundary will vary considerably according to the location, elevation and proximity of service roads and interchanges. Generally, the project width is within a range of 50 to 200 metres. Large sections of the project upgrade will occur adjacent to the existing highway. The upgrade and widening of

the road will be such that the existing barrier effect of the highway will be substantially increased. Sections of the project that deviate substantially from the existing highway could create a new barrier effect (such as sections 3 to 4 and 9 to 10).

There is currently a high degree of habitat fragmentation across much of the study area. This is due to the broad-scale clearing of native vegetation for agriculture and development including construction of the existing Pacific Highway and network of roads. This fragmentation of habitat is evident in the floodplain regions of the Corindi River, Clarence River and Richmond River. Contiguous areas of forest are generally associated with state forests, national parks and conservation reserves, which have been partitioned in the landscape over time. Any impacts on these lands associated with the project will occur along the outer boundaries of the property and will not divide these larger important areas of habitat. This feature of the project alignment, in addition sections consisting largely of a duplication of the existing highway corridor, suggests that further large-scale fragmentation of habitat on a regional scale has been avoided by the project route selection.

However, the widening of the existing Pacific Highway in some areas will exacerbate the current barrier effect of the highway on regional and local populations of general flora and fauna. The loss of connectivity has potential to impact on populations of several listed fauna species as determined by ecological surveys undertaken 2006 to 2012, review of NSW Atlas data identifying broad population hotspots and through consultation with Office of Environment and Heritage.

These species include:

- Coastal Emu - the endangered population of the lower Clarence Valley and Yuraygir area is intersected by the project from Pillar Valley to lower Shark Creek (sections 3 and 4). The project will bisect important habitat for pre and post breeding life-cycle activities
- Oxleyan Pygmy Perch - known and potential habitat for the species from Devils Pulpit to Tabbimoble (Section 7), and between Woodburn and Broadwater (Section 9) including MacDonalds Creek and Broadwater National Park
- Yellow-bellied Glider and Squirrel Glider - important populations exist from Woolgoolga to Wells Crossing (sections 1 and 2), at Tabbimoble (sections 6 and 7) and Broadwater National Park (Section 9)
- Rufous Bettong, Common Planigale and Brush-tailed Phascogale - important populations exist from Woolgoolga, Halfway Creek, Wells Crossing, Glenugie and Pillar Valley (sections 1 to 3)
- Spotted-tailed Quoll - a relatively higher density of records from Woolgoolga and Halfway Creek north to Wells Crossing (sections 1 to 2) and Devils Pulpit to Broadwater (sections 7 to 9) suggesting the likely presence of quoll populations in these areas
- Koala - scattered areas of Primary and Supplementary Koala Habitat identified on both sides of the project boundary between Tabbimoble and Woodburn (Section 7) as well as high densities of koala records between Woodburn and Wardell (sections 9 and 10) including Broadwater National Park. The majority of these records occur to the west of the project boundary but in some locations these cross the project around the Richmond River
- Long-nosed Potoroo in the Wardell Heath (Section 10)
- Giant Barred Frog, Green-thighed Frog and Wallum Sedge Frog (sections 1 to 3 and 6 to 9).

As part of the response to mitigate and minimise the barrier effect for these species, Roads and Maritime has developed a Biodiversity Connectivity Strategy as part of the EIS, with the aim of providing connectivity structures and enhancing landscape connectivity where feasible and reasonable in strategic locations.

Throughout the largely cleared or fragmented habitats, smaller east-west vegetated corridors are likely to play an important role in the wider corridor network. These include those fragmented by the existing highway such as at Yaegl Nature Reserve or Tabbimoble Nature Reserve to Doubleduke State Forest. The project will increase the level of isolation or fragmentation of some patches of vegetation that follow in an east-west direction. An increase in the width of the road is likely to increase this barrier effect for some species and in some sections where regional corridors have been identified, (such as the Dirty Creek Range to Yuraygir National Park or Bundjalung National Park). This will be the case particularly for ground-dwelling and arboreal mammals. Mobile species such as birds and bats may not be as affected by the increase in road corridor width.

Roads act as a barrier or filter to the movement of vertebrates (eg Mansergh and Scotts 1989; Alexander and Waters 2000; van der Ree 2006). Animal movement may involve daily travel through a home range, seasonal migration associated with changes in habitat use or breeding events, or the dispersal of individuals from their natal areas (Taylor and Goldingay 2011). A barrier effect may result from a behavioural aversion to a road. There have been few studies in Australia to understand this effect, however those that have been done reveal that diverse responses can be expected among mammalian taxa. Rodents of different genera showed a gradient of responses to crossing road clearings, from no inhibition to severe inhibition (Goosem 2001). Squirrel Gliders regularly crossed a high-volume two-lane highway, whereas females appeared to be inhibited from crossing a high-volume four-lane highway with a median strip (van der Ree 2006).

As part of the conditions of approval (B10) for the project the Connectivity Strategy (as required by condition D2) is to be updated as part of detailed design and further informed by the outcomes of the Mitigation Framework required by condition D1.

3.6 Habitat fragmentation

Fragmentation of habitat will be greatest where the project deviates from the existing Pacific Highway. This occurs on a large scale through sections 3 to 4 and sections 9 to 10. Portions of the landscape in these regions are already largely cleared; particularly the alluvial floodplain areas of the Coldstream River and Richmond River where vegetation is heavily fragmented and a mosaic of different sized remnants exist. However, Section 3 will traverse the western foothills of the Summervale Range from Pillar Valley to Tyndale and this route will fragment remnant open forest habitats in moderate and high quality condition over a distance of around 23 kilometres. This includes fragmentation of a portion of the identified Sandstone Rough-barked Apple (*Angophora robur*) population and known and potential habitat for a range of threatened and common fauna species expected in sections 3 and 4. Much of this habitat occurs on sandy soil that is identified as having a high density of hollow-bearing trees and generally higher fauna species richness. This habitat includes a range of old growth forests with minimal evidence of past logging particularly between Pine Brush State Forest and the interchange at Tyndale.

The second area of major deviation from the existing highway occurs south of the Richmond River to the interchange with the existing highway north of Wardell, a distance of around 12 kilometres. This will fragment habitats of a local and regional scale of importance. These habitats are of such importance partly due to the already increased isolation of the Wardell Heath from the Blackwall Range and the localised east-west wildlife corridors that are situated north of the Richmond River.

Loss of connectivity between smaller habitat patches can cause the loss of genetic diversity in populations (Forman et al. 2003). As fragmentation proceeds, stochastic forces add to potential declines caused by a dwindling supply of habitat. Some species are at greatest risk in fragmented

landscapes than others and this relates to the biological characteristics of the species. In this regard species that share similar adaptations to habitat niches and similar life-cycle traits are assumed to be impacted in a similar way, for example microchiropteran bats, gliders, nectarivorous and insectivorous birds, large forest owls.

In a comprehensive literature review of the effects of fragmentation, Henle et al. (2004) showed that sensitivity to habitat fragmentation is caused by similar traits in plants and animals. Indeed species with particular traits may be more sensitive to fragmentation. Based on the literature review, these authors documented those ecological traits that showed a positive correlation to fragmentation sensitivity. This data is used to highlight a number of threatened species from the study area which may be more susceptible to the effects of fragmentation. However it is evident from the review that indicators of sensitivity to fragmentation are scale-dependent (eg Metzger 2000) and that there is no consistent response to habitat fragmentation, such that it is not possible to predict which species will be impacted the most or to what extent.

3.7 Hollow-bearing trees

The loss of hollow-bearing trees (HBTs) is listed as a key threatening process under the TSC Act. Hollow-bearing trees are a critical habitat feature for a number of threatened species (Gibbons & Lindenmayer 2002), providing breeding and/or sheltering habitat. Gibbons and Lindenmayer (2002) found that hollow bearing trees were more common in older stands, gullies, vegetation not logged and on flat terrain. Habitats with high productivity were also noted to support a higher number of hollow-bearing trees.

Hollow-bearing trees are present in habitats to be cleared by the project in all habitat types and project sections. The number of hollow-bearing trees in each project section is presented in Table 10. A total of 4,244 hollow-bearing trees are proposed for removal. Loss of these is greatest in Section 3, where more than one quarter of the total number of hollow-bearing trees recorded are proposed for removal.

In NSW, terrestrial vertebrate species that are reliant on tree hollows for shelter and nests include at least 46 mammals, 81 birds, 31 reptiles and 16 frogs (Gibbons and Lindenmayer 1997, Gibbons and Lindenmayer 2002). Of these, 22 are listed as threatened species (TSC Act or EPBC Act) and have either been identified in the study area or are considered likely to occur in the three dominant habitat types discussed.

Table 10. Hollow bearing tree impacts

| Project section | Number of HBTs to be removed |
|-----------------|------------------------------|
| 1 | 830 |
| 2 | 689 |
| 3 | 1206 |
| 4 | 64 |
| 5 | 18 |
| 6 | 53 |
| 7 | 520 |
| 8 | 592 |
| 9 | 172 |
| 10 | 81 |
| 11 | 19 |

| Project section | Number of HBTs to be removed |
|------------------------|-------------------------------------|
| TOTAL | 4244 |

In accordance with MCoA D6, Nest Box Plans have been prepared to offset the loss of hollow-bearing trees across the project (Biosis 2014a & 2014b, Ecosure 2014b, Geolink 2014a, Aecom 2014a, Melaleuca Group 2014a, Australian Museum Consulting 2014a). The nest box management plans identify density and placement of nest boxes and fauna groups to be targeted. Nest boxes will be distributed throughout suitable habitat within and adjacent to the project corridor in all project sections. Monitoring and management strategies for nest boxes have also been included in the plans to assess their effectiveness and ensure installed nest boxes are maintained. The Nest Box Plans for project sections 1, 2, 4, 5, 8, 9, 10, & 11 were approved by the Department of Planning and Environment (DP&E) on 16 January 2015. The Nest Box Plans for project sections 3, 6, & 7 were approved by DP&E on 17 February 2015.

4 Management of biodiversity impacts

Measures to manage the impact of the projects on biodiversity have been developed as part of the environmental assessment for the project. Management measures for biodiversity impacts were developed following these general principles, in order of preference:

- Avoiding impacts
- Mitigating impacts
- Offsetting impacts

Measures relevant to avoiding and mitigating biodiversity impacts are outlined and detailed in the Environmental Impact Statement (Roads and Maritime, 2012), and the Submissions / Preferred Infrastructure Report (Roads and Maritime, 2013). However, not all impacts to biodiversity can be fully mitigated through 'on- ground' management measures alone and offsetting for projects biodiversity impacts is required. A summary of the key measures relevant to biodiversity impacts are outlined below.

4.1 Avoiding impacts

Disturbance and clearing of vegetation as a result of the project will be unavoidable, however opportunities to minimise the loss of native vegetation and fauna habitat are to be prioritised during all aspects of the detailed design, in particular this includes the following:

- Avoiding and minimising vegetation removal wherever possible through the detailed design process
- Sensitive selection of ancillary facilities. The ancillary facilities identified in the SPIR present a selection of available sites, which have been further assessed and refined to minimise biodiversity impacts
- Water quality basins will be placed in the optimal location for treating surface runoff. During detailed design, the location of water quality treatment measures will consider the competing environmental requirement of minimising vegetation removal, particularly where there is the potential for threatened plant species, threatened fauna habitat or in identified regional wildlife corridors
- Protective fencing will be installed to mark the limits of clearing (ie 'no-go' areas) surrounding the footprint to ensure that vehicles and other direct disturbances associated with the road construction, including construction compounds and stockpile sites do not enter adjacent areas of vegetation outside the footprint
- Construction staff will be educated with regards to the status and location of protected areas during site induction and/or tool box talks and pre-clearing surveys will be undertaken to flag hollow bearing trees and identify trees where fauna may be present
- Vegetation management strategies will be developed for retained areas of vegetation, including weed management, native plantings, and the collection of seed.

4.2 Mitigating impacts

Mitigation measures designed to reduce impacts on biodiversity include:

- Connectivity strategies

- Construction measures
- Threatened species management

4.2.1 Connectivity strategies

The biodiversity assessment built on previous work started during the preferred route design phase to develop a whole of project Connectivity Strategy. The Connectivity Strategy focuses both on design and management actions that minimise the barrier effect of the project.

The goal of the Connectivity Strategy is to maintain connectivity in the landscape, as well as enhance connectivity where feasible and reasonable near the road corridor. Additionally, the Connectivity Strategy presents opportunities for protection or revegetation at key sites adjoining the project boundary to enhance connectivity. It also outlines future research and adaptive monitoring needs for fauna crossing structures. The format of the Connectivity Strategy is presented as follows:

- Guiding principles: basis for developing whole of project connectivity goals and influence decision making
- Connectivity strategy goals: provides a focus for the strategy that is appropriate at a local and regional level
- Decision-making framework: presents a framework for meeting the connectivity goals including identification of the issues and how these have been met, outlines future monitoring needs and strategic connectivity enhancement opportunities
- Connectivity design measures: details the structures proposed, fencing requirements and further recommendations and design principles for consideration at detailed design.

The Connectivity Strategy outlines the measures to be adopted for the detailed design in the form of connectivity design principles. The summary of crossing structures for each project section includes dedicated and combined fauna crossing structures. This summary is based on the concept design for the project, and the locations will be subject to some refinement during detailed design. Any changes will be made in line with the design principles identified in the Connectivity Strategy.

It is expected that a number of biodiversity offset sites will be located adjacent to the project, and where appropriate these areas will be revegetated and managed to enhance connectivity in accordance with the Connectivity Strategy.

Exclusion fencing

The connectivity design measures provide recommended locations for fauna exclusion fencing. These locations are based on ensuring exclusion of fauna from known roadkill hotspots (including emu road kill research) and directing fauna to dedicated and combined crossing structures. The connectivity design principles outline measures for exclusion fencing including fence design specifications and length of fencing around dedicated and combined structures. The detailed design should refer to the connectivity design principles for final fence design.

Fauna exclusion fencing will target species identified through the ecological surveys completed as part of the project development and in accordance with the design principles set out in the Fauna Connectivity Strategy. Fencing will target fauna species including frogs, phascogale, emu and koala in addition to general fauna exclusion fencing.

Koala exclusion fencing will be provided throughout Section 10 to divert Koala and other fauna around the highway and towards crossing structures.

Exclusion fencing is recommended for portions of sections 3 and 4 to exclude emus from the road corridor and to direct emus and other fauna to the bridge underpass structures. It is recognised that fencing will be problematic in low-lying areas of sections 3 and 4 subject to flooding and that fencing in these areas should be placed higher on fill embankments to reduce impacts of flooding on the fauna fence.

Arboreal crossing structure locations

During detailed design it will be necessary to conduct tree surveys at proposed rope and glider crossing locations to determine the most appropriate location to place the structure at a site specific scale. The design should aim to place arboreal crossing structures at grade level, where average tree heights exceed 20 metres, and/ or taller trees will be naturally positioned close to the road edge. Preference will be given to riparian habitats if possible and the tree survey should aim to identify hollow-tree density.

Widened medians

Widened medians are located in the design at key areas for aerial connectivity, targeting arboreal species such as gliders. The design of fauna exclusion fencing and drainage or fauna underpass structures in widened medians should minimise any vegetation clearing.

Widened medians will be located at:

- Section 1: Corindi, north of Corindi floodplain
- Section 2: Newfoundland State Forest, north of Wells Crossing Creek
- Section 7: Doubleduke State Forest, alongside Tabbimobile Nature Reserve.

Further details of widened medians are outlined in Section 5 of the EIS.

Landscape plans

Landscape planning is to avoid placement of emu food plants along the road corridor in sections 3 and 4. These species include the following genera: *Dianella*, *Gahnia*, *Lomandra* and *Ficus* in addition to Bangalow Palm (*Archontophoenix cunninghamiana*) and soy, oats or rye grass cover crops. However, depending on soil suitability/presence of native vegetation initial plantings of soy and / or oats will be targeted at key emu crossing locations to help with the adaptation of emus to these crossing structures.

In general, landscape plans are to avoid dense plantings of grasses and graminoids in road verge areas in sections 2 and 3 to discourage use by Rufous Bettong and minimise potential roadkill of this species. There will be additional planting of trees around glider crossings and widened medians in order to provide long-term replacement of these structures.

At least 130 hectares of Koala food trees are to be planted in Section 10, 50% of which is to be planted prior to construction. Areas prioritised to be planted before construction are those which are most likely to facilitate connectivity through the landscape for local “hotspots” or known

concentrations of Koalas. Plantings will encompass existing large trees wherever possible as Koalas prefer to use these for shelter. Further detail on the identified revegetation areas, species selections, planting methods and proposed monitoring is provided in the Koala Revegetation Strategy (Niche 2015).

4.2.2 Construction measures

Roads and Maritime has developed Biodiversity Guidelines for protecting and managing biodiversity on Roads and Maritime projects (Roads and Traffic Authority 2011a). These guidelines are intended for Roads and Maritime project managers, staff and contractors (including ecologists and landscape designers). They are a tool to help minimise impacts on biodiversity during construction and maintenance works. Reference is to be made to the biodiversity guidelines in addition to the *Roads and Maritime Vegetation Clearing and Fauna Management Practice Note: Pacific Highway Projects* (Roads and Maritime Services 2012b) when preparing environmental specifications for contracts and for the development of project specific Construction Environmental Management Plans (CEMPs), including flora and fauna management sub-plans (FFMPs). An outline of the content of the biodiversity guidelines is shown in Table 11 and each management guide described below.

Table 11. Content of Roads and Maritime Biodiversity Guidelines for developing project CEMPs and FFMPs

| Management guide | Outline of content |
|---|---|
| 1. Pre-clearing process | Guidance for the pre-clearing process that should be conducted before any clearing takes place to minimise the impact on native flora and fauna. |
| 2. Exclusion zones | Guidance for determining and establishing exclusion zones to prevent damage to native vegetation and fauna habitats and prevent the distribution of pests, weeds and disease. |
| 3. Re-establishment of native vegetation | Guidance for the re-establishment of native vegetation through managing site conditions, material sourcing and procurement, and seed and plant stock installation and establishment. |
| 4. Clearing of vegetation and removal of bushrock | Guidance for minimising the impact of habitat removal, such as vegetation clearing and bush rock removal, on native flora and fauna. |
| 5. Re-use of woody debris and bushrock | Guidance for maximising the re-use of woody debris and bushrock to minimise loss and/or damage to native flora and fauna habitats. |
| 6. Weed management | Guidance for preventing or minimising the spread of noxious and environmental weed species on all Roads and Maritime project sites and during maintenance works. |
| 7. Pathogen management | Guidance for preventing the introduction and/or spread of disease causing agents such as bacteria and fungi. |
| 8. Nest boxes | Guidance for works that involve the removal of hollow-bearing trees. Guidance for minimising the impact of hollow loss by providing supplementary fauna habitat in the form of artificial hollows (nest boxes). |
| 9. Fauna handling | Guidance for minimising impacts on fauna as a result of being handled by humans and prevent injury to people handling fauna. |
| 10. Aquatic habitats and riparian zones | Guidance for limiting impacts on aquatic flora and fauna and their habitats, and to ensure the movement of fish up and downstream is maintained at all times during works in a waterway. |

4.2.3 Threatened species management

General survey, avoidance, management and monitoring requirements for flora and fauna during construction will be detailed in the whole of project Flora and Fauna Management Plan (FFMP). Impacts on threatened species will be generally managed via the FFMP, however there are a number of targeted management measures that will be managed via specific threatened species management plans, as required under MCoA D8. These plans will focus on species identified as potentially significantly impacted by the project and are to be prepared in consultation with EPA, DPI (Fisheries) and DoE. Draft Threatened Species Management Plans were prepared for the SPIR and are being updated for each project section. These are separate and additional to the Flora and Fauna Management Plan required by condition D26(e).

5 Offsetting biodiversity impacts

5.1 Principles for obtaining biodiversity offsets

The principles followed for Roads and Maritime to target suitable biodiversity offsets for the Woolgoolga to Ballina upgrade project are as follows:

- The vegetation communities and habitat types represented in the offset areas will reflect the vegetation communities and habitat types impacted by the project
- Offset areas will contain suitable habitat for threatened and migratory fauna (TSC Act and EPBC Act) and will contain or be suitable for re-establishing threatened flora (TSC Act and EPBC Act) affected by the project
- Roads and Maritime will prioritise investigations into areas that contain vegetation communities and suitable habitat for Endangered and / or Critically Endangered species listed under the EPBC Act
- Offset areas cannot be already funded or protected under another scheme unless it can be demonstrated that protection will be increased through additional management actions to those already required under existing obligations. For example the NSW Biodiversity Banking and Offset Scheme allows credits to be determined for several types of voluntary conservation agreements entered into prior to 2009.
- Areas that are already managed for conservation by the government, such as flora reserves, national parks and public open space will not be chosen as offsets
- Offset properties will be located as close to the impact site as feasible
- Offset properties will aim to protect larger patches of vegetation and habitat with preference given to sites that are connected to, or provide connectivity to, other core areas of habitat
- Assess potential offset sites against the EPBC Offset Assessment Guide for Commonwealth listed species.

5.2 Policy requirements

5.2.1 EPBC Act Environmental Offset Policy

Under the EPBC Act Environmental Offsets Policy, environmental offsets are measures that compensate for the residual adverse impacts of an action. Offsets should counterbalance the impacts that remain after avoidance and mitigation measures have been implemented. For assessments under the EPBC Act, offsets are only required if residual impacts are significant. The EPBC Act Environmental Offsets Policy (SEWPAC 2012) has five key aims:

- Ensure the efficient, effective, transparent, proportionate, scientifically robust and reasonable use of offsets under the EPBC Act
- Provide proponents, the community and other jurisdictions with greater certainty and guidance on how offsets are determined and applied under the EPBC Act
- Deliver improved environmental outcomes by consistently applying offsets policy
- Outline the appropriate nature and scale of offsets and how they are determined
- Provide guidance on acceptable delivery mechanisms for offsets.

Suitable offsets under the EPBC Act Environmental Offsets Policy must be specific to the particular area, habitat type (ie foraging or roosting habitat) and habitat condition or number of individuals of impacted MNES. The offsets must result in an overall conservation outcome that improves or maintains the viability of a protected matter (a MNES). The offset package is to contain a minimum of 90 per cent direct offsets of the total offset requirement for each MNES, and a maximum of 10 per cent comprising other compensatory measures such as contributions towards research or particular threat abatement works.

The EPBC Act Environmental Offsets Policy is guided by eight overarching principles to be applied when determining the suitability of offsets. These offset principles have been applied in the development of this Biodiversity Offset Strategy and each principle is discussed and addressed below.

1. *A suitable offset must deliver an overall conservation outcome that improves or maintains the viability of the aspect of the environment that is protected by national environment law and affected by the proposed development*

Using the proposed methodology, indicative offset requirements will be at minimum approximately 3623 hectares. The impact to compensatory habitat ratio equates to at least 3623 hectares to 900 hectares, an overall ratio of around 4:1. This will result in a net improvement in biodiversity over time as the proposed offset area is greater than the potential loss resulting from the project.

One of the criteria for selecting offsets is to ensure that the land is suitable for ongoing management for conservation through an appropriate legal instrument. Offsets will not be chosen that cannot be managed in this way, to ensure the offset results in a net improvement in biodiversity over time.

2. *A suitable offset must be built around direct offsets but may include other compensatory measures*

Direct offsets are Roads and Maritime's first priority to achieve the objectives of this strategy, and it is expected that direct offsets will form 100 per cent of the offset requirement. Deviation from the 90 per cent direct offset requirement may be considered if it can be demonstrated that a greater benefit to the protected matter is likely to be achieved through increasing the proportion of other compensatory measures in an offsets package. This will be determined following consultation with the Department of the Environment and EPA.

3. *A suitable offset must be in proportion to the level of statutory protection that applies to the protected matter*

Offsets for the project will be chosen using a number of criteria to ensure biodiversity is offset on a like-for-like or better conservation outcome. Only offsets that meet these criteria will be considered for use as an offset. This ensures that impacts, particularly TECs and key threatened species habitat are offset with areas that have equal or greater conservation status than the area to be impacted.

4. *A suitable offset must be of a size and scale proportionate to the residual impacts on the protected matter*

A quantitative assessment has been undertaken to determine the exact area that requires offsetting. This includes using total clearing areas from the direct construction footprint, construction buffers, potential ancillary areas and utility adjustment works. The impact assessments conducted for the project were conducted in accordance with the relevant

guidelines to ensure impacts were accurately estimated.

5. *A suitable offset must effectively account for and manage the risks of the offset not succeeding*

Offsets will only be chosen if they are suitable for ongoing management for conservation through an appropriate legal instrument. Additionally, offsets will be audited to ensure that the actions have been carried out, and monitored to determine that the actions are leading to positive biodiversity outcomes. Details of monitoring and auditing will be included in the Biodiversity Offset Package.

6. *A suitable offset must be additional to what is already required, determined by law or planning regulations or agreed to under other schemes or programs (this does not preclude the recognition of state or territory offsets that may be suitable as offsets under the EPBC Act for the same action).*

The offset package will ensure that any offsets identified for the project will not include land that has already been set aside in the conservation estate. Further any proposed offsets will be additional to what has been paid for under other schemes or programs on a pro rata basis, for example conservation initiatives on private land.

7. *A suitable offset must be efficient, timely, transparent, scientifically robust and reasonable*

A decision making framework has been developed for the selection of offsets to ensure they include the consideration of structure, function and compositional elements of biodiversity, enhance biodiversity at a range of scales, consider the conservation status of ecological communities, and ensure the long-term viability and functionality of biodiversity. Further detail on the decision making framework is provided below.

The timely delivery of the offset package has been considered and is discussed in the offset strategy.

8. *A suitable offset must have transparent governance arrangements including being able to be readily measured, monitored, audited and enforced*

Offsets will be audited to ensure that the actions have been carried out, and monitored to determine that the actions are leading to positive biodiversity outcomes. Details of monitoring and auditing will be included in the Biodiversity Offset Package.

5.2.2 OEH principles for the use of biodiversity offsets in NSW

The Office of Environment and Heritage (OEH) have developed principles for the use of biodiversity offsets in NSW, to be used as a framework for considering environmental impacts and developing offset proposals (OEH 2014b). The OEH offsetting principles have been developed to provide a framework for assessing offset proposals for approvals under the *Environmental Planning and Assessment Act 1979*.

The OEH offset principles for the use of biodiversity offsets in NSW have been used in the development of this Biodiversity Offset Strategy, in accordance with the Director General's Requirements (DGRs) for the project and in order to satisfy MCoA D5. The principles have been addressed as follows:

Principle 1: Impacts must be avoided first by using prevention and mitigation measures

Measures to manage the impact of the project on biodiversity have been developed as part of the environmental assessment for the project. Management measures for biodiversity impacts were developed following these general principles, in order of preference:

- Avoiding impacts
- Mitigating impacts
- Offsetting impacts

Principle 2: All regulatory requirements must be met

The strategy is being implemented to address biodiversity impacts and satisfy the Minister's Conditions of Approval as part of the project approval under Part 5.1 of the Environmental Planning and Assessment Act. This Biodiversity Offset Strategy is not being used concurrently to satisfy an assessment or approval under other legislation.

Principle 3: Offsets must never reward ongoing poor performance

Land for offsets will be chosen based on the criteria outlined in this strategy, and any land found to address these criteria will not be deliberately degraded in order to increase the value from the offset.

Principle 4: Offsets will complement other government programs

Offset properties and associated management actions will not conflict or contradict NSW and/or Commonwealth government initiatives or programs relating to the conservation of. Land(s). Roads and Maritime will consult with other government departments to ensure offsets are appropriate located, are of sufficient quality and are managed appropriately to ensure the offsets are secured in perpetuity.

The Draft NSW Biodiversity Strategy (DECCW and I&I NSW 2010), or subsequent updates, and the Mid and Far North Coast Regional Conservation Plans (DECCW 2010a and b) will be consulted when identifying offset options. Roads and Maritime acknowledges the NSW State plan's commitment to continue to build and establish national parks and nature reserves as the primary biodiversity conservation mechanism, and also recognises the Commonwealth Government's objective of Building the National Reserve System, through mechanisms such as supporting conservation covenants (DSEWPC, The National Reserve System Fact Sheet 1, April 2010).

Principle 5: Offsets must be underpinned by sound ecological principles

A decision making framework has been developed for the selection of offsets to ensure they include the consideration of structure, function and compositional elements of biodiversity, enhance biodiversity at a range of scales, consider the conservation status of ecological communities, and ensure the long-term viability and functionality of biodiversity. Further detail on the decision making framework is provided below.

Principle 6: Offsets should aim to result in a net improvement in biodiversity over time

Using the proposed methodology, indicative offset requirements will be at minimum approximately 3623 hectares. The impact to compensatory habitat ratio equates to 3623 hectares to 900 hectares, an overall ratio of around 4:1. This will result in a net improvement in biodiversity over time as the proposed offset area is greater than the potential loss resulting from the project.

One of the criteria for selecting offsets is to ensure that the land is suitable for ongoing management for conservation through an appropriate legal instrument. Offsets will not be chosen that cannot be managed in this way, to ensure the offset results in a net improvement in biodiversity over time.

Principle 7: Offsets must be enduring – they must offset the impact of the development for the period that the impact occurs

Road projects generally have a long-term impact on the environment by removing areas of vegetation and fauna habitat, and reducing fauna connectivity. Therefore, all offsets for road construction projects are secured in perpetuity, to ensure the impact is offset for the period that it occurs.

The selection criteria identified in this strategy include the need for the offset to be appropriate for ongoing management for conservation through an appropriate legal instrument. This ensures any land selected under these criteria will be secured in perpetuity.

Principle 8: Offsets should be agreed prior to the impact occurring.

In accordance with NSW Department of Planning and Environment and Commonwealth Department of Environment conditions of approval, the Biodiversity Offset Strategy and Biodiversity Offset Status Report must be submitted for approval within three months of commencement of sections 1 and 2 of the action.

Principle 9: Offsets must be quantifiable – the impacts and benefits must be reliably estimated.

A quantitative assessment has been undertaken to determine the exact area that requires offsetting. This includes using total clearing areas from the direct construction footprint, construction buffers, potential ancillary areas and utility adjustment works. The impact assessments conducted for the project were conducted in accordance with the relevant guidelines to ensure impacts were accurately estimated.

Principle 10: Offsets must be targeted.

Offsets for the project will be chosen using a number of criteria to ensure biodiversity is offset on a like-for-like or better conservation outcome. Only offsets that meet these criteria will be considered for use as an offset. This ensures that impacts, particularly TECs and key threatened species habitat are offset with areas that have equal or greater conservation status than the area to be impacted.

Principle 11: Offsets must be located appropriately.

All offsets will be located within the NSW North Coast Bioregion to ensure that these offsets have similar characteristics and broad vegetation types of those to be impacted. Where it is not feasible to offset on a like for like basis other vegetation types of a similar conservation value that contain habitat suitable for the impacted threatened species will be considered in consultation with EPA.

The offset strategy will primarily target securing offsets that are linked into broader landscapes.

Principle 12: Offsets must be supplementary.

Offsets chosen will not be already funded or protected under another scheme. Additionally, areas that are already managed for conservation by the government, such as flora reserves, national parks and public open space will not be chosen as offsets. Further any proposed offsets will be additional to what has been paid for under other schemes or programs on a pro rata basis, for

example conservation initiatives on private land.

Principle 13: Offsets and their actions must be enforceable through development consent conditions, licence conditions, conservation agreements or a contract.

Offsets will only be chosen if they are suitable for ongoing management for conservation through an appropriate legal instrument. Additionally, offsets will be audited to ensure that the actions have been carried out, and monitored to determine that the actions are leading to positive biodiversity outcomes. Details of monitoring and auditing will be included in the Biodiversity Offset Package.

5.2.3 NSW Biodiversity Offsets Policy for Major Projects

The NSW biodiversity offsets policy for major projects commenced on 1 October 2014 and is currently in a 12-18 month transitional implementation period. The policy applies to State Significant Development and State Significant Infrastructure and includes a new Framework for Biodiversity Assessment, aligned with the Biobanking Assessment Methodology (BBAM).

The NSW biodiversity offsets policy for major projects is underpinned by six principles; five of the six principles are equivalent or similar to the one or more OEH offset principles for the use of biodiversity offsets in NSW (Table 12). As such, this offset strategy is broadly consistent with the principles of the NSW biodiversity offsets policy for major projects.

Table 12. Comparison of NSW Biodiversity Offset principles to Major Project offset principles

| NSW biodiversity offsets policy for major projects: offset principles | Equivalent or similar OEH offset principles for the use of biodiversity offsets in NSW |
|--|--|
| 1. Before offsets are considered, impacts must first be avoided and unavoidable impacts minimised through mitigation measures. Only then should offsets be considered for the remaining impacts. | Principle 1: Impacts must be avoided first by using prevention and mitigation measures. |
| 2. Offset requirements should be based on a reliable and transparent assessment of losses and gains. | Principle 5: Offsets must be underpinned by sound ecological principles Principle 9: Offsets must be quantifiable – the impacts and benefits must be reliably estimated. |
| 3. Offsets must be targeted to the biodiversity values being lost or to higher conservation priorities. | Principle 10: Offsets must be targeted. Principle 11: Offsets must be located appropriately. |
| 4. Offsets must be additional to other legal requirements. | Principle 2: All regulatory requirements must be met Principle 12: Offsets must be supplementary. |
| 5. Offsets must be enduring, enforceable and auditable. | Principle 7: Offsets must be enduring – they must offset the impact of the development for the period that the impact occurs Principle 13: Offsets and their actions must be enforceable through development consent conditions, licence conditions, conservation agreements or a contract. |

| NSW biodiversity offsets policy for major projects: offset principles | Equivalent or similar OEH offset principles for the use of biodiversity offsets in NSW |
|---|--|
| 6. Supplementary measures can be used in lieu of offsets. | N/A |

5.3 Calculating offset requirements

The offset requirements for the project have been calculated using the following principles:

- Offsets are to be provided on a like-for-like basis
- A minimum offset ratio of 4:1 for all native vegetation cleared by the project
- Offsets for MNES subject to significant impacts from the project will be calculated in accordance with the EPBC Act Offsets Assessment Guide
- Offsets for threatened species will account for species' habitat requirements with reference to whether the species requires ecosystem credits or species credits using assumptions developed as part of the Biobanking Assessment Methodology (BBAM).

5.3.1 Vegetation communities

The MCoAs for the project require offsets to be provided on a like-for-like basis and at a minimum ratio of 4:1 for native vegetation (including salt marsh) impacted by the project, unless a greater ratio is required by the EPBC Offsets Policy and Assessment Guide. Of the 4.55 hectares of rainforest communities subject to direct impacts from the project, 1.9 hectares meets the criteria for critically endangered ecological communities listed under the EPBC Act: Lowland Rainforest of Subtropical Australia (1.88 hectares) and Littoral Rainforest and Vine Thickets of Eastern Australia (0.2 hectares). Impacts to these TECs will require additional offsets under the EPBC Offsets Policy; these are discussed in Section 5.3.3.

The offsets required for native vegetation communities impacted by the project are detailed in Table 13.

Table 13. Impacts and offsets for native vegetation communities

| Vegetation formation (Keith 2004)^ | Biometric Vegetation type | Direct impacts (ha) | Offset required (ha) |
|------------------------------------|---|---------------------|----------------------|
| Dry Sclerophyll Forest | <i>Angophora paludosa</i> shrubby forest and woodland on sandstones or sands of the North Coast | 0.61 | 2.44 |
| Dry Sclerophyll Forest | <i>Angophora robur</i> shrubby forest and woodland on sandstones of the North Coast | 7.39 | 29.56 |
| Dry Sclerophyll Forest | Blackbutt - Bloodwood dry heathy open forest on sandstones of the northern North Coast | 82.4 | 329.6 |
| Dry Sclerophyll Forest | Coast Cypress Pine shrubby open forest of the North Coast Bioregion | 2.04 | 8.16 |
| Dry Sclerophyll Forest | Forest Red Gum grassy open forest of the coastal ranges of the North Coast | 15.07 | 60.28 |

| Vegetation formation (Keith 2004)^ | Biometric Vegetation type | Direct impacts (ha) | Offset required (ha) |
|---|---|----------------------------|-----------------------------|
| Dry Sclerophyll Forest | Grey Gum - Grey Ironbark open forest of the Clarence Lowlands of the North Coast | 62.72 | 250.88 |
| Dry Sclerophyll Forest | Narrow-leaved Ironbark dry open forest of the North Coast | 5.47 | 21.88 |
| Dry Sclerophyll Forest | Needlebark Stringybark - Red Bloodwood heathy woodland on sandstones of the Lower Clarence of the North Coast | 17.13 | 68.52 |
| Dry Sclerophyll Forest | Orange Gum (<i>Eucalyptus bancroftii</i>) open forest of the North Coast | 9.26 | 37.04 |
| Dry Sclerophyll Forest | Scribbly Gum - Needlebark Stringybark heathy open forest of coastal lowlands of the northern North Coast | 69.73 | 278.92 |
| Dry Sclerophyll Forest | Scribbly Gum - Red Bloodwood heathy open forest of the coastal lowlands of the North Coast | 35.17 | 140.68 |
| Dry Sclerophyll Forest | Spotted Gum - Grey Box - Grey Ironbark dry open forest of the Clarence Valley lowlands of the North Coast | 11.34 | 45.36 |
| Dry Sclerophyll Forest | Spotted Gum - Grey Ironbark - Pink Bloodwood open forest of the Clarence Valley lowlands of the North Coast | 143.4 | 573.6 |
| Dry Sclerophyll Forest | Tallowwood dry grassy forest of the far northern ranges of the North Coast | 1.42 | 5.68 |
| Freshwater wetland | Coastal floodplain sedgelands, rushlands, and forblands | 3.84 | 15.36 |
| Grassy Woodland | Forest Red Gum - Swamp Box of the Clarence Valley lowlands of the North Coast | 45.56 | 182.24 |
| Grassy Woodland | Narrow-Leaved Red Gum woodlands of the lowlands of the North Coast | 25.83 | 103.32 |
| Grassy Woodland | Swamp Box swamp forest of the coastal lowlands of the North Coast | 18.02 | 72.08 |
| Heathlands | Coastal heath on sands of the North Coast | 19.93 | 79.72 |
| Rainforest | Black Bean - Weeping Lilly Pilly riparian rainforest of the North Coast | 0.97 | 3.88 |
| Rainforest | Tuckeroo - Riberry - Yellow Tulipwood littoral rainforest of the North Coast | 0.2 | 0.8 |
| Rainforest | White Booyong - Fig Subtropical Rainforest of the North Coast | 2.91 | 11.64 |
| Saline wetland | Mangrove - Grey Mangrove low closed forest of the NSW Coastal Bioregions | 1.26 | 5.04 |
| Swamp Sclerophyll | Paperbark swamp forest of the coastal lowlands of the North Coast | 88.65 | 354.6 |

| Vegetation formation (Keith 2004)^ | Biometric Vegetation type | Direct impacts (ha) | Offset required (ha) |
|---|---|----------------------------|-----------------------------|
| Forest | | | |
| Swamp Sclerophyll Forest | Swamp Mahogany swamp forest of the coastal lowlands of the North Coast | 44.25 | 177 |
| Swamp Sclerophyll Forest | Swamp Oak swamp forest of the coastal lowlands of the North Coast | 39.07 | 156.28 |
| Wet Sclerophyll Forest | Blackbutt - Pink Bloodwood shrubby open forest of the coastal lowlands of the North Coast | 5.38 | 21.52 |
| Wet Sclerophyll Forest | Blackbutt – Tallowwood dry grassy open forest of the central parts North Coast | 0.5 | 2 |
| Wet Sclerophyll Forest | Blackbutt grassy open forest of the Lower Clarence Valley of the North Coast | 21.75 | 87 |
| Wet Sclerophyll Forest | Brush Box Tallowwood shrubby open forest of the northern ranges of the North Coast | 0.55 | 2.2 |
| Wet Sclerophyll Forest | Flooded Gum – Tallowwood - Brush Box moist open forest of the coastal ranges of the North Coast | 7.09 | 28.36 |
| Wet Sclerophyll Forest | Pink Bloodwood -Tallowwood moist open forest of the far northern ranges of the North Coast | 31 | 124 |
| Wet Sclerophyll Forest | Red Mahogany open forest of the coastal lowlands of the North Coast | 37.78 | 151.12 |
| Wet Sclerophyll Forest | Turpentine moist open forest of the coastal hills and ranges of the North Coast | 42.7 | 170.8 |
| Total native vegetation impacts | | 900.39 | 3601.56 |
| Cleared and modified | N/A | 857.29 | |

A total minimum area of 3623.24 hectares of native vegetation will be required to offset the impacts of the project, comprised of:

- 3601.56 hectares of native vegetation providing a 4:1 offset ratio for the total 900.39 hectares of vegetation cleared, minus 8.32 hectares of 4:1 offset for direct impacts to Commonwealth listed TECs.
- 30 hectares of vegetation meeting the criteria for the Commonwealth listed TECs as required to offset these TECs under the EPBC Environmental Offsets Policy (see section 5.3.3 and Appendix C for further detail)

5.3.2 Threatened species

The proposed offset methodology will take into account both the vegetation type and the value of key threatened species habitat when determining appropriate offsets. To assist with this the Biodiversity Offset Package will utilise the EPBC offsets calculator (under the EPBC Offsets Policy, 2012) for significantly impacted MNES species (see Appendix C), and the assumptions developed as part of the Biobanking assessment methodology for threatened species listed under the NSW TSC Act and FM Act impacted by the project.

Under the Biodiversity Banking and Offsets Scheme (or 'Biobanking'), the Biobanking assessment methodology establishes two classes of biodiversity credits that can be used to address the loss of habitat values for threatened species: ecosystem credits and species credits.

Ecosystem credits

Under the Biobanking methodology ecosystem credits can be created or required for all impacts on biodiversity values (including threatened species that can be reliably predicted by habitat surrogates according to the Threatened Species Profile Database (TSPD) (OEH 2015), except the threatened species or populations that require species credits (see below). Threatened species recorded or predicted to occur in the study area where ecosystem credits and therefore habitat surrogates could be used are listed in Table 14.

Table 14. Threatened fauna species recorded or considered likely to occur in the project boundary where habitat surrogates can be reliably used to predict use by threatened species.

| Scientific name | Common name | Confirmed | Associated habitat types in the project boundary |
|---|-----------------------|-------------------------|---|
| Species identified from surveys in the project area that require ecosystem credits | | | |
| Birds | | | |
| <i>Anseranas semipalmata</i> | Magpie Goose | Section 3 | Forested Wetlands, Grassy Woodlands |
| <i>Burhinus grallarius</i> | Bush stone-curlew | Section 2 | Dry Sclerophyll Forests, Wet Sclerophyll Forests, Grassy Woodlands, Forested Wetlands |
| <i>Calyptorhynchus lathami</i> | Glossy Black-cockatoo | Sections 1, 3, 7 and 10 | Dry Sclerophyll Forests, Wet Sclerophyll Forests, Forested Wetlands, Heathlands, Grassy Woodlands |
| <i>Climacteris picumnus</i> | Brown Treecreeper | Sections 2, 6 and 7 | Rainforest, Forested Wetlands, Grassy Woodlands, Dry Sclerophyll Forests, Wet Sclerophyll Forests |
| <i>Daphhoenositta chrysoptera</i> | Varied Sittella | Sections 1-8 | Grassy Woodlands, Dry Sclerophyll Forests, Wet Sclerophyll Forests |
| <i>Grus rubicundus</i> | Brolga | Sections 1-3 | Forested Wetlands, Freshwater Wetlands |

| Scientific name | Common name | Confirmed | Associated habitat types in the project boundary |
|---|---|------------------------|--|
| <i>Melithreptus gularis gularis</i> | Black-chinned Honeyeater (eastern subsp.) | Section 2 | Dry Sclerophyll Forests, Grassy Woodlands |
| <i>Ninox strenua</i> | Powerful Owl | Sections 3, 7 | Rainforest, Forested Wetlands, Grassy Woodlands, Dry Sclerophyll Forests, Wet Sclerophyll Forests |
| <i>Pomatostomus temporalis temporalis</i> | Grey-crowned Babbler (eastern subsp) | Sections 3, 6, 7 and 8 | Rainforest, Forested Wetlands, Grassy Woodlands, Dry Sclerophyll Forests, Wet Sclerophyll Forests |
| <i>Ptilinopus regina</i> | Rose-crowned Fruit Dove | Section 10 | Rainforest, Dry Sclerophyll Forests, Wet Sclerophyll Forests |
| <i>Tyto longimembris</i> | Eastern Grass Owl | Section 9 | Forested Wetlands, Dry Sclerophyll Forests, Heathlands, Grassy Woodlands |
| <i>Tyto novaehollandiae</i> | Masked Owl | Section 11 | Rainforest, Forested Wetlands, Grassy Woodlands, Dry Sclerophyll Forests, Wet Sclerophyll Forests |
| <i>Tyto tenebricosa</i> | Sooty Owl | Section 2 | Rainforest, Forested Wetlands, Wet Sclerophyll Forests, Grassy Woodlands |
| Mammals | | | |
| <i>Chalinolobus nigrogriseus</i> | Hoary Wattled Bat | Sections 1-3 and 6-8 | Forested Wetlands, Grassy Woodlands, Dry Sclerophyll Forests, Wet Sclerophyll Forests, Heathlands |
| <i>Falsistrellus tasmaniensis</i> | Eastern False Pipistrelle | Sections 1-3 | Rainforests, Forested Wetlands, Grassy Woodlands, Dry Sclerophyll Forests, Wet Sclerophyll Forests, Heathlands, Freshwater Wetlands |
| <i>Kerivoula papuensis</i> | Golden-tipped Bat | Sections 9-11 | Rainforests, Forested Wetlands, Grassy Woodlands, Dry Sclerophyll Forests, Wet Sclerophyll Forests |
| <i>Mormopterus norfolkensis</i> | Eastern Freetail-Bat | Sections 6-11 | Rainforests, Forested Wetlands, Grassy Woodlands, Dry Sclerophyll Forests, Wet Sclerophyll Forests, Heathlands, Freshwater Wetlands, Saline Wetlands |
| <i>Petaurus australis</i> | Yellow-bellied Glider | Section 2 | Forested Wetlands, Grassy Woodlands, Dry Sclerophyll Forests, Wet Sclerophyll Forests |

| Scientific name | Common name | Confirmed | Associated habitat types in the project boundary |
|--|--------------------------------|----------------------------|--|
| <i>Petaurus norfolcensis</i> | Squirrel Glider | Sections 1-11 | Forested Wetlands, Grassy Woodlands, Dry Sclerophyll Forests, Wet Sclerophyll Forests, Heathlands |
| <i>Phascolarctos cinereus</i> | Koala | Sections 1, 3, 5, 7, 9, 10 | Rainforest, Forested Wetlands, Grassy Woodlands, Dry Sclerophyll Forests, Wet Sclerophyll Forests |
| <i>Potorous tridactylus tridactylus</i> | Long-nosed Potoroo | Sections 6-11 | Rainforests, Forested Wetlands, Grassy Woodlands, Dry Sclerophyll Forests, Wet Sclerophyll Forests, Heathlands, Freshwater Wetlands |
| <i>Saccolaimus flaviventris</i> | Yellow-bellied Sheath-tail Bat | Sections 9-11 | Rainforests, Forested Wetlands, Grassy Woodlands, Dry Sclerophyll Forests, Wet Sclerophyll Forests, Heathlands, Freshwater Wetlands, Saline Wetlands |
| <i>Scoteanax rueppellii</i> | Greater Broad-nosed Bat | Sections 9-11 | Rainforests, Forested Wetlands, Grassy Woodlands, Dry Sclerophyll Forests, Wet Sclerophyll Forests, Freshwater Wetlands, Saline Wetlands |
| <i>Syconycteris australis</i> | Common Blossom-Bat | Sections 8-11 | Rainforests, Forested Wetlands, Dry Sclerophyll Forests, Wet Sclerophyll Forests, Heathlands, Freshwater Wetlands |
| Reptiles | | | |
| <i>Hoplocephalus stephensii</i> | Stephens' banded snake | Section 3 | Rainforests, Forested Wetlands, Grassy Woodlands, Wet Sclerophyll Forests |
| Species considered likely to occur in project area that require ecosystem credits | | | |
| <i>Anthochaera phrygia</i> | Regent Honeyeater | Sections 1-11 | Wet Sclerophyll Forests, Forested Wetlands, Dry Sclerophyll Forests, Grassy Woodlands |
| <i>Coracina lineata</i> | Barred Cuckoo-shrike | Sections 1-2 and 6-11 | Rainforests, Forested Wetlands, Grassy Woodlands, Dry Sclerophyll Forests, Wet Sclerophyll Forests |
| <i>Glossopsitta pusilla</i> | Little Lorikeet | Sections 1-11 | Wet Sclerophyll Forests, Forested Wetlands, Dry Sclerophyll Forests, Grassy Woodlands |

| Scientific name | Common name | Confirmed | Associated habitat types in the project boundary |
|---|--------------------------|--------------------|---|
| <i>Hieraaetus morphnoides</i> | Little Eagle | Sections 1-11 | Wet Sclerophyll Forests, Forested Wetlands, Dry Sclerophyll Forests, Grassy Woodlands, Heathlands, Saline Wetlands, Freshwater Wetlands |
| <i>Lathamus discolor</i> | Swift Parrot | Sections 1-11 | Wet Sclerophyll Forests, Forested Wetlands, Dry Sclerophyll Forests, Grassy Woodlands |
| <i>Lophoictinia isura</i> | Square-tailed Kite | Sections 1-11 | Wet Sclerophyll Forests, Forested Wetlands, Dry Sclerophyll Forests, Grassy Woodlands |
| <i>Ninox connivens</i> | Barking Owl | Sections 1-11 | Rainforests, Wet Sclerophyll Forests, Forested Wetlands, Dry Sclerophyll Forests, Heathlands, Grassy Woodlands |
| <i>Ptilinopus magnificus</i> | Wompoo Fruit-dove | Sections 1-2, 6-11 | Rainforests, Wet Sclerophyll Forests |
| <i>Ptilinopus superbus</i> | Superb Fruit Dove | Sections 1-2, 8-11 | Rainforests, Wet Sclerophyll Forests, Forested Wetlands, Grassy Woodlands |
| <i>Rostratula australis</i> | Australian Painted Snipe | Sections 1-11 | Forested Wetlands |
| <i>Stictonetta naevosa</i> | Freckled Duck | Sections 3-5 | Grassy Woodlands, Forested Wetlands |
| | | | |
| Mammals | | | |
| <i>Cercartetus nanus</i> | Eastern Pygmy-Possum | Sections 1-11 | Rainforests, Forested Wetlands, Grassy Woodlands, Dry Sclerophyll Forests, Wet Sclerophyll Forests, Heathlands, Freshwater Wetlands |
| <i>Dasyurus maculatus maculatus</i> (SE population) | Spotted-tailed Quoll | Sections 1-11 | Rainforest, Dry Sclerophyll Forests, Wet Sclerophyll Forests, Forested Wetlands, Grassy Woodlands, Heathlands, Saline Wetlands, Freshwater Wetlands |
| <i>Mormopterus beccarii</i> | Beccari's Freetail-Bat | Sections 1-11 | Rainforests, Wet Sclerophyll Forests, Dry Sclerophyll Forests, Heathlands, Grassy Woodlands, Forested Wetlands |

Species credits

Under the Biobanking methodology, species credits can be created or required for impacts on threatened species that cannot be reliably predicted to use an area of land based on habitat

surrogates. A total of 23 threatened fauna species (TSC Act and EPBC Act) were identified as requiring species credits. Twenty of these have habitat constraints specified under the Biobanking tab of the Threatened Species database (OEH 2015). Refer to Table 15 below.

Table 15. Threatened fauna species recorded or considered likely to occur in the project boundary that require species credits

| Scientific name | Common name | Project sections | Associated habitat types project boundary | Habitat constraints as specified in the TSPD |
|---|------------------------|------------------|---|---|
| SPECIES RECORDED IN PROJECT AREA | | | | |
| Birds | | | | |
| <i>Botaurus poiciloptilus</i> | Australasian Bittern* | Section 3 | Forested Wetlands, Grassy Woodlands, Saline Wetlands, Freshwater Wetlands | Land containing brackish or freshwater wetlands |
| <i>Ephippiorhynchus asiaticus</i> | Black-necked Stork | Sections 1-5 | Forested Wetlands, Grassy Woodlands, Saline Wetlands, Freshwater Wetlands | Shallow, open freshwater terrestrial or saline wetlands (or shallow edges of deeper wetlands) and estuarine habitats with abundant prey. Usually nest in isolated, live, paddock trees in NSW, within or near foraging habitat. Territories large (~9,000ha). |
| <i>Dromaius novaehollandiae</i> | Coastal Emu Population | Sections 3-4 | Dry Sclerophyll Forests, Forested Wetlands, Grassy Woodlands, Freshwater Wetlands | Not specified |
| <i>Lichenostomus fasciocularis</i> | Mangrove Honeyeater | Section 10 | Forested Wetlands, Saline Wetlands, Freshwater Wetlands | Mangrove vegetation associations of coasts, estuaries and offshore islands |

| Scientific name | Common name | Project sections | Associated habitat types project boundary | Habitat constraints as specified in the TSPD |
|------------------------------|-------------------------|---------------------------|---|--|
| <i>Pandion haliaetus</i> | Eastern Osprey | Sections 1-11 | Rainforest, Dry Sclerophyll Forests, Wet Sclerophyll Forests, Forested Wetlands, Grassy Woodlands, Heathlands, Saline Wetlands, Freshwater Wetlands | Land within 40 m of fresh/ brackish/saline waters of larger rivers or creeks; estuaries, coastal lagoons, lakes and/or inshore marine waters |
| Mammals | | | | |
| <i>Aepyprymnus rufescens</i> | Rufous Bettong | Sections 1-3 | Rainforest, Dry Sclerophyll Forests, Wet Sclerophyll Forests, Forested Wetlands, Grassy Woodlands, | A variety of habitats from coastal eucalypt forests, through tall wet sclerophyll and rainforests to dry open forests and woodlands |
| <i>Phascogale tapoatafa</i> | Brush-tailed Phascogale | Sections 2, 4, 6, 7 and 8 | Dry Sclerophyll Forests, Wet Sclerophyll Forests, Forested Wetlands, Grassy Woodlands, Freshwater Wetlands | Not specified |
| <i>Planigale maculata</i> | Common Planigale | Sections 1-2 | Rainforest, Dry Sclerophyll Forests, Wet Sclerophyll Forests, Forested Wetlands, Grassy Woodlands, Heathlands, Freshwater Wetlands | Not specified |
| Amphibians | | | | |
| <i>Crinia tinnula</i> | Wallum Froglet | Sections 1,2 and 6-11 | Freshwater Wetlands, Forested Wetlands | Land within 40 m of coastal swamps and wet heaths. |

| Scientific name | Common name | Project sections | Associated habitat types project boundary | Habitat constraints as specified in the TSPD |
|--|---------------------------------|--------------------|---|--|
| <i>Litoria brevipalmata</i> | Green-thighed Frog | Sections 1 and 6-8 | Rainforest, Dry Sclerophyll Forests, Wet Sclerophyll Forests, Forested Wetlands, Grassy Woodlands, Heathlands, Saline Wetlands, Freshwater Wetlands | Land within 300 m of semi-permanent or ephemeral ponds or depressions containing leaf litter |
| <i>Litoria olongburensis</i> | Wallum Sedge Frog | Sections 1-11 | Forested Wetlands, Freshwater Wetlands | Land within 40m of wallum swamps. |
| <i>Mixophyes iteratus</i> | Giant Barred Frog* | Section 1 | Rainforest, Wet Sclerophyll Forests, Forested Wetlands, Grassy Woodlands | Permanent freshwater coastal streams with pools and riffles and about 20m of adjacent forest. Generally moist riparian vegetation (e.g. rainforest or wet sclerophyll), although sometimes drier forest or degraded riparian remnants. |
| Invertebrates | | | | |
| <i>Phyllodes imperialis southern subsp.</i> | Pink Underwing Moth* | Section 10 | Rainforest | Land within 40 m of rainforest containing <i>Carronia multiseppalea</i> |
| <i>Nurus atlas</i> | Atlas Rainforest Ground Beetle* | Section 10 | Rainforest, Wet Sclerophyll Forests | Land within 40 m of low elevation rainforest/wet eucalypt forest with rainforest understorey containing leaf litter or fallen timber |
| SPECIES CONSIDERED LIKELY TO OCCUR IN PROJECT AREA | | | | |
| Birds | | | | |

| Scientific name | Common name | Project sections | Associated habitat types project boundary | Habitat constraints as specified in the TSPD |
|---------------------------------------|--------------------------------|----------------------|--|--|
| <i>Amauornis moluccana</i> | Pale-vented Bush Hen | Sections 9-10 | Rainforests, Forested Wetlands, Wet Sclerophyll Forests, Freshwater Wetlands, Saline Wetlands | Dense vegetation 2-4 m tall, within 300 m of, or in shallows of, streams or other natural or artificial wetlands. |
| <i>Cyclopsitta diophthalma coxeni</i> | Double-Eyed Fig-Parrot* | Sections 9-11 | Rainforests, Wet Sclerophyll Forests | Rainforests with fig or other fleshy-fruited trees |
| <i>Erythrotriorchis radiatus</i> | Red Goshawk* | Sections 1-11 | Forested Wetlands, Grassy Woodlands, Dry Sclerophyll Forests, Wet Sclerophyll Forests, Freshwater Wetlands | Tall trees in forest or woodland, within 1 km of permanent water |
| <i>Irediparra gallinacea</i> | Comb-Crested Jacana | Sections 3-9 | Freshwater Wetlands, Forested Wetlands | Permanent freshwater wetlands, slow-moving or still, with a good surface cover of floating aquatic vegetation, or fringing vegetation. |
| <i>Ixobrychus flavicollis</i> | Black Bittern | Sections 1-3, 6-7, 9 | Forested Wetlands, Grassy Woodlands, Saline Wetlands, Freshwater Wetlands | land within 40 m of freshwater and estuarine wetlands, in areas of permanent water and dense vegetation or emergent aquatic vegetation |
| <i>Pezoporus wallicus wallicus</i> | Ground Parrot (eastern subsp.) | Sections 8-10 | Freshwater Wetlands, Forested Wetlands | land within 40 m of dense multi-layered coastal heath with patches that have been unburnt for 3 years or more |
| Mammals | | | | |

| Scientific name | Common name | Project sections | Associated habitat types project boundary | Habitat constraints as specified in the TSPD |
|----------------------------------|-----------------------|-------------------|---|---|
| <i>Chalinolobus dwyeri</i> | Large-eared Pied Bat* | Sections 1-7 | Rainforest, Dry Sclerophyll Forests, Wet Sclerophyll Forests, Forested Wetlands, Grassy Woodlands, Saline Wetlands, Freshwater Wetlands | land containing escarpments, cliffs, caves, deep crevices, old mine shafts or tunnels |
| Reptiles | | | | |
| <i>Hoplocephalus bitorquatus</i> | Pale-headed Snake | Sections 1-3, 6-8 | Rainforest, Dry Sclerophyll Forests, Wet Sclerophyll Forests, Forested Wetlands, Grassy Woodlands, Heathlands | land containing hollow-bearing trees, loose bark and/or fallen timber |
| Invertebrates | | | | |
| <i>Petalura litorea</i> | Coastal Petaltail | Sections 7-10 | Forested Wetlands, Grassy Woodlands, Freshwater Wetlands | Permanent to semi-permanent coastal freshwater wetlands |

* Listed Matter of National Environmental Significance (EPBC Act)

No habitat requirements are defined in the Threatened Species Characteristics by CMA database (TSCCD) for the Brush-tailed Phascogale, Common Planigale, or the Coastal Emu Population. Habitat requirements for these species are specified in the Threatened Species Profile Database (TSPD) (OEH 2015). These are provided below in Table 16.

Table 16. Threatened fauna habitat requirements specified in the TSPD (OEH 2015) for species with no habitat constraints defined

| Scientific name | Common name | Habitat requirements as specified in Threatened Species Profiles (OEH 2015) |
|-----------------------------|-------------------------|--|
| Mammals | | |
| <i>Phascogale tapoatafa</i> | Brush-tailed Phascogale | Preferred habitat is dry open forest with a sparse open understorey, however, has been located in heath, swamps and rainforest and wet sclerophyll forest. Breeding habitat for this species is 'tree hollows, logs or stumps with entrances > 2.5 cm wide' (OEH 2015) |
| <i>Planigale maculata</i> | Common Planigale | Inhabit rainforest, eucalypt forest, heathland, marshland, grassland and rocky areas where there is surface cover, and usually close to water. Breeding and shelter habitat is specified in the TSPD as hollow logs, under bark, rocks, cracks in |

| Scientific name | Common name | Habitat requirements as specified in Threatened Species Profiles (OEH 2015) |
|---------------------------------|------------------------|---|
| | | soil, grass tussocks or building debris. |
| Birds | | |
| <i>Dromaius novaehollandiae</i> | Coastal Emu Population | On the NSW north coast, Emus occur in a range of predominantly open lowland habitats, including grasslands, heathland, shrubland, open and shrubby woodlands, forest, and swamp and sedgeland communities, as well as the ecotones between these habitats. They also occur in plantations of tea-tree and open farmland, and occasionally in littoral rainforest. Eggs are laid on a platform of grass, twigs, leaves and bark on the ground, often at the base of some vegetation and with good views from the nest. Incubation and all parental care is by the male. |

Based on the habitat requirements for the 23 threatened species requiring species credits that occur or are predicted to occur within the study area, the proposed offset should contain the habitat types specified in Table 14 and Table 15. Expert opinion from a suitably qualified ecologist will be sought to determine whether the proposed offset land is suitable for threatened fauna species that can't be offset using vegetation type alone.

For six bat species recorded in the study area, there is no specification in the TSPD for whether they require ecosystem or species credits, as particular habitat elements, such as breeding habitat of cave-roosting bats, may require species credits whereas foraging habitat may be offset with ecosystem credits. Given that the study area represents foraging habitat only for most of these species (with the exception of the Eastern Long-eared Bat and Grey-headed Flying-fox), it is likely that the habitat within the study area for these species can be offset by vegetation type. These five species and their associated breeding/sheltering habitat are outlined in Table 17. The six species are associated with, or predicted to be associated with dry sclerophyll forests, wet sclerophyll forests, and swamp sclerophyll forests within the study area.

Table 17. Threatened fauna recorded in the project boundary for which no credit type is defined

| Scientific name | Common name | Project sections | Associated vegetation formations in the project boundary | Breeding/shelter habitat and/or habitat constraints as defined in the TSPD |
|-------------------------------|-------------------------|------------------|---|---|
| <i>Pteropus poliocephalus</i> | Grey-headed Flying-Fox* | Sections 1-11 | Rainforest, Dry Sclerophyll Forests, Wet Sclerophyll Forests, Forested Wetlands, Grassy Woodlands, Heathlands, Saline Wetlands, Freshwater Wetlands | land within 40 m of rainforest, coastal scrub, riparian or estuarine communities Canopy trees associated with rainforest, or coastal scrub or riparian or estuarine communities and with sufficient forage resources available |

| Scientific name | Common name | Project sections | Associated vegetation formations in the project boundary | Breeding/shelter habitat and/or habitat constraints as defined in the TSPD |
|--|------------------------|-----------------------|---|--|
| | | | | within 40 km |
| <i>Miniopterus australis</i> | Little Bent-wing Bat | Sections 1-11 | Rainforest, Dry Sclerophyll Forests, Wet Sclerophyll Forests, Forested Wetlands, Grassy Woodlands, Saline Wetlands, Freshwater Wetlands | Caves, often limestone; abandoned mines, tunnels, stormwater drains, tree hollows, buildings or bridges. |
| <i>Miniopterus schreibersii oceanensis</i> | Eastern Bent-wing Bat | Sections 1-2 and 6-11 | Rainforest, Dry Sclerophyll Forests, Wet Sclerophyll Forests, Forested Wetlands, Grassy Woodlands, Saline Wetlands, Freshwater Wetlands | Land containing caves or similar structures |
| <i>Myotis macropus</i> | Southern Myotis | Sections 1-2 and 6-11 | Rainforest, Dry Sclerophyll Forests, Wet Sclerophyll Forests, Forested Wetlands, Grassy Woodlands, Heathlands, Saline Wetlands, Freshwater Wetlands | Hollow-bearing trees, bridges, caves or artificial structures within 200 m of riparian zone |
| <i>Nyctophilus bifax</i> | Eastern Long-eared Bat | Sections 6-11 | Wet Sclerophyll Forests, Forested Wetlands, Rainforest | Rainforest, dense foliage. Maternity colonies known to roost in tree hollows. Roosts in dense tree foliage, in tree hollows, under bark, in epiphytes. Requires a range of roost sites for survival. Roosts edge of rainforest remnants in winter, centre of rainforest in summer. |

| Scientific name | Common name | Project sections | Associated vegetation formations in the project boundary | Breeding/shelter habitat and/or habitat constraints as defined in the TSPD |
|------------------------------|------------------|------------------|---|--|
| <i>Vespadelus troughtoni</i> | Eastern Cave Bat | Sections 6-11 | Rainforest, Dry Sclerophyll Forests, Wet Sclerophyll Forests, Grassy Woodlands, | Land within 5 km of cliffs, caves, mines or tunnels. |

Mitigation measures proposed for the six bat species include: pre-clearing surveys, fauna rescue protocol, avoidance of hollow-bearing trees where possible, and the inspection of large pipes beneath the existing highway prior to removal.

5.3.3 Calculation of offset requirements under the EPBC Act

Offset calculations have been prepared for the MNES subject to residual significant impacts from the project, based on the guidance provided in the EPBC Offset assessments guide. These calculations have been undertaken to provide guidance on the indicative offset areas required to achieve a 100% of the required offset for the project. The calculations, including values and rationale for the offsets, were initially based on the preliminary calculations provided in the Supplementary Biodiversity Assessment (Attachment J of the Submissions/ Preferred Infrastructure Report), and have been revised and updated following further detailed information from threatened species surveys and habitat quality mapping undertaken in 2014. The approximate offset area required for each MNES is based on calculations using the minimum values for offset start habitat quality, and these areas may be revised depending on the habitat quality values of the available offset sites.

A detailed description of the methodology used to determine habitat quality scores and the values entered in the EPBC offsets assessment guide for each species is included in Appendix C. The extent of offsets required for each MNES are summarised below in Table 18.

Table 18. Potential impacts on MNES and indicative offset requirements

| Protected matter | Status EPBC Act | Project impacts | Approximate offset required |
|--|-----------------------|--|-----------------------------|
| Threatened ecological communities | | | |
| Lowland Rainforest of Subtropical Australia | Critically Endangered | 3.25 ha (1.88 ha direct impacts and 1.37 ha indirect impacts) | 26.6 ha |
| Littoral Rainforest and Coastal Vine Thickets of Eastern Australia | Critically Endangered | 0.46 ha (0.2 ha direct impacts and 0.26 indirect impacts) | 3.4 ha |
| Threatened flora | | | |
| <i>Acronychia littoralis</i> Scented Acronychia | Endangered | N/A | N/A |

| Protected matter | Status EPBC Act | Project impacts | Approximate offset required |
|--|-----------------|--|--|
| <i>Angophora robur</i> Sandstone Rough Barked Apple | Vulnerable | 91.68 ha | 410 ha |
| <i>Arthraxon hispidus</i> Hairy Joint-grass | Vulnerable | 3.11 ha | 8.9 ha |
| <i>Cryptocarya foetida</i> Stinking Cryptocarya | Vulnerable | 48 individuals | 70 individuals + 51 individuals planted / translocated |
| <i>Endiandra hayesii</i> Rusty Rose Walnut | Vulnerable | N/A | N/A |
| <i>Eucalyptus tetrapleura</i> Square-fruited Ironbark | Vulnerable | 20.97 ha | 128.98 ha |
| <i>Macadamia tetraphylla</i> Rough-shelled Bush Nut | Vulnerable | 15 individuals | 90 individuals + 9 individuals planted / translocated |
| <i>Prostanthera cineolifera</i> Singleton Mint Bush | Vulnerable | 0.42 ha | 2.2 ha |
| <i>Quassia</i> sp. 'Moonee Creek Moonee Quassia | Endangered | 210 stems (73 directly impacted and 137 indirectly impacted) | 817 stems + 215 stems to be planted / translocated |
| Threatened fauna species | | | |
| Spotted-tailed Quoll <i>Dasyurus maculatus maculatus</i> (SE population) | Endangered | 795.8 ha | 2059 ha |
| Swift Parrot <i>Lathamus discolor</i> | Endangered | 773.24 ha | 1760.5 ha |
| Giant Barred Frog <i>Mixophyes iteratus</i> | Endangered | 4.91 ha | 18.5 ha |
| Oxleyan Pygmy Perch <i>Nannoperca oxleyana</i> | Endangered | 8.68 ha | 15.77 ha |
| Koala <i>Phascolarctos cinereus</i> | Vulnerable | 884.73 ha | 2136.8 ha |
| Pink Underwing Moth <i>Phyllodes imperialis</i> | Endangered | 2.61 ha | 9.05 ha |
| Regent Honeyeater <i>Anthochaera phrygia</i> | Endangered | 722.73 ha | 1594 ha |
| Long-nosed Potoroo <i>Potorous tridactylus tridactylus</i> | Vulnerable | 49.32 ha | 137 ha |
| Grey-headed Flying-fox <i>Pteropus poliocephalus</i> | Vulnerable | 845.91 ha | 2000.5 ha |
| Wallum Sedge Frog <i>Litoria olongburensis</i> | Vulnerable | 12.73 ha | 43.4 ha |

5.4 Decision making framework

In accordance with the Roads and Maritime Pacific Highway Upgrade Biodiversity Offset Principles (2013) the following steps and decision making framework will be followed in order to ensure that the process in obtaining biodiversity offsets meets the objectives of being transparent and justifiable on environmental, social and economic grounds.

Step 1 - Identification of project impacts

Roads and Maritime has undertaken environmental assessment of the Woolgoolga to Ballina project impacts and determined the level of impact to vegetation communities and habitat as a result of the project. These impacts are detailed in Section 3. Appendix C details habitat quality scores for the input into the EPBC offsets calculator

Step 2 - Investigation into direct biodiversity offsets

Roads and Maritime has undertaken a number of actions to target potential offset lands that meet the following criteria for the Woolgoolga to Ballina project:

- Properties located within 30 km radius of the project extending to 100 km with the agreement of the Department of Planning and EPA (and DoE) where it can be demonstrated that a suitable offset could not be found
- Offset land will contain vegetation communities as detailed in Section 3
- Land will be assessed as to its suitability as habitat for the threatened species impacted by the project (including patch sizes) based on OEH and DoE threatened species profiles databases
- Offset land will comprise land that enables connectivity between adjacent areas of vegetation, where possible
- Offset land must be suitable for ongoing management for conservation through an appropriate legal instrument.

The status of these Stage 1 and 2 investigations is detailed in Section 6. Investigations are ongoing to target suitable offset lands for the project and to secure offset properties which will be detailed in the Biodiversity Offset Package required under NSW and Commonwealth conditions of approval. The first priority is to secure direct land offsets. Roads and Maritime released a public expression of interest to assist in identifying and prioritising available lands for potential future offsets.

Step 3 - Assessment using EPBC Act Offsets Guide

Roads and Maritime has conducted EPBC offset calculator assessments for the Woolgoolga to Ballina upgrade based on the impacts to the MNES identified in Table 8 of this report. In order to provide suitable offset measures to address these identified impacts from the assessment calculator, Roads and Maritime will use potential offset properties from a number of different scenarios:

1. Properties Roads and Maritime currently owns or has commenced acquisition discussions with the landowners
2. Private properties where landowners have previously contacted Roads and Maritime about suitability of their properties for offsets
3. Applications received from a public Expression of Interest.

4. Review of the NSW BioBanking Register to identify any credits issued for species and communities that require offsetting

Once potentially suitable sites have been located, they will be assessed for biodiversity value by qualified ecologists and then inputted into the EPBC offset calculator to determine how they meet the offset requirements for the project and whether additional offsets are required to meet NSW conditions of approval requirements. Refer to Section 6 for further details on these investigations into potential offset properties. Sites identified as being suitable will be submitted to DoE and DP&E for approval, following consultation with EPA and DPI (Fisheries), to be secured in-perpetuity and included in the Biodiversity Offset Package.

Step 4 - Identification of other biodiversity offset measures

In addition to identifying suitable biodiversity offset locations, Roads and Maritime will investigate other potential offset measures that can lead to benefits to the relevant protected matter. The EPBC Offsets Policy (2012) defines Other Compensatory Measures as:

those actions that do not directly offset the impacts on the protected matter, but are anticipated to lead to benefits for the impacted protected matter, for example funding for research or educational programs.

Roads and Maritime will review any potential other compensatory offset measures against the requirements detailed in Appendix A of the EPBC Offsets Policy (2012) to determine their suitability. This review will be undertaken in consultation with DoE to determine the suitability of the measures proposed.

Step 5 – Seek Approval of the Biodiversity Offset Package

Approved offset sites that have been secured in-perpetuity will be detailed in the Biodiversity Offset Package. The Offset Package will be submitted to DoE and DP&E for approval following consultation with EPA and DPI (Fisheries).

Step 6 – Implementation

Following approval of the Biodiversity Offset Package, Roads and Maritime will implement the Biodiversity Offset Package. All the potential offset mechanisms available (refer Section 7) require the managing agency (NPWS, OEH, FCNSW or NCT) to undertake and/or oversee the management and monitoring requirements for the approved offset properties.

6 Biodiversity offset investigations

6.1 Status of investigations into potential offset properties

Roads and Maritime has commenced investigations into suitable biodiversity offset properties and measures for the Woolgoolga to Ballina upgrade using potential offset properties from three different scenarios:

1. Roads and Maritime owned lands
2. Private properties (includes properties Roads and Maritime has commenced acquisition discussions with the landowners or where landowners have previously contacted Roads and Maritime about suitability of their properties for offsets)
3. Review of the NSW BioBanking Register to identify any credits issued for species and communities that require offsetting.

The extent of potential compensatory habitat in the region was assessed at EIS stage. The regional vegetation mapping data was reviewed to determine the availability of unreserved land within 30 kilometres and 100 kilometres of the project alignment supporting communities affected by the project. Land under private tenure was assumed to be theoretically available to be considered as part of any offset package. It was found that there are substantial tracts of land potentially available for consideration in a biodiversity offset package, although areas greater than 30 kilometres from alignment are likely to be needed to fulfil some or all of the biodiversity offset obligations.

Stage 1 and 2 of the offset program has identified and assessed more than 2,500 hectares as being suitable offset land. These properties are included in the Update 2 Threatened Biodiversity Offset Status Report. In June and July 2015, Roads and Maritime released a public Expression of Interest to seek additional landowners interested in participating in the Biodiversity Offset Program. More than 8,500 hectares of additional land has been identified through this process and will be assessed against the current shortfalls in vegetation communities and species habitat. If a shortfall in a species habitat or vegetation community remains after this assessment, a further targeted expression of interest will be released in early 2016.

6.2 Potential offset sites

Consideration of potential offset sites has been ongoing during the EIS and property acquisition phases as opportunities arise. Correspondence from the Department of the Environment during the project development suggested priority for identifying suitable offsets should initially target MNES that are cryptic, less mobile or more threatened. This has been reflected in the Commonwealth and NSW conditions of approval (D4) that require details of offset sets prior to commencement of construction work that will result in the disturbance of habitat relevant to the following areas/species:

- Koala populations in Coolgardie/Bagotville, Broadwater and Woombah/Iluka
- *Quassia* sp. 'Moonee Creek' – Moonee Quassia (endangered)
- *Angophora robur* – Sandstone Rough-Barked Apple (vulnerable)
- *Prostanthera cineolifera* – Singleton Mint Bush - (vulnerable)
- Lowland Rainforest of Subtropical Australia (critically endangered).

Jacobs (2015) has prepared the Update 2 Threatened Biodiversity Offset Status Report to partly address MCoA D4. The Update 2 report identifies 18 properties as potential offset sites, with all being located within 30 km of the project. Detailed site surveys were conducted on each property, and site reports prepared for each property detailing their suitability for meeting the offset requirements of the project. Field survey activities were focused on identifying, quantifying and mapping the extent and quality of high priority MNES on the potential offset sites.

Detailed surveys have been conducted to document the full quantum of offsets required for all MNES and State listed threatened species; these include:

- Targeted surveys for threatened flora and fauna species
- Detailed mapping of threatened ecological communities and threatened species habitat
- Biometric vegetation types and condition assessment
- Fauna habitat assessment
- Existing threatening processes
- Management considerations to be incorporated into a property management plan for each site.

Detailed conservation area configuration maps and management action work plans are provided for 6 of these properties to demonstrate that more than 100% of the offset requirements for priority MNES impacted by Sections 1 and 2 and soft soil works (Moonee Quassia and Sandstone Rough-barked Apple) have been met.

In addition, the results of site surveys and offset calculations using the EPBC Offsets Assessment Guide indicated that the remaining potential offset areas investigated by Roads and Maritime will adequately meet 100 per cent or greater of the offset requirements for the remaining high priority MNES impacted by the project and discussed in Condition D4 of the MCoA, with the exception of the Broadwater koala population. Roads and Maritime are actively seeking offset properties in this area to address this shortfall. These remaining properties will be the focus of the Update 3 Threatened Biodiversity Offset Status Report.

Additional surveys including further mapping of habitats and targeted seasonal surveys for some cryptic or seasonally dependent MNES such as Giant Barred Frog and Hairy Joint Grass in potential offset areas may increase the range and quantum of threatened species within the properties.

Many of the potential offset properties investigated have not been formally acquired and further work is required by Roads and Maritime to negotiate the total offset area and the conservation mechanism to be formalised for each property. Suitable properties will be submitted for approval prior to being secured in-perpetuity and included in the Biodiversity Offset Package prepared for the project.

7 Implementation of offsets

Within 24 months of the approval of this strategy, Roads and Maritime will submit a Biodiversity Offset Package to the Department of Planning and Environment and Department of the Environment. The package shall be prepared in consultation with EPA and DoE and will include details of the final suite of measures selected and secured in accordance with this strategy. The package will identify a timeline and responsibilities for the implementation of the package and the detail of measures, including arrangements for ongoing management of offset lands, to be undertaken.

7.1 Offset protection mechanisms

Four mechanisms are available to Roads and Maritime to ensure in-perpetuity protection for offset sites:

1. Biobanking Agreements under the Threatened Species Conservation Act 1995.
2. By agreement with Forestry Corporation of NSW to provide in-perpetuity protection for State Forest lands by including the offset site in a Conservation Forestry Management Zone 1 (Flora Reserve) under the Forestry Act 2012.
3. Purchasing land for transfer to the National Parks estate that would be managed in perpetuity by the NSW National Parks and Wildlife Service, according to a specific Plan of Management.
4. Placing an in-perpetuity Trust Agreement with the Nature Conservation Trust of NSW on the title of offset sites. This can be done on Roads and Maritime owned properties or by agreement with private landowners.

Further detail on all of the proposed mechanisms is provided below.

The selection of the protection mechanism will be on a site by site basis and will include:

1. Discussions with NPWS or FCNSW to gauge their interest and commitment to manage the land in line with the specified management actions.
2. An initial assessment by Roads and Maritime regarding the suitability of the site for a private conservation agreement.
3. Detailed discussions with providers of conservation agreements (OEH, NCT) regarding the suitability of the potential site as a in-perpetuity conservation area.

7.1.1 BioBanking Agreements

The NSW Government established BioBanking under Part 7A of the Threatened Species Conservation Act 1995. The Threatened Species Conservation (Biodiversity Banking) Regulation 2008 and the BioBanking Assessment Methodology complete the legal framework that provides for the creation of biodiversity credits that can be sold on the open market.

Credits are created when a landowner enters into a biobanking agreement to maintain or

improve their land's biodiversity values by undertaking management actions. The land is then known as a biobank site. The agreement is attached to the land title and includes provisions that require current and future landowners to:

- carry out management actions to improve biodiversity values on the site;
- not undertake activities that would reduce the biodiversity values of the site.

When a landowner sells their credits, a specified minimum amount from the sale proceeds (a portion or all of the Total Fund Deposit) is paid into the BioBanking Trust Fund. Annual payments are then made to the landowner from the fund. This endowment runs with the land in perpetuity to benefit current and future owners.

Roads and Maritime can enter into a BioBanking Agreement in two ways:

1. As the landholder, Roads and Maritime can initiate a BioBanking Agreement with the Office of Environment and Heritage (OEH), retire 100% of the credits generated on the property and deposit all of the Total Fund Deposit required into the BioBanking Trust Fund prior to on-selling the property to a third party with the BioBanking Agreement in place.
2. As a purchaser of credits from private landholders, Roads and Maritime can purchase and retire up to 100% of the credits from a property by depositing the required Total Fund Deposit into the BioBanking Trust Fund.

Credits retired would then be translated back into hectares of vegetation communities and species habitat protected to enable Roads and Maritime to demonstrate our compliance with the State and Commonwealth approval conditions that apply to this project and the EPBC Act Offset Policy and Assessment Guide.

OEH assume responsibility for monitoring, compliance and enforcement of all BioBanking Agreements as outlined in the BioBanking Compliance Assurance Strategy (DECC, 2008). OEH monitor compliance through annual reports submitted by owners of biobank sites, inspections and compliance audits. OEH has a range of enforcement responses at its disposal, applied on a risk basis. These include:

- Requests for remedial action, warning letters and inspections;
- Withholding annual payments from the BioBanking Trust Fund if management actions have not been carried out;
- Directing the owner of a biobank site to carry out work at their own cost to rectify a breach of a biobanking agreement;
- Allowing OEH to enter the land to carry out necessary work where the owner has failed to comply with a Ministerial direction;
- Allowing OEH to seek an award of damages against the owner of a biobank site for breaching a biobanking agreement; and
- Applying to the Land and Environment court to have the land transferred to a more responsible land manager where a person has contravened a biobanking agreement.

7.1.2 Forest Management Zone 1 Special Protection (Flora Reserves)

Forest Management Zoning (FMZ) is a land classification system which sets out in map format the way the Forestry Corporation of NSW (FCNSW) intends to manage forest areas across the entire State forest estate. It was developed by the then State Forests in consultation with the National Parks and Wildlife Service, the Department of Mineral Resources and community groups. The FMZ system is based on nationally agreed reserve criteria and clearly differentiates between those areas of State forests which are specifically set aside for conservation and those areas that are available for other activities including timber harvesting. Each zone has an activities table to provide guidance for forest management: 'Activities Not Permitted', 'Activities Permitted with Standard Conditions' and 'Activities Permitted with Special Conditions'.

Areas identified as offset sites would be established as FMZ1 Special Protection, areas which are managed to maximise protection of very high natural and cultural conservation value. Areas within this zone are designed to meet the requirements of JANIS dedicated (formal) reserves in the National Forest Policy Statement and, as such, are equivalent to IUCN-Protected Area categories I, II, III or IV.

New areas are set apart as Flora Reserves under Section 16 of the Forestry Act 2012 and an Act of Parliament is required to revoke this Zoning. Section 25 of the Forestry Act 2012 requires a working plan (management plan) for each Flora Reserve approved by the Minister for Forestry. Activities within Flora Reserves are not included within Integrated Forest Operation Approvals and are subject to Environmental Planning and Assessment Act requirements.

Activities not permitted within Flora Reserves include:

- Timber harvesting;
- Removal of forest products and materials;
- Grazing by domestic stock;
- Mineral and petroleum exploration.

Activities permitted with standard conditions include:

- Scientific surveys;
- Maintenance of existing roads and fire trails;
- General access for activities such as bush walking or photography, except as required to meet specific management needs;
- Prescribed burning;
- Beekeeping; and
- Feral animal and noxious weeds control.

Roads and Maritime undertake a comprehensive ecological assessment on all proposed offset sites and this is provided to FCNSW to assist the development of a site specific working plan to ensure the key biodiversity values that have been identified are protected. Roads and Maritime provide a compensation payment to FCNSW that covers the value of the harvestable timber that will be protected, as well as a contribution to the on-going management and monitoring of Flora Reserves that are created as a Roads and Maritime offset site. Monitoring is agreed on a site by site basis but generally a comprehensive vegetation condition is undertaken every 5 years in mature forest communities. FCNSW assume compliance and enforcement responsibility for all Flora Reserves established under the Forestry Act 2012. Enforcement responses for undertaking

illegal activities in a Flora Reserve include fines and/or imprisonment.

7.1.3 National Parks – creation of new or extension of existing.

NSW National Parks and Wildlife Service (NPWS) manages more than 850 protected areas in NSW, covering over 7 million hectares and representing around 8% of the land area of the state. Management of these areas involves a wide range of responsibilities, including plant and animal conservation, fire management, sustainable tourism and visitation, research, education, volunteering programs and more.

Roads and Maritime consult closely with NPWS to identify potential offset properties that could be added to the National Parks estate. In line with the management of all national parks, these properties will be acquired by Roads and Maritime and transferred to NPWS to be managed for conservation in-perpetuity under Part 4 of the National Parks and Wildlife Act 1974. A key consideration in the selection of offset properties is the Directions Statement for National Park Establishment 2015-2020 and the 25 year Strategic Investment Layer developed by OEHL to inform reserve acquisitions.

The objectives of the National Parks and Wildlife Act 1974 are to:

- Protect the full range of habitats and ecosystems, plant and animal species and landforms found across the state
- Protect areas of significant cultural heritage, including places, objects and features of scenic beauty and landscapes and natural features of significance; wilderness areas and wild rivers; water catchments; popular places for nature-based recreation; and certain icons of national significance
- Provide opportunities for public enjoyment including nature-based recreation and education in a diverse array of landscapes in all regions of NSW.

NPWS produces plans of management which outline the values of NSW national parks – including biodiversity and Aboriginal culture – and how they will be managed. These plans of management are used in conjunction with fire management strategies to protect conservation areas. NPWS makes all plans of management publically available on their website. Roads and Maritime undertake a comprehensive ecological assessment on all proposed offset sites and this is provided to NPWS to assist the development of a site specific plan of management which protects the key biodiversity values that have been identified. Roads and Maritime provide funding to NPWS for required management actions and monitoring to be carried out for up to 20 years, after which, NPWS assumes responsibility for on-going management actions and monitoring.

NPWS also ensures compliance and enforcement of the plan of management for each national park, with enforcement responses including fines and/or imprisonment specified under the National Parks and Wildlife Act 1974 for damaging reserved lands.

7.1.4 Nature Conservation Trust Agreements

The Nature Conservation Trust of NSW (NCT) was established by the Nature Conservation Trust Act 2001 (NCT Act) as a not for profit entity, with a primary purpose to protect and enhance natural heritage in NSW through the application of in perpetuity Trust Agreements on property titles.

Properties must be managed in accordance with the Trust Agreement and accompanying Plan of Management prepared in conjunction with the NCT.

The Plan of Management contains information about the vegetation communities and species protected by the Trust Agreement, much of which is drawn from the detailed ecological assessment that is carried out on each site by Roads and Maritime. The Plan of Management outlines the management strategies that must be applied at the site. The Plan includes the conditions the land owner must observe in accordance with the Trust Agreement and strategies to assist landholders to maintain and improve biodiversity values. The Plan of Management is designed to complement existing environmental legislation, which continues to apply to the land.

Offset properties would be managed by landowners (Roads and Maritime or individuals) in accordance with the Trust Agreement and Plan of Management. These activities, costs, responsibilities and timeframes will be documented in a Property Works Plan developed with the NCT at the time that the Trust Agreement and site specific Plan of Management are developed. It is expected that management activities will be funded over a 20 year period with the most intensive works completed in the first two years. Roads and Maritime will be responsible for implementation of the works while an offset property is in Roads and Maritime ownership.

Roads and Maritime owned properties would be on-sold after the Trust Agreement has been registered on the title of the property. For all offset sites with Trust Agreements, Roads and Maritime will make funds available for current and future property owners to implement continuing management actions for up to 20 years. The funding will be made available to landholders via a Management Funding Contract with the NCT. The NCT will be responsible for monitoring compliance with the Trust Agreement, Plan of Management and any funded management actions under a Management Funding Contract. Subsequent funding would be via grants, which the NCT assists landowners in applying for.

Trust Agreements are legally enforceable in the NSW Land and Environment Court, and in the event of a breach the NCT can direct rectification work be carried out or enter the land to undertake the works itself. The NCT Act also provides for NCT to apply to the Land and Environment Court for damages against a landholder who breaches a Trust Agreement. Trust Agreements may not be terminated other than in accordance with the NCT Act.

The precise terms of the Trust Agreement will be developed by the NCT in consultation with Roads and Maritime and landowners, but would include the following broad conditions:

- Exclusion of activities that would result in impacts on habitat for the affected threatened fauna, including timber harvesting, vegetation clearing, grazing, apiary, controls on cats and dogs in the conservation area, or uncontrolled public access.
- Management of the property in accordance with the Plan of Management which will include reference to site specific management activities.
- Ongoing monitoring by NCT of management action implementation, vegetation and habitat condition as per individual offset site Plans of Management. The standard monitoring regime includes annual site inspections in Years 1, 2, 3 and 7 with full vegetation condition monitoring to be undertaken in Years 5, 10, 15 and 20.

Table 19. Comparison of available offset protection mechanisms

| Offset requirement | BioBanking Agreement | FMZ 1 (Flora Reserve) | National Park | NCT Trust Agreement |
|-----------------------------|---|---|--|---|
| Protection | In-perpetuity under Threatened Species Conservation Act 1995. | In-perpetuity under Forestry Act 2012. | In-perpetuity under National Parks and Wildlife Act 1975. | In-perpetuity under Nature Conservation Trust Act 2001. |
| Management actions funded | In-perpetuity via the BioBanking Trust Fund. Payments are made annually to landowners. | In perpetuity by FCNSW, with initial 40 year contribution by Roads and Maritime. | In-perpetuity by NPWS, with initial 20 year contribution by Roads and Maritime. | For 20 years, funded by Roads and Maritime. |
| Monitoring | Office of the Environment and Heritage as specified in individual BioBanking Agreements. | FCNSW, Reserve specific but generally vegetation condition surveys every 5 years. | NPWS, as specified in the plan of management. | NCT, mixture of site visits and 5 yearly vegetation condition monitoring. |
| Compliance and enforcement. | Office of the Environment and Heritage as outlined in the BioBanking Compliance Assurance Strategy. | FCNSW, enforcement penalties as per Section 38 of Forestry Act 2012. | NPWS, enforcement penalties as per Section 156A of the National Parks and Wildlife Act 1974. | NCT, as per Section 38 of the Nature Conservation Trust Act 2001. |

7.2 Timeframe for delivery of offset

In order to deliver the required offsets for the Woolgoolga to Ballina project, Roads and Maritime propose to undertake the following:

- Seek DoE and DP&E approval of the 6 priority sites identified in the Update 2 Threatened Biodiversity Offset Status Report
- Undertake ongoing field investigations to identify additional potentially suitable properties
- Submit the Update 3 Threatened Biodiversity Offset Status Report and seek approval of the final sites required to meet the offset requirements of MCoA D4 in full.
- Submit a series of site suitability reports to DoE and DP&E for approval of additional offsets required to meet remaining offset requirements.
- Finalise in-perpetuity protection of all offset sites under the approved mechanism.
- Submit the Biodiversity Offset Package for approval, detailing the approved offset sites that have been secured in-perpetuity.
- Implement Biodiversity Offset Package, once approved.

Indicative timeframes of these activities are shown in Table 20 below.

Table 20. Indicative timeframes for implementation of offsets

| Activity | Timeframe |
|--|---|
| Submission and approval of Update 2 Threatened Biodiversity Offset Status Report | December 2015 - January 2016 |
| Offset site identification and ecological surveys undertaken | August 2015 – December 2016 |
| Submission and approval of Update 3 Threatened Biodiversity Offset Status Report | First quarter 2016 |
| Rolling submission and approval of Site Suitability Reports. | Approximately 6-18 months from approval of Biodiversity Offset Strategy |
| Secure in-perpetuity protection. | Upon approval of Site Suitability Reports, approximately 8 -20 months from approval of Biodiversity Offset Strategy |
| Submission and approval of the Biodiversity Offset Package | Within 24 months from approval of Biodiversity Offset Strategy. |
| Implementation of the Biodiversity Offset Package | On-going upon approval of the Biodiversity Offset Package. |

7.3 Identification of potential indirect offsets or compensatory measures for consideration

As detailed in Section 6, Roads and Maritime is progressing investigations into potential direct offset measures. If 100% of direct offsets cannot be met, indirect offsets or compensatory measures (such as funding of research, recovery plans and management actions) will be agreed with DP&E and DoE. Compensatory measures will be reviewed to ensure that they are consistent with the guidelines outlined in Appendix B of the EPBC Act Offsets Policy. An addendum to the Biodiversity Offset Strategy would be made if any indirect offsets are required.

7.4 Management of changes in biodiversity impacts

Throughout the detailed design and construction phase there is the possibility that design changes may lead to an unexpected impact on areas of native vegetation. Strict clearing limits will be established during the construction phase to ensure clearing limits set by conditions of approval are achieved. There is also potential for detailed design to result in reduced impacts to native vegetation.

It is important to note that in the Commonwealth approval, EPBC Condition 23 states that ‘*The*

Minister will not approve a revised plan or agreement, unless the revised plan or agreement would result in an equivalent or improved environmental outcome.'

Should proposed design changes have the potential to create an additional impact beyond what was anticipated in the EIS and associated approval conditions a consistency assessment will be undertaken against the NSW and Commonwealth Conditions of Approval for the project. Consistency assessment(s) will take into account the vegetation type, quality and habitat to determine whether there is at least an equivalent or improved outcome. If the design change is deemed inconsistent with the Conditions of Approval then a modification under Section 115ZI of the *Environmental Planning and Assessment Act 1979* will be lodged for determination by the Minister for Planning. Agreement will also be sought from the Commonwealth Minister for the Environment, before proceeding with design change. If approved, any additional clearing impacts will be offset as per the Biodiversity Offset Strategy.

Where vegetation impacts are reduced during the detailed design phase, these areas of reduced clearing will be assessed to determine extent and nature of vegetation that has been retained rather than cleared. This process will enable a detailed record of any reduction to the clearing impacts outside of what was originally anticipated in the Biodiversity Offset Strategy. These reduced areas of impact will form part of the final vegetation impact tables that are used to determine the final suite of offset requirements.

The proposed mitigation measures for the project are set out in detail within management plans subject to approval by DP&E and DoE. Should any changes to mitigation measures be required, the revised plans would be subject to approval under EPBC Condition 23 and/or MCoA D8. It should be noted that offsets for the project have been calculated based on the total impacts of the project, and mitigation measures have not been considered as a factor in determining residual impact for offset purposes. As such, any potential changes to mitigation measures would be unlikely to require additional offsets.

Should additional threatened species be identified within the clearing boundary through pre-clearance surveys or during construction, the unexpected threatened species finds procedure would be implemented as detailed in the Biodiversity Guidelines for protecting and managing biodiversity on Roads and Maritime projects (Roads and Traffic Authority 2011a) and the Flora and Fauna Management Plan for the project. Offsets for additional threatened species would be determined as part of the assessments of impact for these species, and details of the offsets would be set out in reporting for the Biodiversity Offset Package.

The threatened species management plans approved in accordance with MCoA D8 and D9 identify corrective actions should monitoring undertaken identify that mitigation or connectivity measures have been ineffective. Should this occur then additional offsets would be considered. In addition MCoA D5 includes specific provision for these additional offsets to be incorporated into the Biodiversity Offset Package as it states:

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.

Any provision for additional offsets would be discussed with relevant stakeholders following review of the monitoring reports to determine the appropriate actions.

The extent of any additional offset measures will be determined in consultation with EPA, DoE, DPI Fisheries and Department of Planning as appropriate.

Additional offset measures may include one or a combination of the following:

- Secure additional native vegetation protected through in-perpetuity conservation agreements (or other equivalent protection mechanism)
- Additional revegetation in strategic locations
- Investment in management research related to the rehabilitation and protection of relevant threatened species.

8 Conclusion

This report details how Roads and Maritime propose to deliver the biodiversity offset requirements for the properties for the Woolgoolga to Ballina upgrade project.

Measures for managing biodiversity impacts arising from the project were developed following the general principles of avoiding, mitigating and offsetting impacts. Impacts on biodiversity values within the region have been avoided, where possible, through the route selection process and development of the concept design alignment. Management measures designed to reduce impacts on biodiversity include:

- Fauna crossing measures
- Revegetation measures
- Threatened flora protection and translocation
- Additional fauna mitigation measures
- Monitoring measures.

The implementation of the Offset strategy as detailed throughout this report will satisfy the NSW Minister for Planning's Condition of Approval (D3, D4, and D5) and the Commonwealth Minister for the Environment Conditions of Approval (EPBC 15, 16, 17, and 18). Once approval has been received for the strategy, Roads and Maritime will undertake the actions required in order to implement the required offsets for the project. Within two years of the approval of this strategy, Roads and Maritime will submit a Biodiversity Offset Package which includes details of the final suite of measures selected in accordance with this strategy.

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Appendix A

Woolgoolga to Ballina project map



- The project
- Upgrade completed to dual carriageway
- Upgrade under construction
- Existing Pacific Highway
- Project interchange

Appendix B

Consultation

Commonwealth Department of Environment comments on Woolgoolga to Ballina Biodiversity Offset Strategy (DRAFT 1), March 2015

Dated 8 July 2015

| Condition | Requirement | Plan reference | DoE notes/comments | RMS Response |
|-----------|-------------|-----------------|---|--|
| General | | | Content page should include the list of all appendices. | RMS to amend. |
| General | | | All relevant figures and EPBC offset calculation worksheets must be listed as appendices and included in the final BOS. | Appendix C currently includes all inputs required for the EPBC calculator sheets for all species. If this is not considered sufficient RMS can provide calculator sheets, noting that each species has a number of separate sheets to allow separate calculations based on differing habitat quality scores across the 155 km alignment. |
| General | | | Please insert a table of acronyms used with full titles | RMS to amend. |
| General | | 2.3.2 | Reference is made to Biodiversity Status report for 3 plant species, Koala and the Lowland Rainforest ecological community in relation to identified offset sites. These should be incorporated in to the BOS. Why are potential offset sites not identified for other impacted/communities species? | State condition D3 outlines the requirements for both the BOS and the BOSR. There is no requirement for the BOS to provide details of offset sites identified, rather this the requirement of the Biodiversity Offset Package (D5). Given the allowance for the BOSR to be submitted in stages, prior to construction impacts on each of the identified species (D4) it is required to maintain this as a separate report to the BOS. |
| General | | 2.3.2- | Last paragraph should be updated | RMS to amend. |
| General | | Table 1- page 6 | D4- it is incorrect to state that D4 is N/A and will be subject to separate report. This applies to D 5 only. | See comment above re standalone requirement for BOSR. |

| Condition | Requirement | Plan reference | DoE notes/comments | RMS Response |
|-----------|---|----------------|--|---|
| 15 | Submit for approval a Biodiversity Offset Strategy (BOS) to compensate for any residual impacts on threatened species and communities | This Strategy | | |
| 15 | The BOS must meet the requirements of the EPBC offset policy. | | As discussed below there is inadequate information to provide informed comments in the absence of additional information. | RMS will provide EPBC calculator sheets if required and will also include a section that summarises the data sources used and provide more detail on the offset mechanisms proposed into the BOS. |
| 16 | The BOS and Biodiversity Offset Package must be prepared in accordance with NSW approval conditions D3, D4 and D5 | | D5 refers to the offset package and is not relevant to the BOS Cross referencing where D3 and D4 are addressed is provided in Table 1. | |
| 17 | BOS must include information required by NSW condition D4. Must be approved by the Minister within 3 months of commencement of stages 1 & 2. | | BOS does not include information required by condition D4. It is noted that this information has previously been provided to the Environmental Assessment Branch (Biodiversity Status Report) in December 2014. Comments on the Biodiversity report are included in this review. Notwithstanding the above, the BOS must include information in relation to condition D4 for consideration by the Minister in approving the BOS. | After reviewing Condition 17, RMS does not agree that the information required by NSW condition D4 must be included in the BOS. The condition has been written to accommodate the staged submission of the BOSR if required and it is RMS's intention to stage submission over at least 2 BOSRs. The BOS must be finalised before the BOSR as it provides all of the information regarding the impacts and offset requirements for all species, including the 5 priority MNES nominated in D4. It is then the BOSR's role to demonstrate that we have identified appropriate offset sites to meet the offset requirements identified in the BOS for the 5 priority MNES. |

| Condition | Requirement | Plan reference | DoE notes/comments | RMS Response |
|------------|---|-----------------------|--|--|
| | | | <p>long term protection of offset sites provided through this mechanism in comparison to other available mechanisms.</p> <p>Suggest inclusion of details for the other available mechanisms, including the mechanism's ability to offer long term (in perpetuity) protection for the protected matters and their enforceability.</p> | <p>FCNSW Flora Reserves, Nature Conservation Trust Agreement and Biobanking Agreements. The assessment will cover in-perpetuity protection, compliance and enforcement for each mechanism.</p> |
| General/D3 | | | <p>Please confirm that impact areas which have been calculated in Tables 3, 4, 5 & 6 include results of most recent ecological surveys and impacts associated with ancillary facilities, soft soil areas and other utility works for the entire project. It is noted that pre-clearance surveys are yet to be undertaken for the majority of sections.</p> | <p>RMS to confirm this in BOS.</p> |
| general | | 3.4 para 1, line 1 | <p>Typo in relation to references to sections</p> | <p>RMS to amend.</p> |
| D3 | <p>As a minimum offsets must be provided at a minimum ratio of 4:1 for native vegetation (including salt marsh) or as required by EPBC offset policy and guide.</p> | Section 3.4 & Table 8 | <p>Identifies specific MNES and area impacted in hectares for each protected matter.</p> <p>Please provide explanation as to the use of 0.46ha (Table 8) and 0.2 ha in Table 4 as opposed to 1.09 ha listed under Table 3 for Littoral Rain Forest EC (direct impact areas). Similar discrepancies exist for other protected matters and need clarification/correction.</p> <p>It is noted that under NSW condition B1 (d) clearing of Littoral Rainforest must be limited to a total of 0.5 ha.</p> | <p>See previous response.</p> <p>RMS to confirm that we are meeting NSW clearing condition B1(d).</p> |

| Condition | Requirement | Plan reference | DoE notes/comments | RMS Response |
|-----------|-------------|----------------|---|---|
| | | | <p>Table 8 indicates an impacted area of 782.28ha of primary, secondary and tertiary habitat for the Koala. Please verify, how this complies with the NSW condition B1 (e) for a total of 375 ha of primary and secondary habitat. A breakdown of the 3 types of habitat areas impacted will need to be provided.</p> | <p>The BOS will breakdown the impact for each identified koala population in D4 as well as the residual impacts on koala habitat along other areas of the alignment.</p> <p>The SPIR estimated that 375 ha of primary and secondary 'habitat critical to the survival of Koala' habitat would be cleared throughout the Project footprint. This figure was derived from 160 habitat assessment plots, each 0.1 ha in size and distributed throughout a similar number of vegetation polygons, in which absence of the required percentage composition (30% and 50%) of primary and secondary Koala food trees was interpreted as absence of primary and secondary Koala habitat within the entire vegetation polygon. This methodology was based on Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC, 2012) Interim Koala referral advice for proponents.</p> <p>As part of the detailed vegetation surveys conducted across all sections, consultants assigned habitat quality scores for all threatened species, including koalas. The koala habitat score methodology was in accordance with the EPBC Act's Environmental Offset Policy (October 2012), using the 3 generic habitat quality categories found in the Offsets Assessment Guide (stocking rate, condition and landscape connectivity).</p> |

| Condition | Requirement | Plan reference | DoE notes/comments | RMS Response |
|------------|---|------------------|---|---|
| | | | | The area of habitat to be removed that has been assigned a habitat quality score for koala, as estimated using this method, is larger than the 375 ha estimated as 'habitat critical to the survival of the Koala' (DSEWPaC 2012) in the SPIR. This is because Roads and Maritime Services decided to take a more conservative approach to estimating the area of Koala habitat that would be removed as part of the Project. RMS assumed that all Biometric Vegetation Types that nominally contain Koala food tree species (regardless of percentage tree cover) or provide resting or connecting habitat were included in determining habitat quality scores. As such calculations included all possible koala habitat ie 'tertiary koala habitat' in these calculations and forms the basis for determining offsets under the EPBC Act Biodiversity Offsets Policy. |
| General/D3 | | Tables 6 & 8 | Information provided against Eucalyptus tetrapleura in the two tables do not tally. Similarly for Cryptocarya foetida, Grey-headed Flying Fox, Wallum Sedge Frog | RMS to amend tables to ensure that any species/communities listed in Table 8 will be noted as having a significant impact in Table 6. |
| D3 | Use of the EPBC Offset Policy & Guide | | The accuracy of the calculations provided is difficult to determine at this stage in the absence of ecological quality data and EPBC work sheets. | See previous responses re section summarising the data sources used and provision of EPBC calculator sheets. |
| D3a | BOS must include the objectives and outcomes sought through the offset package to achieve a neutral or net beneficial outcome for all impacted species and ecological communities | 1,2, 1,3 & 2.3.3 | Compliant | |

| Condition | Requirement | Plan reference | DoE notes/comments | RMS Response |
|-----------|---|---|--|---|
| D3b | Confirmation of the vegetation type/habitat in hectares to be cleared and their condition and size of offset required | Sections 3 & 5 | Section 3 identifies impact areas for protected matters. See previous comment in relation to inclusion of impact areas associated with soft soil works, ancillary facilities etc | Refer to previous comment. |
| D3c | Details of the available offset measures that have been selected to compensate for the loss of existing native vegetation (including mangroves, salt march and riparian vegetation), species, their habitat and ecological communities and potential offset sites | 5.3.3 & Appendix C Table 17 | Describes calculation of offset requirements under the EPBC Act. The project impacts calculated for Lowland and Littoral Rainforest communities differ from those in previous tables (3 and 12). Please explain how the areas (ha) provided in Table 8 for these communities have been derived and why they have been used to calculate offset requirements (and not those in Tables 3 and 12). Please provide rationale for using the area for <i>E tetrapleura</i> and <i>Prosanthera cineolifera</i> , rather than the numbers of individuals impacted. | Refer to previous comment. DoE (NSW assessment section) have previously advised RMS that it is appropriate to use area rather than number for determination of impacts to flora species. |
| general | | Appendix C, page 2, first line below Table C1 | Error | RMS to amend. |
| D3d | Consideration of contingency measures for offsets to address potential changes to impacted areas as a result of detailed design changes | 7.3 & 7.4 | This section identifies 3 main additional offset measures in relation to potential SIS design changes but does not provide any detail in relation to species. | RMS to incorporate information on how potential changes will be managed should area of impact change or new MNES be identified. |

| Condition | Requirement | Plan reference | DoE notes/comments | RMS Response |
|-----------|--|----------------|---|---|
| D3e | Process to address changes to SSI footprint due to detailed design, changes to predicted impacts as a result of changes to mitigation measures, identification of additional species through pre clearance surveys, additional impacts associated with ancillary facilities. | 7.4 | Not specifically addressed in regard to changes to mitigation measures, additional species etc. | RMS to incorporate additional information. |
| D3f | Decision making framework that would be used to select the final suit of offset measures to achieve the objectives and outcomes established within the strategy, including the ranking of offset measures | 7 | The requirements of this condition has not been specifically addressed. | RMS to incorporate further information on the decision making framework as part of the re-drafting of Section 7 of the BOS. |
| D3g | Options to securing and management of biodiversity offsets in perpetuity. | 6 & 7 | See comment above under D3, section 7.1 | See previous response re further information on the suite of offset mechanisms available to RMS. |

NSW Department of Planning & Environment comments on Woolgoolga to Ballina Biodiversity Offset Strategy (DRAFT 1), March 2015

Dated 17 July 2015

| Item | Condition No/Report Reference | Department's Comment | RMS Response | DP&E Additional Comments 28/8/15 | RMS Final Response |
|------|--|--|--|--|---|
| 1. | Condition D3(a) Objectives and outcomes | More detail must be provided/discussion of the proposed objectives and outcomes of the BOS, including direct and indirect impacts, beneficial outcomes for TECs and threatened species/habitats, and operation of the project. | Additional detail on the objectives of the BOS has been provided in Section 1.3. | | |
| 2. | Condition D3(b) Offsets required | More detail must be provided on the quantum of offsets required and how the amount was determined. The BOS in section 3 (and associated tables) refer to direct impacts on vegetation and habitat. An amount of 3590 ha is required to be acquired for offset lands, on the basis of 4:1 and 892 ha impacted. It is unclear if the amount of offset land required includes both direct and indirectly impacted land. Clarification of this should be provided. | The quantum of offset for vegetation communities and fauna habitat has been determined using a 4:1 offset ratio as specified in condition D3. Offsets are proposed for direct impacts on native vegetation only, except for certain threatened communities species which are identified as being particularly sensitive to indirect impacts. | | |
| 3. | Condition D3(c) Available offset measures | More information must be provided on the available measures, particularly for TSC listed TECs and threatened species/habitat. | More detail has been provided on the available offset measures in Section 7.1. | In the event that 100% of the offset is not able to be provided, will RMS consider other options such as funding of research towards the threatened species or preparation of management/recovery plans What process would be | Yes, if 100% of direct offsets cannot be met, indirect offsets (such as funding of research, recovery plans and management actions etc) will be agreed with DP&E and DoE. An addendum to the |

| Item | Condition No/Report Reference | Department's Comment | RMS Response | DP&E Additional Comments 28/8/15 | RMS Final Response |
|------|--|---|---|--|--|
| | | | | followed to update the Strategy should the delivery of 100% offsetting for a species/community not be able to be achieved. | Biodiversity Offset Strategy would be made if any indirect offsets are required. Section 7.21 has been amended to include the above. |
| 4. | Condition D3 (e) Changes in biodiversity impacts | The BOS should include a process for its review and amendment, particularly to address the requirements (i) to (iv) and the monitoring of the effectiveness of mitigation measures. See comments 22 and 23 below. | Review and amendment of offset requirements will be addressed in the Biodiversity Status Reports and Biodiversity Offset Package. | | |
| 5. | Section 1 | Paragraph 5 discusses residual impacts of the project, which are listed in 2 dot points. The first dot point about loss of native vegetation should include threatened flora species in additions to TECs. The second dot point should be revised to state: ...variety of native fauna, including protected and threatened species. | The dot point has been updated. | | |
| | Section 1.5 Data Sources | | | This section discusses MNES matters. Include discussion on State listed species and communities. | This section does not exclusively refer to MNES – most of the data sources also include TSC Act listed species, although there is additional discussion on habitat scoring for MNES. To clarify this, references to both Acts have been included where applicable. |

| Item | Condition No/Report Reference | Department's Comment | RMS Response | DP&E Additional Comments 28/8/15 | RMS Final Response | | | | | | | | | | | | | | | |
|---------------------------------------|-------------------------------|--|---|----------------------------------|--------------------|---------------------|------|------|--------------------|------|------|---------------------|------|------|---------------------------------------|-------|-------|--|--|--|
| 6. | Section 3.1 | This section must include discussion of the existing condition of the vegetation impacted by the project, as required by principle 3 of Table 11. | Condition of vegetation is reflected in habitat quality scoring for fauna species with broad habitat values. The requirement to offset with highly-scored habitat quality will ensure like-for-like or better vegetation is secured as offsets. | | | | | | | | | | | | | | | | | |
| 7. | Table 3 | Add the following to the note for Table 3: of sections 3-11. | The recommended text has been added to the note | | | | | | | | | | | | | | | | | |
| 8. | Table 4 | <p>The total area of TEC's directly impacted by the project is shown in Table 4. However, the amounts shown in Table 4 for the TECs listed below do not correspond with the amounts listed in Table 3:</p> <table border="1" data-bbox="512 805 947 1249"> <thead> <tr> <th>TEC</th> <th>Table 3 (ha)</th> <th>Table 4 (ha)</th> </tr> </thead> <tbody> <tr> <td>Littoral rainforest</td> <td>1.09</td> <td>0.20</td> </tr> <tr> <td>Lowland Rainforest</td> <td>3.46</td> <td>3.83</td> </tr> <tr> <td>Freshwater wetlands</td> <td>3.82</td> <td>6.05</td> </tr> <tr> <td>Subtropical coastal floodplain forest</td> <td>89.02</td> <td>80.07</td> </tr> </tbody> </table> <p>Please verify the area of TEC impacted by the project and amend Tables 3 and</p> | TEC | Table 3 (ha) | Table 4 (ha) | Littoral rainforest | 1.09 | 0.20 | Lowland Rainforest | 3.46 | 3.83 | Freshwater wetlands | 3.82 | 6.05 | Subtropical coastal floodplain forest | 89.02 | 80.07 | Table 3 previously listed whether particular Biometric vegetation types included TECs; the entire area of each vegetation type does not necessarily equate to TEC, with some areas not meeting all the criteria for listed TECs. The TEC/overcleared column has been removed from Table 3 in order to avoid confusion. | | |
| TEC | Table 3 (ha) | Table 4 (ha) | | | | | | | | | | | | | | | | | | |
| Littoral rainforest | 1.09 | 0.20 | | | | | | | | | | | | | | | | | | |
| Lowland Rainforest | 3.46 | 3.83 | | | | | | | | | | | | | | | | | | |
| Freshwater wetlands | 3.82 | 6.05 | | | | | | | | | | | | | | | | | | |
| Subtropical coastal floodplain forest | 89.02 | 80.07 | | | | | | | | | | | | | | | | | | |

| Item | Condition No/Report Reference | Department's Comment | RMS Response | DP&E Additional Comments 28/8/15 | RMS Final Response |
|------|-------------------------------|---|---|----------------------------------|--------------------|
| | | 4 accordingly. | | | |
| 9. | Section 3.4 | Missing cross reference in first sentence. | Updated. | | |
| 10. | Table 8 | <p>Note 1 states the 782.48 ha of Koala habitat impacted comprises primary, secondary and tertiary habitat. A definition of these types of habitat should be provided as Note 2.</p> <p>Condition B1 limits the amount of Koala habitat (primary and secondary) permitted to be cleared to a total of 375 ha. Table 8 should show the amount of primary and secondary habitat that would be impacted, to verify compliance with condition B1(e).</p> <p>Are the impacts identified in Table 8 included in the 3590 ha offset requirement for the project?</p> | <p>The SPIR estimated that 375 ha of primary and secondary 'habitat critical to the survival of Koala' habitat would be cleared throughout the Project footprint. This figure was derived from 160 habitat assessment plots, each 0.1 ha in size and distributed throughout a similar number of vegetation polygons, in which absence of the required percentage composition (30% and 50%) of primary and secondary Koala food trees was interpreted as absence of primary and secondary Koala habitat within the entire vegetation polygon. This methodology was based on Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC, 2012) Interim Koala referral advice for proponents.</p> <p>As part of the detailed vegetation surveys conducted across all sections, consultants assigned habitat quality scores for all threatened species, including koalas. The koala habitat score methodology was in accordance with the EPBC Act's Environmental Offset Policy (October</p> | | |

| Item | Condition No/Report Reference | Department's Comment | RMS Response | DP&E Additional Comments 28/8/15 | RMS Final Response |
|------|-------------------------------|--|--|----------------------------------|--------------------|
| | | | <p>2012), using the 3 generic habitat quality categories found in the Offsets Assessment Guide (stocking rate, condition and landscape connectivity).</p> <p>The area of habitat to be removed that has been assigned a habitat quality score for koala, as estimated using this method, is larger than the 375 ha estimated as 'habitat critical to the survival of the Koala' (DSEWPaC 2012) in the SPIR. This is because Roads and Maritime Services decided to take a more conservative approach to estimating the area of Koala habitat that would be removed as part of the Project. RMS assumed that all Biometric Vegetation Types that nominally contain Koala food tree species (regardless of percentage tree cover) or provide resting or connecting habitat were included in determining habitat quality scores. As such calculations included all possible koala habitat ie 'tertiary koala habitat' in these calculations and forms the basis for determining offsets under the EPBC Act Biodiversity Offsets Policy.</p> | | |
| 11. | Section 3.5 | Last paragraph – reference Condition D2 for the Connectivity Strategy. | Reference included. | | |
| 12. | Section 3 | The BOS should discuss indirect impacts such as edge effects and changes to hydrological regimes and impacts on TECs and threatened flora, | This section will be updated as necessary. | | |

| Item | Condition No/Report Reference | Department's Comment | RMS Response | DP&E Additional Comments 28/8/15 | RMS Final Response |
|------|-------------------------------|--|--|---|---|
| | | and impacts on threatened species habitat. | | | |
| 13. | Section 4.2.1 | <p>Exclusion fencing - this section should state that exclusion fencing will be provided in all sections of the project, targeting fauna in general, but with specific fencing for emus, koalas and frogs. The second paragraph implies fauna exclusion fencing will be provided for sections 3 and 4 only.</p> <p>Widened medians – briefly discuss the purpose of the widened medians and target species.</p> <p>Landscaping – planting of specific vegetation will be undertaken to encourage fauna to connectivity structures (eg, koala food species near koala crossings) – this should be discussed in this section of the BOS.</p> | The section has been updated with some additional information. | <u>Landscape Plans</u> – provide details of proposal to revegetate areas in section 10 with Koala food trees. | Agreed, general details of Koala Revegetation Plan have been included in Section 4.2.1. Cross reference to the Koala Revegetation Plan for specific detail on revegetation areas, methods and monitoring etc. |
| 14. | Section 4.2.2 | Further details should be provided on the Construction Flora and Fauna Management Plan (FFMP) which provide guidance on managing construction impacts on flora and fauna. | The FFMP is referenced, but not described in detail. Section 4.2 comprises a broad overview of the proposed mitigation measures for the project. | | |
| 15. | Section 4.2.3 | A distinction should be made between the threatened species management | A reference to the FFMP has been included. | | |

| Item | Condition No/Report Reference | Department's Comment | RMS Response | DP&E Additional Comments 28/8/15 | RMS Final Response |
|------|-------------------------------|---|---|----------------------------------|--------------------|
| | | plans (TSMP) required by condition D8 and the FFMP (see above) required by condition D26(e). Although there is some overlap, they serve different functions. | | | |
| 16. | Section 5.2.2 | <p>The reference OEH 2011 is not contained in the References chapter of the BOS. Are these principles the most recent applicable to the project?</p> <p>Principle 4 – reference is made to the NSW Biodiversity Strategy – is this an OEH document or this BOS? A reference should be provided for this document, similarly the Mid and Far North Coast Regional Conservation Plan.</p> | <p>OEH (2011) has been updated and is now referred to more appropriately as OEH (2014b). The NSW Biodiversity Offsets Policy for Major Projects is discussed in Section 5.2.3.</p> <p>References have been provided for the Draft NSW Biodiversity Strategy and the Mid and Far North Coast Regional Conservation Plan.</p> | | |
| 17. | Section 5.3.1 | Ensure that the total 4.55 ha of rainforest communities directly impacted is consistent with the amounts specified in Tables 3 and 4. | The values for rainforest communities listed in Table 13 directly correlate with those listed in Table 3. | | |
| 18. | Table 12 | Ensure that the amounts specified in Table 12 are consistent with Tables 3 and 4 (and other tables which list direct impacts on TECs). | The amounts in Table 13 are consistent with Table 3. Table 4 lists TECs separately. | | |
| 19. | Section 5.3.2 | Paragraph two following Table 15 states expert advice would be sought to determine whether proposed offset land is suitable for threatened fauna species | Expert advice would be sought during investigations of potential offset sites and would be reported as part of the Biodiversity Offsets Package. | | |

| Item | Condition No/Report Reference | Department's Comment | RMS Response | DP&E Additional Comments 28/8/15 | RMS Final Response |
|------|-------------------------------|--|--|---|--|
| | | that can't be offset using vegetation type alone. At what stage would this advice be sought? Prior to submission of the Biodiversity Offset Package? | | | |
| 20. | Table 17 | See comment 8 about the actual impact on TECs. How is the offset calculated for individuals impacted by the project (offset provided is individuals rather than an area of land)? | See response to comment 8. The offsets for individuals were calculated using the EPBC Offsets Calculator. | | |
| 21. | Section 7 | Four mechanisms are identified to deliver in-perpetuity conservation of offset lands. However, only Nature Conservation Trust Agreements are discussed in detail. Similar discussion of the other available mechanisms should be provided, including measures to manage the land under these mechanisms. | Additional discussion of proposed offset mechanisms is provided in Section 7.1. | | |
| | Section 7.1.4 | | | <u>NCT Agreements</u> RMS will provide funding for management activities for a period for up to 20 years. What are the subsequent funding arrangements – the Nature Conservation Trust or the landowner or | Subsequent funding would be via grants which the NCT assists landowners in applying for. This has been added in Section 7.1.4. |

| Item | Condition No/Report Reference | Department's Comment | RMS Response | DP&E Additional Comments 28/8/15 | RMS Final Response |
|------|-------------------------------|----------------------|--------------|--|--|
| | | | | <p>grants, etc.</p> <p>RMS could provide details of the operation of these agreements for other projects (eg Hume Highway, other Pacific Highway projects).</p> | |
| | Section 7.2 | | | <p>The 4th dot point states a series of site suitability reports would be submitted to DP&E and DoE for approval of additional offsets to meet remaining offset requirements. Are these reports for those EPBC listed species not included in Condition D4?</p> | <p>Yes, these will be site reports for all other EPBC species and State offset requirements that are still outstanding.</p> <p>An update to the BOSR is planned for early 2016 to identify sites to meet the shortfall in two D4 species, koala populations in Broadwater and Wardell/Coolgardie. The timeframe in Table 20 has been amended for the next BOSR update.</p> |

| Item | Condition No/Report Reference | Department's Comment | RMS Response | DP&E Additional Comments 28/8/15 | RMS Final Response |
|------|-------------------------------|---|--|---|--|
| 22. | Section 7.4 | <p>This section should be expanded to include discussion of the following</p> <p>Identification of additional species/habitat through pre-clearance surveys;</p> <p>Additional impacts from ancillary facilities or other design changes/refinements during construction; and</p> <p>Additional offsets required in the event mitigation measures are demonstrated to be not effective, eg. Giant Barred Frog (B39(b)) and Koala (D9j)), and contingency measures specified for each Threatened Species Management Plan required by condition D8.</p> | <p>Additional discussion of measures to address changes to biodiversity impacts has been added to section 7.4.</p> | <p>3rd paragraph - replace modification under Section 75W with Section 115ZI.</p> <p>5th paragraph – add after EPBC Condition D23 the following “and/or MCoA D8”.</p> <p>The comments regarding additional offsetting to address the non-performance of mitigation measures (connectivity structures) has not been addressed. The Department considers that the Strategy should acknowledge that additional offsetting may be required in the event that monitoring has shown the absence of the Giant Barred Frog, that monitoring of connectivity measures and revegetation for Koalas has been ineffective, and provisions within the Threatened Species Management Plans for additional offsetting in the event corrective actions are ineffective.</p> | <p>Agreed - updated.</p> <p>Agreed - updated.</p> <p>Following paragraph has been inserted into Section 7.4:</p> <p>The threatened species management plans approved in accordance with MCoA D8 and D9 identify corrective actions should monitoring undertaken identify that mitigation or connectivity measures have been ineffective. Should this occur then additional offsets would be considered. In addition MCoA D5 includes specific provision for these additional offsets to be incorporated into the Biodiversity Offset Package as it states: <i>Where monitoring required under conditions D8 and/or D9 indicates that biodiversity outcomes are not being achieved, remedial actions as approved by the</i></p> |

| | | | | | |
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| | | | | | Secretary, shall be undertaken to ensure that the objectives of the Biodiversity Offset Package are achieved. Any provision for additional offsets would be discussed with relevant stakeholders following review of the monitoring reports to determine the appropriate actions. |
| 23. | | The BOS should include mechanisms for its review and amendment, particularly when offsetting or additional offsetting is required following the monitoring of the effectiveness of mitigation measures, or as required by the conditions of the approval (see comment 18). | See response to comment 4. | | |

NSW Department of Primary Industries (Fisheries) comments on Woolgoolga to Ballina Biodiversity Offset Strategy (DRAFT 1), March 2015

| Item | Condition No/Report Reference | Department's Comment | RMS Response |
|------|-------------------------------|--|--|
| 1. | Tables 3 and 4 | Ensure that all saltmarsh and mangrove communities impacted by the project are listed. | The only saltmarsh or mangrove vegetation community surveyed in the alignment is the Mangrove-Grey Mangrove vegetation community. If unexpected impacts occur on other saltmarsh or mangrove vegetation communities these will be offset as per this Strategy. |
| 2. | Section 7 | Do you intend to consult NSW DPI regarding the OPP offset properties? | Yes, the offset sites for OPP will be included in the Biodiversity Offset Package and consultation on the selection of appropriate sites with DPI Fisheries will continue. |

Appendix C

Offset calculations

Appendix C: Offset Calculations

Introduction

The Commonwealth Conditions of Approval require the Biodiversity Offset Strategy to compensate for any residual significant impacts on 'threatened species and communities', as identified in the 'definitions' section of the approval.

There are 21 threatened species and communities identified in the Commonwealth approval. These are listed in Table C1 along with the legal status under the EPBC Act and the expected impacts of the project on each Matter of National Environmental Significance (MNES).

Two of the threatened flora species listed in the approval, *Acronychia littoralis* (Scented Acronychia) and *Endiandra hayesii* (Rusty Rose Walnut) are no longer considered to have been identified within the project area, based on further survey and specimen identification. EPBC Act offset assessments are provided for the remaining MNES in the following sections.

Table C1. Impacts on MNES

| PROTECTED MATTER | COMMON NAME | EPBC Act Status | Impacts | |
|--|------------------------------|-----------------|--|---|
| | | | Area (ha) | No. of individuals impacted |
| Threatened ecological communities | | | | |
| Littoral Rainforest and Coastal Vine Thickets of Eastern Australia | | CE | 0.46 ha (0.2 ha direct impacts and 0.26 indirect impacts) | |
| Lowland Rainforest of Subtropical Australia | | CE | 3.25 ha (1.88 ha direct impacts and 1.37 ha indirect impacts) | |
| Threatened flora species | | | | |
| <i>Acronychia littoralis</i> | Scented Acronychia | E | | 0 |
| <i>Angophora robur</i> | Sandstone Rough-barked Apple | V | 91.68 | 6551 |
| <i>Arthraxon hispidus</i> | Hairy Joint-grass | V | 3.11 | |
| <i>Cryptocarya foetida</i> | Stinking Cryptocarya | V | | 48 (41 directly impacted and 7 indirectly impacted) |
| <i>Endiandra hayesii</i> | Rusty Rose Walnut | V | | 0 |
| <i>Eucalyptus tetrapleura</i> | Square-fruited Ironbark | V | 20.97 | 822 |
| <i>Macadamia tetraphylla</i> | Rough Shelled Bush Nut | V | | 15 (10 directly impacted and 5 indirectly impacted) |

| PROTECTED MATTER | COMMON NAME | EPBC Act Status | Impacts | |
|---|------------------------|-----------------|-----------|--|
| | | | Area (ha) | No. of individuals impacted |
| | | | | impacted) |
| <i>Prostanthera cineolifera</i> | Singleton Mint Bush | V | 0.42 | 609 |
| <i>Quassia sp. 'Moonee Creek'</i> | Moonee Quassia | E | | 210 stems (73 directly impacted and 137 indirectly impacted) |
| Threatened fauna species | | | | |
| <i>Anthochaera phrygia</i> | Regent Honeyeater | E, M | 722.73 | |
| <i>Dasyurus maculatus maculatus (SE population)</i> | Spotted-tailed Quoll | E | 795.8 | |
| <i>Lathamus discolor</i> | Swift Parrot | E, M | 773.24 | |
| <i>Litoria olongburensis</i> | Wallum Sedge Frog | V | 12.73 | |
| <i>Mixophyes iteratus</i> | Giant Barred Frog | E | 4.91 | |
| <i>Nannoperca oxleyana</i> | Oxleyan Pygmy Perch | E | 8.68 | |
| <i>Phascolarctos cinereus</i> | Koala | V | 884.73 | |
| <i>Phyllodes imperialis southern subsp.</i> | Pink Underwing Moth | E | 2.61 | |
| <i>Potorous tridactylus tridactylus</i> | Long-nosed Potoroo | V | 49.32 | |
| <i>Pteropus poliocephalus</i> | Grey-headed Flying-fox | V | 845.91 | |

CE – Critically Endangered, E – Endangered, V – Vulnerable, M - Migratory

For the purposes of this assessment, protected matters listed in Table C1 are grouped in this review as follows:

- Threatened ecological communities;
- Threatened flora species from rainforest habitats;
- Threatened flora species from sclerophyll forest habitats; and
- Threatened fauna species.

All impacts noted include impacts that would result from the project described in the EIS and SPIR documents, any impacts resulting from design refinements, or impacts on additional areas of threatened species populations and habitat identified in the project area as a result of pre-construction surveys. A discussion of any changes in impacts between project assessment stages is provided with each assessment.

EPBC Act offsets assessments guide

The offsets calculator provided with the EPBC offsets policy allows for calculation of the level of habitat quality and area or number of individuals required to be offset based on the level of impact from the project. For MNES for which impacts and offsets are calculated using area of community or habitat, the calculator requires a habitat quality 'score' on a scale of 1 to 10 as a measure of

how well a particular site supports a particular threatened species or ecological community and contributes to its ongoing viability. Three components contribute to the calculation of this score: site condition, site context and species stocking rate.

The instructions for the EPBC offsets assessment guide only briefly explain the scoring system based on indicators from these three components, and there is no specific field methodology provided in the guide for calculating habitat condition scores.

Habitat quality scores for the identified MNES in the project area were assigned as part of vegetation surveys conducted in 2014. Vegetation surveys were undertaken on a section by section basis by Aecom (2014b), Australian Museum Consulting (2014a), Biosis (2014c and 2014d), Ecosure (2014c), Geolink (2014b and 2014c) and Melaleuca Group (2014b). Habitat quality scores for each species were generally determined based on specified criteria for each of the three components, and were largely consistent across sections. The criteria used by each assessor to determine habitat scores and the key influencing factors considered when assigning scores for each MNES are compiled in Attachment 1 at the end of this appendix.

Habitat quality scores were assigned to individual vegetation or habitat polygons; for most MNES assessed using area of habitat or community, there were numerous polygons with a range of habitat quality scores. Where multiple habitat quality scores were recorded for an MNES, a separate calculation was undertaken for the area to which each habitat quality score was assigned and the calculator results were summed to determine the total offset area requirement for each MNES. Where there are multiple habitat quality scores, the calculator inputs for each scored area of habitat are presented (Tables C2 to C20).

The impacts on each MNES are based on the direct and likely indirect impacts from the project. Some species are more vulnerable to potential indirect impacts than other species; potential impacts relate to life history attributes, the proximity of the remaining individuals/areas to the project boundary, topographic factors, and local habitat conditions. Where indirect impacts are being considered in the context of offset requirements, this is stated in the individual assessment.

Inputs into the calculator for the offset area include:

- Temporal scales including time over which loss is averted (maximum 20 years) and time until ecological benefit.
- Risk scales including risk of loss without and with the establishment of the offset.
- Future habitat quality with and without the establishment of an offset.
- Confidence in the result is the level of certainty about the success of the proposed offset.

For the purpose of the current calculations, in most cases where MNES are assessed using area of habitat or community, the offset start quality is generally assumed to be one point lower than the impact area quality (except where the impact area quality is scored 5 or less) and is assumed to increase to meet the same quality as the impact area in the future quality with offset score. This will meet the minimum requirements of the EPBC Offsets policy; it is possible that offset areas could have higher start and future quality values than those assumed in this strategy. The minimum quality score assigned for offset start value is 5, as areas with a lower quality score are unlikely to be suitable for conservation of the relevant MNES.

The offsets calculator provides a percentage of the impacts offset once all data is entered. The current calculations aimed for at least 100% of impacts to be offset directly, however there is scope to provide up to 10% of the offset requirement through other compensatory measures.

The following assessments for each MNES provide further specific explanation and detail on the above factors.

Rainforest habitats

This section details potential offset requirements for rainforest habitat communities and rainforest plant species that would be significantly impacted by the project. This includes Lowland Rainforest of Subtropical Australia, Littoral Rainforest and Coastal Vine Thickets of Eastern Australia, and the threatened rainforest flora species *Cryptocarya foetida* and *Macadamia tetraphylla*.

Two other threatened rainforest flora species, *Acronychia littoralis* (Scented Acronychia) and *Endiandra hayesii* (Rusty Rose Walnut) were identified in surveys for the EIS and SPIR and are listed in the definition of 'threatened species and communities' in the Commonwealth approval.

***Acronychia littoralis* (Scented Acronychia)**

Flora surveys for the SPIR identified a clonal stand of *Acronychia* sp. on the eastern edge of the highway north of Coolgardie Road at station 158.5. The *Acronychia* sp. was considered as *Acronychia littoralis* for the purpose of impact assessment as a precautionary measure. Further targeted surveys in rainforest habitats in February 2014 (EMM 2014) included collection of samples of *Acronychia* sp. from three separate sites within the project impact area. All three samples were identified as *Acronychia wilcoxiana* (Silver Aspen) by the Queensland Herbarium (Rena Baker, BakerEcological, pers. comm. 24 November 2014). *Acronychia wilcoxiana* is not listed under either the EPBC Act or the TSC Act.

***Endiandra hayesii* (Rusty Rose Walnut)**

Endiandra hayesii was recorded within and adjacent to the project in Section 11 in the EIS. Eight individuals were initially identified, of which five would be removed under the EIS design. Further targeted surveys for threatened rainforest flora species as part of the SPIR identified 30 individuals of *Endiandra hayesii* in the study area, of which three individuals would potentially be directly impacted by the project, comprising around 10 per cent of the known population in the study area. An additional two individuals of the species close to the project footprint were assessed to be potentially indirectly impacted.

Targeted surveys for *Endiandra hayesii* in 2014 (AM Consulting 2014, EMM 2014) did not identify the species in the study area. A number of records from previous surveys have been confirmed as a different species, *Endiandra pubens* (AM Consulting 2014). There are no previous records of this species in the Atlas of NSW Wildlife database within or in proximity to Sections 10 and 11, although EMM (2014) did record two plants outside the project area. AM Consulting (2014) concluded that *Endiandra hayesii* has a low likelihood of occurring within Sections 10 and 11 of the W2B corridor.

Littoral Rainforest and Coastal Vine Thickets of Eastern Australia

The critically endangered ecological community Littoral Rainforest and Coastal Vine Thickets of Eastern Australia ('Littoral Rainforest') was recorded in Section 10.

The SPIR identified five patches of Littoral Rainforest in Sections 9, 10 and 11 within and adjoining the project boundary. Two of these patches were identified inside the project boundary. The SPIR assessed impacts to 0.23 hectares of Littoral Rainforest occurring in two patches.

Additional field assessment of rainforest communities by AM Consulting (2014) resulted in reclassification of a number of areas of rainforest in the study area. The two patches identified as Littoral Rainforest that were assessed as subject to project impacts in the SPIR were reclassified as Swamp Sclerophyll Forest and Blackbutt – Pink Bloodwood Shrubby Open Forest.

Field surveys conducted by EMM (2014) in February 2014 identified an additional area of Littoral Rainforest within and adjacent to the project, located to the south of Coolgardie Road near chainage 157200. This vegetation had previously been mapped as Swamp Sclerophyll Forest. AM

Consulting (2014) assigned the Littoral Rainforest an HQS of 8, based on moderate condition, connectivity on one side to a large tract of vegetation and presence of the ecological community.

Of the approximately 1.65 hectare mapped patch of Littoral Rainforest, 0.2 hectares falls within the project footprint and an additional 0.26 hectares is within 20 metres of the clearing boundary and subject to potential indirect impacts from the project.

According to the values assigned to the calculator (Table C2), an offset supporting 3.4 hectares of Littoral Rainforest with similar habitat quality would be sufficient to offset 0.2 hectares of direct impacts and 0.26 hectares of indirect impacts. Due to the critically endangered status of this ecological community a larger degree of offset is required compared with endangered and vulnerable protected matters.

It is anticipated that the impacts to Littoral Rainforest can be partially offset within the mapped area of the community adjacent to the impact, where 1.45 hectares will be retained. Conservation management of these areas in perpetuity would also reduce the extent and severity of indirect impacts from the project on Littoral Rainforest.

Table C2. Littoral Rainforest – impacts and a rationale for offset measures

| Attribute | Value | Rationale |
|---|-------|---|
| IMPACT AREA | | |
| Area (ha) | 0.46 | The area of direct impact to Littoral Rainforest, comprising 0.2 ha of direct impacts and 0.26 ha of indirect impacts. |
| Start quality (scale of 0-10) | 8 | Score is based on moderate habitat condition, moderate connectivity and presence of the ecological community. |
| OFFSET AREA | | |
| Risk-related time horizon (max. 20 years) | 20 | This describes the timeframe over which changes to the level of risk to a proposed offset site can be considered and quantified. This value is capped at 20 years or the life of an offset - whichever is shorter. Considering the offset is proposed to be established in perpetuity, the maximum risk-related time horizon was assigned. |
| Time until ecological benefit (years) | 10 | Although an offset site would support high quality rainforest habitats, restoration measures would likely be required to manage/eliminate existing threatening processes and improve habitat quality attributes. Management activities to minimise existing threats are likely to be achieved within 10 years. |
| Area (ha) | 3.4 | An offset of 3.4 hectares of Littoral Rainforest with similar habitat qualities to the impacted area would be sufficient to offset the impacts from the project. |
| Start quality (scale of 0-10) | 8 | Habitat quality of a potential offset site has been assumed to be similar to the impact area. |

| Attribute | Value | Rationale |
|---|-------|---|
| Risk of loss (%) without offset | 30 | Considering the existing threats to areas of Littoral Rainforest on private property are likely to include weed invasion, livestock, feral fauna species, ongoing clearing and underscrubbing for development and/or other activities such as agriculture/hobby farming, the risk of loss without the offset has been estimated at 30%. |
| Future quality without offset (scale of 0-10) | 7 | Considering the likely existing threats to areas of Littoral Rainforest on private property, the future quality without offset has been reduced by a single point from the start quality. |
| Risk of loss (%) with offset | 10 | Considering the existing high level of threat to Littoral Rainforest a residual risk of 10% has been assigned. |
| Future quality with offset (scale of 0-10) | 9 | It is envisaged with the implementation of management and restoration measures the future quality of the offset would be increased above existing levels. |
| Confidence in result (%) | 90 | There is a high confidence of a potential offset providing an improved outcome for Littoral Rainforest provided adequate restoration, monitoring and management actions are implemented. |
| % of impact offset | 101% | This scenario would provide for 101% of the required offset, depending upon the attributes of any proposed offset, the values can be modified within reason to achieve a minimum of 90% of the offset. |
| Other measures (up to 10%) | 10 | There is potential to provide up to 10% of the offset as other measures. This may include contributions towards research into Littoral Rainforest. |

Lowland Rainforest of Subtropical Australia

The critically endangered ecological community Lowland Rainforest of Subtropical Australia ('Lowland Rainforest') was recorded in Sections 10 and 11.

The SPIR identified three patches of Lowland Rainforest in Sections 10 and 11 that would be impacted by the project. The SPIR assessed direct impacts to two hectares of Lowland Rainforest and potential indirect impacts on an additional 1.5 hectares.

Australian Museum Consulting (2014) assessed the Lowland Rainforest patches in Sections 10 and 11 and assigned habitat quality scores (HQS) to all patches. Scoring was based on vegetation condition assessed using ecological data measured from 0.04 ha plots, connectivity to large tracts of vegetation and confirmed presence of the critically endangered community.

The mapping of Lowland Rainforest patches meeting the EPBC Act criteria for the community in the project area was revised, based on further review of the key diagnostic characteristics and condition thresholds for the community and input from experienced botanists with experience in rainforest assessment who have conducted surveys for the project.

The project would result in direct impacts on 1.88 hectares of Lowland Rainforest, with HQS ranging from 7 to 9. There would also be potential indirect impacts on the remaining areas of the impacted patches, comprising about 1.37 hectares. Indirect impacts have been calculated by measuring the remaining area of rainforest patches where patch viability is expected to be reduced

(all of the remaining areas of patch 1 (1.29 hectares) and the remaining areas of patch 2 downslope on the eastern side of the project (1.36 hectares)) and a small area of patch 3 comprising the area within 20 metres of the construction edge (0.09 hectares). As mitigation measures would be implemented to minimise potential indirect impacts, and because of the conservative nature of the above estimate, only half of this potential indirect impact has been assigned to the calculator (that is, 1.37 hectares).

According to the values assigned to the calculator (refer to Table C3), an offset supporting a total of 26.6 hectares of Lowland Rainforest with similar habitat quality would be sufficient to offset the 1.88 hectares of direct impacts and the 1.37 hectares of indirect impacts. Due to the critically endangered status of this ecological community a larger degree of offset is required compared with endangered and vulnerable listed protected matters.

The values and a rationale for the offset measures are provided in Table C3.

Table C3. Lowland Rainforest – impacts and rationale for offset measures

| Attribute | Values | | | Rationale |
|---|--------|-------|-------|--|
| | HQS 7 | HQS 8 | HQS 9 | |
| IMPACT AREA | | | | |
| Area (ha) | 0.49 | 1.05 | 1.71 | The area of direct impact to rainforest habitats which conform to the condition criteria for the critically endangered community. The total area comprises 1.88 ha of direct impacts and 1.37 ha of indirect impacts. |
| Start quality (scale of 0-10) | 7 | 8 | 9 | Scores are based on generally good habitat condition, connectivity and high species diversity. |
| OFFSET AREA | | | | |
| Risk-related time horizon (max. 20 years) | 20 | 20 | 20 | This describes the timeframe over which changes to the in the level of risk to a proposed offset site can be considered and quantified. This value is capped at 20 years or the life of an offset whichever is shorter. Considering the offset is proposed to be established in perpetuity, the maximum risk-related time horizon was assigned. |
| Time until ecological benefit (years) | 10 | 10 | 10 | Although an offset site would support high quality rainforest habitats, restoration measures would likely be required to manage/eliminate existing threatening processes and improve habitat quality attributes. Management activities to minimise existing threats are likely to be achieved within 10 years. |
| Area (ha) | 3.5 | 8.3 | 14.8 | A total offset area of 26.6 hectares of lowland rainforest with similar habitat qualities to the impacted area would be sufficient to offset the impacts from the project. |
| Start quality (scale of 0-10) | 6 | 7 | 8 | Habitat quality of a potential offset site has been assumed to be slightly lower than that of the impact area. |

| Attribute | Values | | | Rationale |
|---|--------|-------|-------|---|
| | HQS 7 | HQS 8 | HQS 9 | |
| Risk of loss (%) without offset | 30 | 30 | 30 | Considering the existing threats to areas of lowland rainforest on private property are likely to include weed invasion, livestock, feral fauna species, ongoing clearing and underscrubbing for development and/or other activities such as agriculture/hobby farming, a risk of loss without the offset has been identified as 30%. |
| Future quality without offset (scale of 0-10) | 5 | 6 | 7 | Considering the likely existing threats to areas of lowland rainforest on private property, the future quality has been reduced by a single point from the start quality. |
| Risk of loss (%) with offset | 10 | 10 | 10 | Considering the existing high level of threat to lowland rainforest a residual risk of 10% has been assigned. |
| Future quality with offset (scale of 0-10) | 7 | 8 | 9 | It is envisaged with the implementation of management and restoration measures the future quality of the offset would be increased by at least one point above existing levels. |
| Confidence in result (%) | 90 | 90 | 90 | There is a high confidence of a potential offset providing an improved outcome for lowland rainforest provided adequate restoration, monitoring and management actions are implemented. |
| % of impact offset | 101% | 103% | 105% | This scenario would provide for at least 100% of the required offset, depending upon the attributes of any proposed offset, the values can be modified within reason to achieve a minimum of 90% of the offset. |
| Other measures (up to 10%) | 10 | 10 | 10 | There is potential to provide up to 10% of the offset as other measures. This may include contributions towards research into Lowland rainforest. |

***Cryptocarya foetida* (Stinking Cryptocarya)**

Cryptocarya foetida (Stinking Cryptocarya) was recorded in Lowland Rainforest in Section 10. Surveys for the EIS identified a local population of 17 individuals. Expanded surveys for the SPIR in rainforest patches further to the west and north of Section 10 found 88 individuals in the local population, of which 13 would be subject to impacts from the project.

Additional field assessment by EMM (2014) in February 2014 AM Consulting (2014) in July 2014 recorded a total of 62 individuals of *Cryptocarya foetida*. Of these, 41 individuals would potentially be directly impacted by the project, with a further seven individuals within 20 metres of the clearing boundary subject to potential indirect impacts.

According to the calculator, an offset supporting 70 individuals with restoration measures to increase the population by at least 51 individuals would provide a suitable offset for the species. The values and a rationale for the offset measures are provided in Table C4.

Table C4. *Cryptocarya foetida* – impacts and rationale for offset measures

| Attribute | Value | Rationale |
|---|-------|--|
| IMPACT | | |
| Number of individuals impacted | 48 | A total of 41 individuals would be directly impacted by the proposal, with an additional seven individuals within 20 metres of the clearing boundary potentially indirectly impacted. |
| OFFSET | | |
| Time horizon (years) | 20 | Considering the offset is proposed to be established in perpetuity, the maximum risk-related time horizon was assigned. |
| Start value (number of individuals) | 70 | A start value of 70 individuals has been assigned based on the presence of at least this many plants on surrounding properties. |
| Future value without offset (number of individuals) | 65 | The existing threats to areas of habitat on private property are likely to include weed invasion, livestock, ongoing clearing and underscrubbing for development and/or other activities such as agriculture/hobby farming. Therefore the future value without the offset includes a reduction of 5 individuals in recognition of these ongoing threats. |
| Future value with offset (number of individuals) | 121 | A future site value of 121 individuals has been assigned based on the potential for translocation and/or plantings, and ongoing management improving habitat conditions to facilitate natural recruitment of individuals increasing the start value by 51 individuals. |
| Confidence in result (%) | 90 | There is a high confidence of a potential offset to provide an improved outcome for the species considering the number of individuals that would potentially be protected (70 individuals) providing an improved outcome for the species. This is based on adequate restoration, monitoring and management actions being implemented. |
| % of impact offset | 101% | This scenario would provide for 101% of the required offset. |
| Other measures (up to 10%) | 10 | There is potential to provide up to 10% of the offset as other measures. This may include restoration or protection of areas of habitat for the species (ie fencing a council reserve) and/or contributions towards research of the species. |

***Macadamia tetraphylla* (Rough-shelled Bush Nut)**

Surveys undertaken for the EIS identified 68 individuals of *Macadamia tetraphylla* in Section 10, of which 37 would have been removed under the EIS design. Supplementary surveys increased the number of individuals identified in the local population to 99 individuals. The SPIR reported that the design refinement at the interchange at Wardell would reduce the impacts of the project on *Macadamia tetraphylla* to removal of one individual.

Additional field assessment by EMM (2014) in February 2014 and AM Consulting (2014) in July 2014 recorded ten individuals of *Macadamia tetraphylla* within the clearing boundary, with a further five individuals within 20 metres of the clearing boundary that may be subject to potential indirect impacts.

According to the calculator, an offset supporting 90 individuals with restoration measures to increase the population by at least nine individuals would provide a suitable offset for the species. This may comprise translocation of the impacted individuals (or part of) into an offset site or plantings of propagated seeds or cuttings. The values and a rationale for the offset measures are provided in Table C5.

Table C5. *Macadamia tetraphylla* – impacts and a rationale for offset measures

| Attribute | Value | Rationale |
|---|-------|--|
| IMPACT | | |
| Number of individuals impacted | 15 | A total of 10 individuals would be directly impacted by the proposal, with an additional 5 individuals within 20 metres of the clearing boundary potentially indirectly impacted. |
| OFFSET | | |
| Time horizon (years) | 20 | Considering the offset is proposed to be established in perpetuity, the maximum risk-related time horizon was assigned. |
| Start value (number of individuals) | 90 | A start value of 90 individuals has been assigned, based on the number of plants in three of the proposed offset properties. It should be noted that there are more individuals in adjacent areas likely to be used as offsets for the project, and the start value may be increased if necessary. |
| Future value without offset (number of individuals) | 81 | The existing threats to areas of habitat on private property are likely to include weed invasion, livestock, ongoing clearing and underscrubbing for development and/or other activities such as agriculture/hobby farming. Therefore the future value without the offset includes a reduction of 9 individuals in recognition of these ongoing threats. |
| Future value with offset (number of individuals) | 99 | A future site value of 99 individuals has been assigned based on the potential for translocation and/or plantings, and ongoing management improving habitat conditions to facilitate natural recruitment of individuals increasing the start value by nine individuals. |
| Confidence in result (%) | 90 | There is a high confidence of a potential offset to provide an improved outcome for the species considering the number of individuals that would potentially be protected, providing an improved outcome for the species. This is based on adequate restoration, monitoring and management actions being implemented. |
| % of impact offset | 104% | This scenario would provide for 104% of the required offset. |
| Other measures (up to 10%) | 10 | There is potential to provide up to 10% of the offset as other measures. This may include restoration or protection of areas of habitat for the species (ie fencing a council reserve) and/or contributions towards research of the species. |

Sclerophyll forest habitats

This section details potential offset requirements for *Angophora robur*, *Arthraxon hispidus*, *Eucalyptus tetrapleura* and *Quassia* sp. Moonee Creek, which generally occur in dry sclerophyll forest habitats including drainage lines within dry forest areas.

***Angophora robur* (Sandstone Rough-barked Apple)**

Angophora robur (Sandstone Rough-barked Apple) was recorded in Sections 3, 4 and 5.

The SPIR assessed impacts to 84.1 hectares of occupied habitat for the species, containing an estimated 7,056 individuals. Additional investigations during threatened flora preconstruction surveys (Jacobs 2014) found no major changes to the distribution and abundance of *Angophora robur* from previous surveys. The current clearing boundary will directly impact 91.68 hectares of occupied habitat for *Angophora robur*, containing an estimated 6551 individuals.

The number of individuals that would be impacted has been quantified along with the area of habitat. However, for this assessment, the area of habitat is considered more appropriate to provide an estimate of the offset requirements, rather than population number.

The species intergrades with two other common (not threatened) *Angophora* species occurring in the locality, *Angophora subvelutina* and *Angophora woodsiana*, and intergrades have been identified in the study area. Considering the large population present in the project area and short project timeframes, it was impractical to identify all potential intergrades. Based on advice from the NSW Herbarium at the time, the presence of intergrades between *Angophora robur* and *Angophora woodsiana* were identified in the project area and excluded from impact calculations, and taking a precautionary approach the remaining trees were assumed to be *Angophora robur* (Jacobs 2014a).

Geolink (2014) assigned habitat quality scores for *Angophora robur* to vegetation polygons mapped in Section 3. HQS for the species were based on vegetation condition, connectivity to similar vegetation types and presence of species based on Wildlife Atlas records and the results of recent surveys. *Angophora robur* habitat polygons mapped by Jacobs (2014) were intersected with the scored vegetation mapping to determine the area and quality of occupied habitat for the species. Andrew Carty (Senior Botanist, Jacobs) reviewed the habitat quality scores and mapping in February 2015 and assigned revised HQS based on the criteria previously used by Geolink and detailed field assessment of the population.

Indirect impacts on the remaining individuals of *Angophora robur* adjacent to the project footprint are not anticipated to be substantial and mitigation measures would be implemented to manage weeds, water quality and diseases that may potentially result in indirect impacts on individuals and habitats. The project footprint would be downstream of the majority of the retained individuals. Considering *Angophora robur* has been observed growing in edge-affected habitats throughout the study area and grows in low nutrient soils with a lower susceptibility to weeds (including roadsides), impacts from edge effects are not anticipated to be substantial.

According to the calculator, an offset supporting a total of 410 hectares of occupied *Angophora robur* habitat with similar habitat quality would be sufficient to offset the 91.68 hectares directly impacted. The values and a rationale for the offset measures are provided in Table C6.

Table C6. *Angophora robur* – impacts and a rationale for offset measures

| Attribute | Values | | | | Rationale |
|---|--------|-------|-------|--------|---|
| | HQS 7 | HQS 8 | HQS 9 | HQS 10 | |
| IMPACT AREA | | | | | |
| Area (ha) | 1.26 | 14.65 | 8.48 | 67.29 | A total area of 91.68 of habitat occupied by <i>Angophora robur</i> will be directly impacted by the project. |
| Start quality (scale of 0-10) | 7 | 8 | 9 | 10 | The habitat quality scores were assigned based on the habitat values within the area occupied by the species (see Attachment 1 for further detail). |
| OFFSET AREA | | | | | |
| Time over which loss is averted (max. 20 years) | 20 | 20 | 20 | 20 | This describes the timeframe over which changes to the level of risk to a proposed offset site can be considered and quantified. This value is capped at 20 years or the life of an offset whichever is shorter. Considering the offset is proposed to be established in perpetuity, the maximum risk-related time horizon was assigned. |
| Time until ecological benefit (years) | 5 | 5 | 5 | 5 | Considering the relatively high condition and moderate/minimal threats to the majority of habitat in the locality occupied by <i>Angophora robur</i> , there is envisaged to be minimal management requirements on a potential offset site supporting a relatively large area of occupied habitat. Therefore five years has been assigned for the establishment and initial management of an offset site, and similarly the time until ecological benefit has been assigned the same value. |
| Area (ha) | 4 | 47 | 29 | 330 | A total area of 410 hectares of habitat occupied by <i>Angophora robur</i> with similar habitat qualities would be sufficient to offset the impacts from the project. |
| Start quality (scale of 0-10) | 6 | 7 | 8 | 10 | Habitat quality of a potential offset site has been assumed to be similar to that in the impact area. |
| Risk of loss (%) without offset | 16 | 16 | 16 | 16 | The existing threats to areas of occupied habitat on private property are likely to include weed invasion, livestock, feral fauna species, ongoing clearing and underscrubbing for development and/or other activities such as agriculture/quarries and altered fire regimes. As such, a risk of loss without the offset has been identified as 16%. |
| Future quality without offset (scale of 0-10) | 5 | 6 | 7 | 9 | Considering the likely existing threats to areas of occupied habitat on private property, the future quality has been reduced by a single point from the start quality. |
| Risk of loss (%) with offset | 1 | 1 | 1 | 1 | An offset site would substantially reduce the risk of loss by eliminating the majority of threats to the species, however some residual risk is considered to be present and a value of 1% has been assigned. |

| Attribute | Values | | | | Rationale |
|--|--------|-------|-------|--------|---|
| | HQS 7 | HQS 8 | HQS 9 | HQS 10 | |
| Future quality with offset (scale of 0-10) | 7 | 8 | 9 | 10 | It is envisaged with the implementation of management and restoration measures, the future quality of the offset would be increased by at least one point (or maintained at existing levels where habitat quality is 10). |
| Confidence in result (%) | 90 | 90 | 90 | 90 | There is a high confidence of a potential offset providing an improved outcome for <i>Angophora robur</i> provided adequate restoration, monitoring and management actions are implemented. |
| % of impact offset | 110 | 102 | 101 | 100 | This scenario would provide for at least 100% of the required offset, depending upon the attributes of any proposed offset, the values can be modified within reason to achieve a minimum of 90% of the offset. |
| Other measures (up to 10%) | 10 | 10 | 10 | 10 | There is potential to provide up to 10% of the offset as other measures. This may include restoration of areas of habitat and/or contributions towards research into <i>Angophora robur</i> . |

***Arthraxon hispidus* (Hairy Joint Grass)**

Arthraxon hispidus (Hairy Joint Grass) was recorded in Sections 1, 8 and 10. This species occurs in or on the edges of rainforest and in wet sclerophyll forest, including modified habitats such as exotic grasslands. In the study area it occurs in areas of low elevated pasture and derived grassland subject to flooding, including the edges of rainforest patches. There are difficulties in identifying *Arthraxon hispidus* individuals due to the creeping habit and density of the species where it occurs. Therefore the assessment is based on the area of direct and indirect impact on habitat occupied by this species.

The SPIR assessed impacts to an estimated 8.4 hectares of occupied habitat for *Arthraxon hispidus* as well as indirect impacts to five hectares. Additional investigations during threatened flora preconstruction surveys (Jacobs 2014) found several additional areas of occupied habitat for the species in Section 10, as well as determining that some previously mapped populations were not currently present, most likely due to altered management regimes.

Habitat quality scores were assigned for *Arthraxon hispidus* to vegetation polygons mapped in Sections 1, 8, and 10. HQS for the species were based on vegetation condition (including attributes such as presence of drainage lines, creeks, and areas of periodic inundation, or low lying areas with an open canopy), connectivity to preferred habitat types and likely occurrence or confirmed presence of the species.

The mapping of occupied habitat for *Arthraxon hispidus* was revised by overlaying all point records of the species from detailed site surveys and enclosing the points with polygons. In order to further account for indirect impacts to *Arthraxon hispidus*, all areas of occupied habitat up to 20 metres outside the clearing boundary were included in offset calculations. The occupied habitat polygons were intersected with the habitat quality scored vegetation mapping to determine the area and quality of occupied habitat for the species.

The total area of direct and potential indirect impact comprises 3.11 hectares. According to the calculator, an offset supporting a total 8.9 hectares of occupied *Arthraxon hispidus* habitat with

similar habitat quality to that impacted would be sufficient to offset the impacts of the project. The values and a rationale for the offset measures are provided in Table C7.

Table C7. *Arthraxon hispidus* – impacts and a rationale for offset measures

| Attribute | Values | | | Rationale |
|---|--------|-------|--------|---|
| | HQS 6 | HQS 9 | HQS 10 | |
| IMPACT AREA | | | | |
| Area (ha) | 0.21 | 1.74 | 1.16 | A total of 3.11 hectares of occupied habitat for <i>Arthraxon hispidus</i> will be directly and potentially indirectly impacted by the project. |
| Start quality (scale of 0-10) | 6 | 9 | 10 | The habitat quality scores were assigned based on the habitat values within the area occupied by the species (see Attachment 1 for further detail) |
| OFFSET AREA | | | | |
| Time over which loss is averted (max. 20 years) | 20 | 20 | 20 | Considering the offset is proposed to be established in perpetuity, the maximum risk-related time horizon was assigned. |
| Time until ecological benefit (years) | 5 | 5 | 5 | A time horizon of 5 years has been assigned to establish the offset site following the impacts from the project and for the ecological benefit of the offset to be realised. This may include translocation and establishment of impacted individuals on an offset site and appropriate monitoring and management actions. |
| Area (ha) | 0.5 | 4.6 | 3.8 | A total offset area of 8.9 hectares of occupied habitat with similar habitat qualities would be sufficient to offset the impacts from the project. |
| Start quality (scale of 0-10) | 5 | 8 | 10 | Habitat quality of a potential offset site has been assumed to be similar to or slightly lower than that of the impact area. |
| Risk of loss (%) without offset | 40 | 40 | 40 | Considering the occurrence of the species within existing areas of pasture currently grazed by livestock and potentially subject to impacts from other agricultural activities on private property, the potential for loss in the absence of an offset and appropriate management is considered to be greater for this species. Therefore a risk of loss without the offset has been identified as 40%. |
| Future quality without offset (scale of 0-10) | 4 | 7 | 9 | Considering the existing threats to occupied habitat on private property, the future quality has been reduced by a single point from the start quality. |
| Risk of loss (%) with offset | 10 | 10 | 10 | Considering the existing high level of threat to occupied habitat a residual risk of 10% has been assigned. |
| Future quality with offset (scale of 0-10) | 6 | 9 | 10 | It is envisaged with the implementation of management and restoration measures, the future quality of the offset would be increased (or maintained at existing levels where habitat quality is 10). |

| Attribute | Values | | | Rationale |
|----------------------------|--------|-------|--------|--|
| | HQS 6 | HQS 9 | HQS 10 | |
| Confidence in result (%) | 90 | 90 | 90 | There is some level of risk from translocation of individuals, however there is a high confidence of a potential offset with an existing population providing an improved outcome for this species provided adequate restoration, monitoring and management actions are implemented. |
| % of impact offset | 104 | 100 | 103 | This scenario would provide for at least 100% of the required offset; depending upon the attributes of any proposed offset, the values can be modified within reason to achieve a minimum of 90% of the offset. |
| Other measures (up to 10%) | 10 | 10 | 10 | There is potential to provide up to 10% of the offset as other measures such as contributions towards research of the species. |

***Eucalyptus tetrapleura* (Square-fruited Ironbark)**

Eucalyptus tetrapleura (Square-fruited Ironbark) was recorded in Section 2 of the Project.

The SPIR assessed impacts to 16.08 hectares of occupied habitat for the species, containing an estimated 1,213 individuals. Additional investigations during threatened flora preconstruction surveys (Jacobs 2014) found no major changes to the spatial distribution and abundance of *Eucalyptus tetrapleura* from previous surveys. Design amendments and minor revisions in habitat mapping have resulted in revised impacts of 20.97 hectares of occupied habitat for *Eucalyptus tetrapleura*, containing an estimated 822 individuals.

The number of individuals that would be impacted has been quantified along with the area of habitat. However, for this assessment, the area of habitat is considered more appropriate to provide an estimate of the offset requirements, rather than population number.

Biosis (2014) assigned habitat scores for *Eucalyptus tetrapleura* to vegetation polygons mapped by Ecosure (2014) where this species was recorded, with adjoining polygons of suitable habitat also being scored. HQS for the species were based on vegetation condition, patch size, connectivity to similar vegetation types and presence of the species based on recent surveys. The *Eucalyptus tetrapleura* habitat polygons mapped by Jacobs (2014) were intersected with the scored vegetation mapping to determine the area and quality of occupied habitat for the species.

Considering the lower susceptibility of the species to indirect impacts and the relatively large area of habitat included in the impact and offset calculations, no additional impact has been assigned for indirect impacts.

According to the calculator, an offset supporting 128.98 hectares of occupied *Eucalyptus tetrapleura* habitat of similar habitat quality would be sufficient to offset the 20.97 hectares directly impacted. The values and a rationale for the offset measures are provided in Table C8.

Table C8. *Eucalyptus tetrapleura* – impacts and a rationale for offset measures

| Attribute | Values | | | Rationale |
|---|--------|-------|--------|---|
| | HQS 8 | HQS 9 | HQS 10 | |
| IMPACT AREA | | | | |
| Area (ha) | 0.05 | 1.61 | 19.31 | A total of 20.97 ha of habitat occupied by <i>Eucalyptus tetrapleura</i> will be directly impacted by the project. |
| Start quality (scale of 0-10) | 8 | 9 | 10 | The habitat quality scores were assigned based on the habitat values within the area occupied by the species (see Attachment 1 for further detail) |
| OFFSET AREA | | | | |
| Time over which loss is averted (max. 20 years) | 20 | 20 | 20 | This describes the timeframe over which changes to the level of risk to a proposed offset site can be considered and quantified. This value is capped at 20 years or the life of an offset whichever is shorter. Considering the offset is proposed to be established in perpetuity, the maximum risk-related time horizon was assigned. |
| Time until ecological benefit (years) | 5 | 5 | 5 | Considering the relatively high condition and moderate/minimal threats to the majority of habitat in the locality occupied by <i>Eucalyptus tetrapleura</i> , there are envisaged to be minimal management requirements on a potential offset site supporting a relatively large area of occupied habitat. Therefore five years has been assigned for the establishment and initial management of an offset site, and similarly the time until ecological benefit has been assigned the same value. |
| Area (ha) | 0.18 | 6.3 | 122.5 | A total of 128.98 hectares of habitat occupied by <i>Eucalyptus tetrapleura</i> with similar habitat qualities would be sufficient to offset the impacts from the project. |
| Start quality (scale of 0-10) | 7 | 8 | 10 | Habitat quality of a potential offset site has been assumed to be similar to or slightly lower than that of the impact area. |
| Risk of loss (%) without offset | 10 | 10 | 10 | The existing threats to areas of occupied habitat on private property are likely to include weed invasion, livestock, feral fauna species, ongoing clearing and underscrubbing for development and/or other activities such as agriculture/quarries and altered fire regimes. As such, a risk of loss without the offset has been identified as 10%. |
| Future quality without offset (scale of 0-10) | 6 | 7 | 9 | Considering the likely existing threats to areas of occupied habitat on private property, the future quality has been reduced by a single point from the start quality. |
| Risk of loss (%) with offset | 1 | 1 | 1 | An offset site would substantially reduce the risk of loss by eliminating the majority of threats to the species, however some residual risk is considered to be present and a value of 1% has been assigned. |

| Attribute | Values | | | Rationale |
|--|--------|-------|--------|--|
| | HQS 8 | HQS 9 | HQS 10 | |
| Future quality with offset (scale of 0-10) | 8 | 9 | 10 | It is envisaged with the implementation of management and restoration measures, the future quality of the offset would be increased (or maintained at existing levels where habitat quality is 10). |
| Confidence in result (%) | 90 | 90 | 90 | There is a high confidence of a potential offset providing an improved outcome for <i>Eucalyptus tetrapleura</i> provided adequate restoration, monitoring and management actions are implemented. |
| % of impact offset | 100 | 100 | 100 | This scenario would provide for 100% of the required offset, depending upon the attributes of any proposed offset, the values can be modified within reason to achieve a minimum of 90% of the offset. |
| Other measures (up to 10%) | 10 | 10 | 10 | There is potential to provide up to 10% of the offset as other measures. This may include restoration of areas of habitat and/or contributions towards research of <i>Eucalyptus tetrapleura</i> . |

Quassia sp. Moonee Creek (Moonee Quassia)

Quassia sp. Moonee Creek (Moonee Quassia) was recorded in Section 1.

Surveys of this species for the EIS and SPIR recorded a total of 899 stems, of which 35 would be directly impacted in the project footprint and up to 167 stems within 10 metres of the construction edge would be indirectly impacted.

Additional investigations during threatened flora preconstruction surveys (Jacobs 2014) found no major changes to the spatial distribution and abundance of *Quassia sp. Moonee Creek* from previous surveys.

Design amendments in Section 1 have resulted in an increased direct impact to 73 stems of *Quassia sp. Moonee Creek*, and indirect impacts of 137 stems within 10 metres of the clearing boundary. The total impact is 210 stems, an increase of eight stems.

Indirect impacts could result from altered exposure and light levels and increased potential for competition from weeds and other flora due to the altered conditions. The counting of stems was considered more appropriate as the extent of each individual was unknown (as this plant is known for suckering, shoots would grow from lateral roots or buried stems and may emerge some distance from the originating plant). Therefore the offset assessment has been based on the number of stems.

According to the calculator, an offset supporting 817 stems with restoration measures to increase the population by at least 215 stems would be sufficient to offset the 210 stems of *Quassia sp. Moonee Creek* potentially impacted by the project. The values and a rationale for the offset measures are provided in Table C9.

Table C9. *Quassia* sp. Moonee Creek – impacts and rationale for offset measures

| Attribute | Value | Rationale |
|---|-------|--|
| IMPACT | | |
| Number of individuals impacted | 210 | A total of 210 stems will potentially be impacted (73 direct and 137 indirect) |
| OFFSET | | |
| Time horizon (years) | 20 | This describes the timeframe over which changes to the level of risk to a proposed offset site can be considered and quantified. This value is capped at 20 years or the life of an offset whichever is shorter. Considering the offset is proposed to be established in perpetuity, the maximum risk-related time horizon was assigned. |
| Start value (number of individuals) | 817 | An offset with at least 817 stems of <i>Quassia</i> sp. Moonee Creek with similar habitat qualities would be sufficient to offset the impacts from the project. |
| Future value without offset (number of individuals) | 735 | The existing threats to areas of habitat on private property are likely to include ongoing clearing and underscrubbing for development and/or other activities such as agriculture/quarries. The future value of the offset includes a reduction of 82 stems (10%) in recognition of these ongoing threats. |
| Future value with offset (number of individuals) | 1032 | A future site value of 1032 individuals has been assigned based on the potential for translocation and/or plantings, and ongoing management improving habitat conditions to facilitate natural recruitment of individuals increasing the start value by 215 stems. |
| Confidence in result (%) | 90 | There is a high confidence of a potential offset considering the existing number of individuals that would potentially be protected providing an improved outcome for the species. This is based on adequate restoration, monitoring and management actions being implemented. |
| % of impact offset | 100 | This scenario would provide for 100% of the required offset. |
| Other measures (up to 10%) | 10 | There is potential to provide up to 10% of the offset as other measures. This may include restoration of areas of habitat and/or contributions towards research of the species. |

***Prostanthera cineolifera* (Singleton Mint Bush)**

Prostanthera cineolifera (Singleton Mint Bush) was recorded in Section 6. This species was recorded along Tabbimoble Creek inhabiting a narrow belt of deep sandy soils on the creek banks and surrounding flats. Impacts on *Prostanthera cineolifera* were estimated in the SPIR to consist of 250 individuals occurring over 0.4 hectares, from an estimated population of 5000 to 8000 individuals occurring over around 2.2 hectares surrounding Tabbimoble Creek. The taxonomic status and distribution of this species and other species in the same genus is uncertain.

Given the high density of plants of the species across a relatively small area, the assessment is based on the area of impact on habitat occupied by this species. The area of occupied habitat was mapped by enclosing all point records for the species with polygons and applying a five metre

buffer to account for GPS error and potential indirect impacts. Habitat quality scores for *Prostanthera cineolifera* were assigned to vegetation polygons mapped in Section 6 by Aecom (2014). HQS for the species were based on presence of suitable habitat, significantly large tracts of native forest in the broader landscape, and confirmed presence of the species.

There is potential for indirect impacts on this species, but habitat for the species impacted is currently edge-affected and open to livestock, so the species is likely to be somewhat tolerant of edge effects and it persists in areas adjacent to the existing highway. Proposed mitigation measures would limit the potential for indirect impacts to have a substantial impact on the surrounding population.

The total area of direct impacts to this species habitat comprises 0.42 hectares. According to the calculator, an offset supporting up to 2.2 hectares of occupied *Prostanthera cineolifera* habitat of similar habitat quality would be sufficient to offset the 0.42 hectares directly impacted. The values and a rationale for the offset measures are provided in Table C10.

Table C10. *Prostanthera cineolifera* – impacts and rationale for offset measures

| Attribute | Value | Rationale |
|---|-------|--|
| IMPACT AREA | | |
| Area (ha) | 0.42 | Impacts to occupied habitat are 0.42 hectares |
| Start quality (scale of 0-10) | 10 | Given the high density of the species in areas of occupied habitat and connectivity to adjacent occupied areas, the habitat for this species to be impacted was assigned the highest possible score. |
| OFFSET AREA | | |
| Time over which loss is averted (max. 20 years) | 20 | This describes the timeframe over which changes to the level of risk to a proposed offset site can be considered and quantified. This value is capped at 20 years or the life of an offset whichever is shorter. Considering the offset is proposed to be established in perpetuity, the maximum risk-related time horizon was assigned. |
| Time until ecological benefit (years) | 5 | Existing threats to the species on offset properties will need to be managed including fencing and weed removal. A 5 year period has been allowed for management actions to be implemented. |
| Area (ha) | 2.2 | An offset of 2.2 hectares of habitat occupied by <i>Prostanthera cineolifera</i> with similar habitat quality would be sufficient to offset the impacts from the project. |
| Start quality (scale of 0-10) | 10 | The habitat quality of the potential offset site is expected to be similar to that of the impact site – particularly as offsets for this species are likely to be located on adjacent land. |
| Risk of loss (%) without offset | 15 | Considering the existing threats to this species on private property comprising ongoing degradation of habitat, weed invasion and removal of plants for agricultural activities the risk of loss without offset has been identified as 15%. |
| Future quality without offset (scale of 0-10) | 9 | Existing threats to populations on the potential offset site have the potential to further degrade habitat. It has been assumed the future quality is reduced by a single point from the start quality. |

| Attribute | Value | Rationale |
|--|-------|---|
| Risk of loss (%) with offset | 1 | An offset site would substantially reduce the risk of loss by eliminating the majority of threats to the species, however some residual risk is considered to be present and a value of 1% has been assigned. |
| Future quality with offset (scale of 0-10) | 10 | It is envisaged with the implementation of management and restoration measures the future quality of the offset would be maintained at existing levels. |
| Confidence in result (%) | 90 | There is a high confidence of a potential offset providing an improved outcome for <i>Prostanthera cineolifera</i> provided adequate restoration, monitoring and management actions are implemented. |
| % of impact offset | 104 | This scenario would provide for 105% of the required offset, depending upon the attributes of any proposed offset, the values can be modified within reason to achieve a minimum of 90% of the offset. |
| Other measures (up to 10%) | 10 | There is potential to provide up to 10% of the offset as other measures. This may include restoration of areas of habitat and/or contributions towards research of <i>Prostanthera cineolifera</i> . Considering the uncertain taxonomic status and distribution of the species, scientific research into these factors would substantially contribute towards the conservation of the species. |

Threatened fauna

Pink Underwing Moth (*Phyllodes imperialis smithersi*)

The Pink Underwing Moth (*Phyllodes imperialis smithersi*) was identified in areas of lowland rainforest at Section 10, although individuals and host plants were recorded outside of the impact area. Areas of potential foraging habitat for the species were identified in the field over an area totalling 2.61 hectares within the project footprint.

Habitat quality scoring was applied to known and potential habitat based on connectivity to large tracts of vegetation/known habitat, the presence of the host plant (*Carronia multiseppalea*) required for breeding, presence of larvae or moth, and habitat condition.

The PIR identified two large areas (covering 33.2 hectares) as known habitat for Pink Underwing Moth where moth larvae were detected on the host plant (*Carronia multiseppalea*) in Section 10 of the study area. 18.1 hectares of habitat was also identified in Section 10 that comprised areas where the host plant was detected with no larvae, yet representing potential breeding habitat for the moth. The remaining areas of habitat identified in the PIR comprised potential habitat where the host plant was not recorded but some food plant species were. Impacts on Pink Underwing Moth from the project would be limited to vegetation of this potential habitat type, generally comprising a habitat quality score of 6 or 7. No host plants are present in the impact areas and no confirmed presence of the moth, though there is some connectivity to vegetation containing the host plant in impact areas.

The PIR identified 2.5 hectares of habitat for the species to be removed. However, minor boundary adjustments and mapping revisions identifying additional habitat at Chainage 157200 resulted in an additional 0.11 hectares of habitat removal. It is understood that the most recent Threatened Vertebrate Management Plan (Roads and Maritime Services July 2015) has identified a greater area of foraging habitat to be removed. Any increase in impacts for this species will be addressed through updates to the Biodiversity Offset Status Report and Biodiversity Offset Package.

There is still potential for indirect impacts on areas of known habitat, mainly from road lighting at the interchange at Wardell. This impact is anticipated to be low, however, given the intersection has been relocated away and lighting structures to minimise light spill into adjacent areas. In addition, impacts on the *Phyllodes* spp from artificial lights are considered unlikely, with the species showing little attraction to them (Dr Don Sands, pers. comm.).

According to the calculator, an offset supporting 9.05 hectares of potential habitat would be sufficient to offset the impact on 2.61 hectares of habitat. Offsets for this species are likely to be provided in areas of known Pink Underwing Moth breeding habitat adjacent to the project. The values and a rationale for the offset measures are provided in Table C11.

Table C11. Pink Underwing Moth – impacts and a rationale for offset measures

| Attribute | Values | | | Rationale |
|---|--------|-------|-------|---|
| | HQS 4 | HQS 6 | HQS 7 | |
| IMPACT AREA | | | | |
| Area (ha) | 0.39 | 0.68 | 1.54 | A total area of 2.6 ha of potential habitat will be directly impacted by the project. |
| Start quality (scale of 0-10) (average) | 4 | 6 | 7 | Habitat scores are based on generally good habitat condition and connectivity to large tracts of vegetation, although no host plants were recorded in the impact areas. |
| OFFSET AREA | | | | |

| Attribute | Values | | | Rationale |
|---|--------|-------|-------|---|
| | HQS 4 | HQS 6 | HQS 7 | |
| Time over which loss is averted (max. 20 years) | 20 | 20 | 20 | Considering the offset is proposed to be established in perpetuity, the maximum risk-related time horizon was assigned. |
| Time until ecological benefit (years) | 10 | 10 | 10 | Restoration measures would likely be required on an offset site supporting lowland rainforest to manage/eliminate existing threatening processes and improve habitat quality attributes. Although an offset site would support high quality rainforest habitats management activities to minimise existing threats are likely to be achieved within 10 years. |
| Area (ha) | 0.85 | 2.3 | 5.9 | A total area of 9.05 hectares of habitat occupied by the host plant and Pink Underwing Moth would be sufficient to offset the impacts from the project. |
| Start quality (scale of 0-10) | 9 | 9 | 9 | This is the habitat quality of adjacent areas of habitat avoided by the project which support Pink Underwing Moth (and the host plant) habitat. If the habitat quality of a potential offset site is assumed to be the same as the impact area (6) the offset requirements can still be achieved provided a larger offset area is provided. |
| Risk of loss (%) without offset | 30 | 30 | 30 | The existing threats to areas of lowland rainforest (potential habitat) on private property are likely to include weed invasion, livestock, feral fauna species, ongoing clearing and underscrubbing for development and/or other activities such as agriculture/hobby farming. As such, a risk of loss without the offset has been identified as 30%. |
| Future quality without offset (scale of 0-10) | 8 | 8 | 8 | Considering the likely existing threats to areas of lowland rainforest (potential habitat) on private property, the future quality has been reduced by a single point from the start quality. |
| Risk of loss (%) with offset | 10 | 10 | 10 | Considering the existing high level of threat to potential habitat a residual risk of 10% has been assigned. |
| Future quality with offset (scale of 0-10) | 9 | 9 | 9 | It is envisaged with the implementation of management and restoration measures the future quality of the offset would be maintained at existing levels. |
| Confidence in result (%) | 90 | 90 | 90 | There is a high confidence of a potential offset providing an improved outcome for Pink Underwing Moth provided adequate restoration, monitoring and management actions are implemented. |
| % of impact offset | 100 | 103 | 100 | This scenario would provide for at least 100% of the required offset, depending upon the attributes of any proposed offset, the values can be modified within reason to achieve a minimum of 90% of the offset. |
| Other measures (up to 10%) | 10 | 10 | 10 | There is potential to provide up to 10% of the offset as other measures. This may include restoration of areas of habitat and/or contributions towards research of Pink Underwing Moth. |

Koala (*Phascolarctos cinereus*)

The SPIR estimated that 375 ha of primary and secondary 'habitat critical to the survival of Koala' habitat would be cleared throughout the Project footprint. This figure was derived from 160 habitat assessment plots, each 0.1 ha in size and distributed throughout a similar number of vegetation polygons, in which absence of the required percentage composition (30% and 50%) of primary and secondary Koala food trees was interpreted as absence of primary and secondary Koala habitat within the entire vegetation polygon. This methodology was based on Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC 2012) Interim Koala referral advice for proponents.

Detailed vegetation surveys for the project in 2014 included habitat quality scoring of vegetation polygons in accordance with the EPBC Act Environmental Offset Policy (October 2012). Habitat quality scores were assigned for the Koala assessing presence of preferred feed trees, habitat connectivity and quality. Habitat quality scores ranged from 3 to 10, with an average score of 5.94. In total, the project would directly impact on 884.73 hectares of identified habitat.

The 884.73 hectares of mapped vegetation that has been assigned a habitat quality score for koala, as estimated using this method, is larger than the 375 ha estimated as 'habitat critical to the survival of the Koala' (DSEWPaC 2012) in the SPIR. This is because Roads and Maritime have decided to take a more conservative approach to estimating the area of Koala habitat that would be removed as part of the Project. RMS assumed that all Biometric Vegetation Types that nominally contain Koala food tree species (regardless of percentage tree cover) or provide resting or connecting habitat were included in determining habitat quality scores. As such calculations included all possible koala habitat ie 'tertiary koala habitat' in these calculations and forms the basis for determining offsets under the EPBC Act Biodiversity Offsets Policy.

MCoA D4 requires that offset sites are identified to compensate for impacts on Koala populations at Coolgardie/Bagotville, Broadwater and Woombah/Iluka. In order to determine the extent of impacts on these Koala populations, the populations were geographically defined in relation to the project, in consultation with Dr Rod Kavanagh (Niche Environment and Heritage), as located approximately between the following project chainages:

- Iluka/Woombah: ch 94200 – 98400
- Broadwater: ch 135500 – 145650
- Coolgardie/Bagotville: ch 146000 - 159600

The areas of each population within the project boundary were mapped, and the habitat quality mapping undertaken in 2014 was used to calculate the extent and quality of Koala habitat to be impacted within these areas.

According to the calculator, a total of 2136.8 hectares of potential habitat would be sufficient to offset the total direct impact on 884.73 hectares of potential Koala habitat. The impacts and offset requirements for each of the Koala populations identified in MCoA D4 have been calculated separately (Table C12a).

Table C12a. Impacts and offset requirements for identified Koala populations and other areas in the Project

| Area within Project | | Direct impacts (ha) | Approximate offset required (ha) |
|-------------------------------------|-----------------------|---------------------|----------------------------------|
| Population as identified in MCoA D4 | Iluka/Woombah | 22.96 | 60.01 |
| | Broadwater | 37.84 | 67.4 |
| | Coolgardie/Bagotville | 39.23 | 104.7 |
| Total D4 populations | | 100.03 | 232.11 |
| All other areas | | 784.70 | 1904.69 |
| Total | | 884.73 | 2136.8 |

Indirect impacts on Koala would be mitigated through connectivity structures, including large underpasses, overland bridges and exclusion fencing, as well as through general mitigation measures including Koala habitat revegetation and weed management. Considering the proposed measures to mitigate indirect impacts on Koala, no additional values have been assigned to the calculator for indirect impacts.

The values and a rationale for the offset measures are provided in Tables C12b to e. Tables C12b to d present the values for impacts and offset requirements within the Iluka/Woombah, Broadwater and Coolgardie/Bagotville Koala populations, and Table C12e presents the values for impacts and offset requirements in all other areas of the project.

Table C12b. Koala – impacts and rationale for offset measures (Iluka/Woombah)

| Attribute | Values | | | | |
|---|--------|-------|-------|-------|-------|
| | HQS 4 | HQS 5 | HQS 6 | HQS 7 | HQS 8 |
| IMPACT AREA | | | | | |
| Area (ha) | 0.06 | 5.38 | 3.45 | 11.44 | 2.63 |
| Start quality (scale of 0-10) | 4 | 5 | 6 | 7 | 8 |
| OFFSET AREA | | | | | |
| Time over which loss is averted (max. 20 years) | 20 | 20 | 20 | 20 | 20 |
| Time until ecological benefit (years) | 2 | 2 | 2 | 2 | 2 |
| Area (ha) | 0.11 | 11.4 | 8.8 | 31.8 | 7.9 |
| Start quality (scale of 0-10) | 5 | 5 | 5 | 6 | 7 |
| Risk of loss (%) without offset | 20 | 20 | 20 | 20 | 20 |
| Future quality without offset (scale of 0-10) | 4 | 4 | 4 | 5 | 6 |
| Risk of loss (%) with offset | 2 | 2 | 2 | 2 | 2 |
| Future quality with offset (scale of 0-10) | 6 | 6 | 6 | 7 | 8 |

| Attribute | Values | | | | |
|----------------------------|--------|-------|-------|-------|-------|
| | HQS 4 | HQS 5 | HQS 6 | HQS 7 | HQS 8 |
| Confidence in result (%) | 90 | 90 | 90 | 90 | 90 |
| % of impact offset | 109 | 100 | 101 | 100 | 101 |
| Other measures (up to 10%) | 10 | 10 | 10 | 10 | 10 |

Table C12c. Koala – impacts and rationale for offset measures (Broadwater)

| Attribute | Values | | | | | | |
|---|--------|-------|-------|-------|-------|-------|-------|
| | HQS 3 | HQS 4 | HQS 5 | HQS 6 | HQS 7 | HQS 8 | HQS 9 |
| IMPACT AREA | | | | | | | |
| Area (ha) | 14.04 | 15.56 | 2.24 | 0.44 | 0.17 | 2.04 | 3.35 |
| Start quality (scale of 0-10) | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| OFFSET AREA | | | | | | | |
| Time over which loss is averted (max. 20 years) | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| Time until ecological benefit (years) | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Area (ha) | 17.8 | 26.3 | 4.8 | 1.2 | 0.5 | 6.1 | 10.7 |
| Start quality (scale of 0-10) | 5 | 5 | 5 | 5 | 6 | 7 | 8 |
| Risk of loss (%) without offset | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| Future quality without offset (scale of 0-10) | 4 | 4 | 4 | 4 | 5 | 6 | 7 |
| Risk of loss (%) with offset | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Future quality with offset (scale of 0-10) | 6 | 6 | 6 | 6 | 7 | 8 | 9 |
| Confidence in result (%) | 90 | 90 | 90 | 90 | 90 | 90 | 90 |
| % of impact offset | 100 | 100 | 102 | 108 | 106 | 100 | 101 |
| Other measures (up to 10%) | 10 | 10 | 10 | 10 | 10 | 10 | 10 |

Table C12d. Koala – impacts and rationale for offset measures (Coolgardie/Bagotville)

| Attribute | Values | | | | | | | | |
|-------------------------------|--------|-------|-------|-------|-------|-------|-------|--------|--|
| | HQS 3 | HQS 4 | HQS 5 | HQS 6 | HQS 7 | HQS 8 | HQS 9 | HQS 10 | |
| IMPACT AREA | | | | | | | | | |
| Area (ha) | 2.45 | 2.59 | 10.78 | 7.47 | 6.07 | 2.30 | 1.51 | 6.06 | |
| Start quality (scale of 0-10) | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | |

| Attribute | Values | | | | | | | |
|---|--------|-------|-------|-------|-------|-------|-------|--------|
| | HQS 3 | HQS 4 | HQS 5 | HQS 6 | HQS 7 | HQS 8 | HQS 9 | HQS 10 |
| OFFSET AREA | | | | | | | | |
| Time over which loss is averted (max. 20 years) | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| Time until ecological benefit (years) | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Area (ha) | 3.2 | 4.4 | 22.8 | 19 | 16.9 | 6.9 | 4.8 | 26.7 |
| Start quality (scale of 0-10) | 5 | 5 | 5 | 5 | 6 | 7 | 8 | 10 |
| Risk of loss (%) without offset | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| Future quality without offset (scale of 0-10) | 4 | 4 | 4 | 4 | 5 | 6 | 7 | 9 |
| Risk of loss (%) with offset | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Future quality with offset (scale of 0-10) | 6 | 6 | 6 | 6 | 7 | 8 | 9 | 10 |
| Confidence in result (%) | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 |
| % of impact offset | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 102 |
| Other measures (up to 10%) | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |

Table C12e. Koala – impacts and rationale for offset measures (all other areas)

| Attribute | Values | | | | | | | |
|---|--------|-------|--------|--------|--------|-------|-------|--------|
| | HQS 3 | HQS 4 | HQS 5 | HQS 6 | HQS 7 | HQS 8 | HQS 9 | HQS 10 |
| IMPACT AREA | | | | | | | | |
| Area (ha) | 17.81 | 92.11 | 177.04 | 218.90 | 172.36 | 99.73 | 6.73 | 0.02 |
| Start quality (scale of 0-10) | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| OFFSET AREA | | | | | | | | |
| Time over which loss is averted (max. 20 years) | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| Time until ecological benefit (years) | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Area (ha) | 22.6 | 155.6 | 374 | 555 | 478 | 298 | 21.4 | 0.09 |

| Attribute | Values | | | | | | | |
|---|--------|-------|-------|-------|-------|-------|-------|--------|
| | HQS 3 | HQS 4 | HQS 5 | HQS 6 | HQS 7 | HQS 8 | HQS 9 | HQS 10 |
| Start quality (scale of 0-10) | 5 | 5 | 5 | 5 | 6 | 7 | 8 | 10 |
| Risk of loss (%) without offset | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| Future quality without offset (scale of 0-10) | 4 | 4 | 4 | 4 | 5 | 6 | 7 | 9 |
| Risk of loss (%) with offset | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Future quality with offset (scale of 0-10) | 6 | 6 | 6 | 6 | 7 | 8 | 9 | 10 |
| Confidence in result (%) | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 |
| % of impact offset | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 102 |
| Other measures (up to 10%) | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |

| Attribute | Rationale |
|---|--|
| IMPACT AREA | |
| Area (ha) | A total of 884.73 ha mapped as containing primary, secondary and tertiary habitat for the Koala will be impacted by the project. |
| Start quality (scale of 0-10) | The habitat quality scores were assigned based on the habitat values within the mapped areas of primary, secondary and tertiary Koala habitat (see Attachment 1 for further detail) |
| OFFSET AREA | |
| Time over which loss is averted (max. 20 years) | Considering the offset is proposed to be established in perpetuity, the maximum risk-related time horizon was assigned. |
| Time until ecological benefit (years) | An offset area supporting primary, secondary and tertiary habitat for Koala would potentially require minimal management measures for habitat qualities to be present for Koala, considering the presence of feed tree species. Therefore a period of 2 years from the impact has been assigned to secure an offset with the required habitat. |
| Area (ha) | A total area of 2136.8 hectares occupied by primary, secondary and tertiary Koala habitat would be sufficient to offset the impact on 884.73 hectares of primary, secondary and tertiary habitat from the project. |
| Start quality (scale of 0-10) | Habitat quality of a potential offset site has been assumed to be similar to or slightly lower than that of the impact area, with a minimum start quality of 5. |

| Attribute | Rationale |
|---|---|
| Risk of loss (%) without offset | Considering the existing threats to areas of habitat on private property are likely to include weed invasion, forestry, livestock, feral fauna species, ongoing clearing and underscrubbing for development and/or other activities such as agriculture/hobby farming, a risk of loss without the offset has been identified as 20%. |
| Future quality without offset (scale of 0-10) | Considering the likely existing threats to areas of habitat on private property, the future quality has been reduced by a single point from the start quality. |
| Risk of loss (%) with offset | Considering an offset site would remove the majority of threats to potential habitat for Koala (ie removal of feed tree species) a residual risk of 2% has been assigned. |
| Future quality with offset (scale of 0-10) | It is envisaged with the implementation of management and restoration measures the future quality of the offset would be increased above existing levels. In particular, facilitating the restoration of feed trees on cleared and modified land with higher fertility soils would result in an increase in the future quality of an offset area. |
| Confidence in result (%) | There is a high confidence of a potential offset providing an improved outcome for Koala provided adequate restoration, monitoring and management actions are implemented. |
| % of impact offset | This scenario would provide for at least 100% of the required offset, depending upon the attributes of any proposed offset, the values can be modified within reason to achieve a minimum of 90% of the offset. |
| Other measures (up to 10%) | There is potential to provide up to 10% of the offset as other measures. This may include planting of feed trees and/or contributions towards research of Koala. |

Giant Barred Frog (*Mixophyes iteratus*)

The Giant Barred Frog (*Mixophyes iteratus*) was confirmed from three locations including Corindi Creek and Dirty Creek in Section 1, and Halfway Creek in Section 2. Potential habitat was also identified in other areas of these project sections. The PIR also reported potential habitat in sections 3 and 7 however, targeted surveys conducted for the species (Lewis 2014) in these sections resulted in ruling out the presence of habitat.

The PIR rated Giant Barred Frog habitat as either high, moderate or low quality and identified impacts to 14 hectares comprising three hectares of known habitat, 2.2 hectares of moderate quality habitat and 8.8 hectares of low quality habitat.

Vegetation survey reports subsequently ruled out the presence of habitat throughout most of the 14 hectares of impact areas based on targeted surveys. Additional habitat was also identified, including nearly 12 hectares of additional habitat near Wells Crossing at Chainage 22000, and an increase to the amount of habitat at Halfway Creek and further north between Chainage 20,500 and 23,000.

Habitat mapping and quality scores for this species were primarily driven by the recent surveys completed by Lewis and Smith (2014b). Known habitat and habitat likely to support the species was identified by Ben Lewis (Lewis Ecological). Habitat quality scores were assigned to the mapped habitat polygons based on habitat presence, connectivity, and species stocking rate using information from vegetation surveys and the Lewis and Smith (2014b) surveys; where information was lacking, conservative assumptions were made.

Within Sections 1 and 2, 4.91 hectares of habitat for the species would be impacted by the project. Indirect impacts on adjacent areas of habitat are also possible, but mitigation measures would be implemented to minimise any indirect impacts; all areas of habitat within 10 metres of the clearing boundary have been included in offset calculations to account for indirect impacts on this species.

According to the calculator, an offset supporting up to 18.5 hectares of suitable habitat for the species would be sufficient to offset the impact on 4.91 hectares of impacted habitat, provided sufficient management and restoration measures are implemented. The values and a rationale for the offset measures are provided in Table C13.

Table C13. Giant Barred Frog – impacts and rationale for offset measures

| Attribute | Values | | | | Rationale |
|---|--------|-------|-------|-------|---|
| | HQS 5 | HQS 7 | HQS 8 | HQS 9 | |
| IMPACT AREA | | | | | |
| Area (ha) | 0.19 | 0.77 | 2.59 | 1.36 | The project would impact a total of 4.91 hectares of habitat for the species. |
| Start quality (scale of 0-10) (average) | 5 | 7 | 8 | 9 | The habitat quality scores were assigned based on the habitat values within the areas of potential habitat mapped for the species (see Attachment 1 for further detail) |
| OFFSET AREA | | | | | |
| Time over which loss is averted (max. 20 years) | 20 | 20 | 20 | 20 | Considering the offset is proposed to be established in perpetuity, the maximum risk-related time horizon was assigned. |
| Time until ecological benefit (years) | 10 | 10 | 10 | 10 | Although an offset site would support some areas of high or known quality habitat, management activities to minimise existing threats or restoration of disturbed areas of habitat may be required and are likely to be achieved within 10 years. |
| Area (ha) | 0.5 | 2.7 | 9.8 | 5.5 | A total offset of 18.5 hectares occupied by known habitat or high quality habitat and potentially some degraded areas of habitat which could be restored would be sufficient to offset the impact on 4.91 hectares of known and potential habitat from the project. |
| Start quality (scale of 0-10) | 5 | 6 | 7 | 8 | The habitat quality of the potential offset site is expected to be similar to or slightly lower than that of the impact site. |
| Risk of loss (%) without offset | 20 | 20 | 20 | 20 | The existing threats to areas of habitat on private property are likely to include poor water quality, availability of water, sedimentation and erosion, weed invasion, livestock, feral fauna species, ongoing clearing and underscrubbing for development and/or other activities such as agriculture/hobby farming. As such, a risk of loss without the offset has been identified as 20%. |

| Attribute | Values | | | | Rationale |
|---|--------|-------|-------|-------|--|
| | HQS 5 | HQS 7 | HQS 8 | HQS 9 | |
| Future quality without offset (scale of 0-10) | 4 | 5 | 6 | 7 | Considering the likely existing threats to areas of habitat on private property as riparian habitats can often be subject to disturbance from agricultural activities, the future quality has been reduced by a single point from the start quality. |
| Risk of loss (%) with offset | 5 | 5 | 5 | 5 | Considering the existing high level of threat to potential habitat a residual risk of 5% has been assigned. |
| Future quality with offset (scale of 0-10) | 6 | 7 | 8 | 9 | It is envisaged with the implementation of management and restoration measures, the future quality of the offset would be increased by one point above the start quality. |
| Confidence in result (%) | 90 | 90 | 90 | 90 | There is a high confidence of a potential offset providing an improved outcome for Giant Barred Frog provided adequate restoration, monitoring and management actions are implemented. |
| % of impact offset | 100 | 103 | 100 | 101 | This scenario would provide for at least 100% of the required offset, depending upon the attributes of any proposed offset, the values can be modified within reason to achieve a minimum of 90% of the offset. |
| Other measures (up to 10%) | 10 | 10 | 10 | 10 | There is potential to provide up to 10% of the offset as other measures. This may include restoration of areas of habitat and/or contributions towards research into Giant Barred Frog. |

Oxleyan Pygmy Perch (*Nannoperca oxleyana*)

The presence of the endangered species Oxleyan Pygmy Perch (*Nannoperca oxleyana*) (OPP) was confirmed in seven locations in sections 7, 8 and 9 comprising:

- Unnamed watercourse south of Serendipity Road (station 114.0, Section 7)
- Tabbimoble Floodway No. 1 (station 115.3, Section 7)
- Unnamed watercourse at Lang Hill (station 134.7, Section 8)
- Tributaries of McDonalds Creek (station 135.53, Section 8)
- McDonalds Creek (station 136.6, Section 8)
- Montis Gully area (station 141.47, Section 9)
- Swamps in Broadwater National Park (Section 9)

In addition, OPP are known from sites near Section 6 (e.g. Tabbimoble Overflow).

The potential habitat around these locations was mapped and identified as known habitat in the PIR, which included:

- Permanent aquatic habitats. Habitats that provide permanent refuge and potential breeding habitat comprise non-ephemeral streams and lagoons and areas of swamp forest and wet heathland inundated for longer periods. Around 4.2 hectares of permanent aquatic habitats were identified.
- Temporary habitats used for dispersal during flood events. Temporary habitat used for dispersal comprise areas of wet heathland (9.8 hectares), swamp forest (9.8 hectares) and floodplain forest (16.3 hectares) where the species is known to occur.

The PIR identified direct and indirect impacts to 5 hectares of permanent aquatic habitat for the species.

The vegetation survey reports for the project included mapping habitat quality for the species. In some cases, entire vegetation polygons were identified as habitat, including terrestrial habitats which are not suitable for the species. In order to accurately calculate habitat impacts in this instance, any waterbodies that intersected the habitat-scored polygons were included as potential habitat areas, plus a buffer of 10 metres applied to drainage lines, based on average wetted width of streams identified in *Aquatic Monitoring RMS Woolgoolga to Ballina – Sections 6 – 11* (Geolink 2013). In two instances in project section 7 where no drainage line intersects the polygon and habitat was considerably larger than what is described or mapped in the aquatic monitoring report, the largest length of the polygon was measured and a 10m buffer was applied. A total of 8.68 hectares of habitat was calculated to occur in impact areas, including permanent and temporary habitats.

There is potential for indirect impacts on habitat through altered water quality, sunlight exposure, water temperature, habitat connectivity and change in stream flow velocities. Mitigation measures would be implemented to minimise the risk of these indirect impacts.

Oxleyan Pygmy Perch habitats were assigned habitat quality scores based on stream condition and habitat features, habitat connectivity, likelihood of occurrence and presence of breeding/feeding habitat. Habitat quality scores ranged from 3 to 8. The highest quality habitat was identified in sections 6 and 7, though there are fewer aquatic habitats suitable for the species. The majority of the species records are in sections 8 and 9, though habitat in these areas was generally assessed as poor quality.

According to the calculator, an offset supporting up to 15.77 hectares of suitable habitat for the species would be sufficient to offset the impact on 8.68 hectares of potential habitat. The values and a rationale for the offset measures are provided in Table C14.

Table C14. Oxleyan Pygmy Perch – impacts and rationale for offset measures

| Attribute | Values | | | | | | Rationale |
|---|--------|-------|-------|-------|-------|-------|---|
| | HQS 3 | HQS 4 | HQS 5 | HQS 6 | HQS 7 | HQS 8 | |
| IMPACT AREA | | | | | | | |
| Area (ha) | 3.09 | 0.17 | 0.12 | 3.44 | 0.91 | 0.95 | A total of 8.68 hectares of Oxleyan Pygmy Perch habitat has been identified as being directly impacted. |
| Start quality (scale of 0-10) (average) | 3 | 4 | 5 | 6 | 7 | 8 | The habitat quality scores were assigned based on the habitat values within the areas of potential habitat mapped for the species (see Attachment 1 for further detail) |
| OFFSET AREA | | | | | | | |
| Time over which loss is averted (max. 20 years) | 20 | 20 | 20 | 20 | 20 | 20 | Considering the offset is proposed to be established in perpetuity, the maximum risk-related time horizon was assigned. |

| Attribute | Values | | | | | | Rationale |
|---|--------|-------|-------|-------|-------|-------|---|
| | HQS 3 | HQS 4 | HQS 5 | HQS 6 | HQS 7 | HQS 8 | |
| Time until ecological benefit (years) | 5 | 5 | 5 | 5 | 5 | 5 | Although an offset site would support some areas of high or known quality habitat, management activities to minimise existing threats or restoration of disturbed areas of habitat may be required and are likely to be achieved within 5 years. |
| Area (ha) | 3.4 | 0.25 | 0.22 | 7.5 | 2.1 | 2.3 | A total area of 15.77 hectares of permanent aquatic habitat occupied by Oxleyan Pygmy Perch and/or potentially including some degraded areas of habitat which could be restored would be sufficient to offset the impact on 8.68 hectares of known/potential habitat from the project. |
| Start quality (scale of 0-10) | 5 | 5 | 5 | 5 | 6 | 7 | Considering much of the high quality habitat for the species is within conserved lands, there may be limited opportunities to provide an offset with high quality known habitat. However areas of degraded habitat such as drainage lines and channels through cleared and open paddocks which are connected to areas of known habitat are present in areas surrounding the project which could potentially be restored as habitat for the species. For the purpose of offset calculations, habitat quality of a potential offset site has been assumed to be similar to or slightly lower than that of the impact area, with a minimum start quality of 5. |
| Risk of loss (%) without offset | 50 | 50 | 50 | 50 | 50 | 50 | The existing threats to areas of habitat on private property are likely to include poor water quality, sedimentation and erosion, weed invasion, livestock, feral fauna species, ongoing clearing and underscrubbing for development and/or other activities such as agriculture/hobby farming. As such, a higher risk of loss without the offset has been identified as 50%. |
| Future quality without offset (scale of 0-10) | 4 | 4 | 4 | 4 | 5 | 6 | Considering the likely existing threats to areas of habitat on private property given that riparian habitats can often be subject to disturbance from agricultural activities, the future quality has been reduced by a single point from the start quality. |
| Risk of loss (%) with offset | 5 | 5 | 5 | 5 | 5 | 5 | Considering the existing high level of threat to potential habitat a residual risk of 5% has been assigned. |

| Attribute | Values | | | | | | Rationale |
|--|----------|----------|----------|----------|----------|----------|--|
| | HQS 3 | HQS 4 | HQS 5 | HQS 6 | HQS 7 | HQS 8 | |
| Future quality with offset (scale of 0-10) | 6 | 6 | 6 | 6 | 7 | 8 | It is envisaged with the implementation of management and restoration measures (assuming there are some areas of degraded habitat within proposed offset sites) the future quality of the offset would be increased by at least one point above the start quality. |
| Confidence in result (%) | 90 | 90 | 90 | 90 | 90 | 90 | There is a high confidence of a potential offset providing an improved outcome for Oxleyan Pygmy Perch provided adequate restoration, monitoring and management actions are implemented. |
| % of impact offset | 101 | 102 | 101 | 100 | 102 | 103 | This scenario would provide for at least 100% of the required offset, depending upon the attributes of any proposed offset, the values can be modified within reason to achieve a minimum of 90% of the offset. |
| Other measures (up to 10%) | 10 | 10 | 10 | 10 | 10 | 10 | There is potential to provide up to 10% of the offset as other measures. This may include restoration of areas of potential habitat and/or contributions towards research of Oxleyan Pygmy Perch. |

Spotted-tailed Quoll (*Dasyurus maculatus maculatus*)

The Spotted-tailed Quoll (*Dasyurus maculatus*) is a wide-ranging species with large home ranges known to use a diversity of habitat types. Habitat quality scores were assigned for this species by considering the presence of preferred habitat features such as hollow-bearing trees and other potential den sites, habitat connectivity and previous records of the species.

The project would directly impact an area of habitat for this species comprising 795.8 hectares, which includes most vegetation types. Cleared habitats, rainforest, coastal floodplain and habitat dominated by *Cinnamomum camphora* (Camphor laurel) were excluded. Habitat quality scores for the mapped areas of habitat range from 2 to 9, with an average score of 5.22.

The PIR assessed impacts to 932.6 hectares of this species habitat based on an assumption that all vegetation types provide habitat for the species. Habitat mapping was revised to exclude some habitats (as noted above) and as such, impacts and offsetting requirements have reduced for this species.

According to the calculator, an offset supporting up to 2059 hectares of potential habitat would be sufficient to offset the impact on 795.8 hectares of potential habitat. The values and a rationale for the offset measures are provided in Table C15.

Table C15. Spotted-tailed Quoll – impacts and rationale for offset measures

| Attribute | Values | | | | | | |
|---|--------|-------|-------|--------|--------|--------|-------|
| | HQS 3 | HQS 4 | HQS 5 | HQS 6 | HQS 7 | HQS 8 | HQS 9 |
| IMPACT AREA | | | | | | | |
| Area (ha) | 37.21 | 53.27 | 65.44 | 195.81 | 303.16 | 115.36 | 25.55 |
| Start quality (scale of 0-10) | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| OFFSET AREA | | | | | | | |
| Time over which loss is averted (max. 20 years) | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| Time until ecological benefit (years) | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| Area (ha) | 48.5 | 92.5 | 142 | 509 | 846.5 | 341 | 79.5 |
| Start quality (scale of 0-10) | 5 | 5 | 5 | 5 | 6 | 7 | 8 |
| Risk of loss (%) without offset | 30 | 30 | 30 | 30 | 30 | 30 | 30 |
| Future quality without offset (scale of 0-10) | 4 | 4 | 4 | 4 | 5 | 6 | 7 |
| Risk of loss (%) with offset | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Future quality with offset (scale of 0-10) | 6 | 6 | 6 | 6 | 7 | 8 | 9 |
| Confidence in result (%) | 90 | 90 | 90 | 90 | 90 | 90 | 90 |
| % of impact offset | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| Other measures (up to 10%) | 10 | 10 | 10 | 10 | 10 | 10 | 10 |

| Attribute | Rationale |
|-------------------------------|--|
| IMPACT AREA | |
| Area (ha) | The total area of habitat impacted for this species includes most native vegetation types impacted by the project and comprises 795.8 hectares. |
| Start quality (scale of 0-10) | The habitat quality scores were assigned based on the habitat values within the areas of potential habitat mapped for the species (see Attachment 1 for further detail). |

| Attribute | Rationale |
|---|--|
| OFFSET AREA | |
| Time over which loss is averted (max. 20 years) | Considering the offset is proposed to be established in perpetuity, the maximum risk-related time horizon was assigned. |
| Time until ecological benefit (years) | Restoration measures would likely be required on several offset sites including rehabilitation of cleared and modified land to manage/eliminate existing threatening processes and improve habitat quality attributes. Although an offset site would support areas of high quality habitats, management activities to minimise existing threats are likely to be achieved within 10 years. |
| Area (ha) | A total area of 2059 hectares occupied by a mix of high quality habitat and disturbed/cleared areas where habitat restoration would be implemented would be sufficient to offset the impact on 795.8 hectares of habitat from the project. |
| Start quality (scale of 0-10) | Considering the expectation that offset sites will support a mix of high quality habitat and disturbed/cleared areas, habitat quality of a potential offset site has been assumed to be similar to or slightly lower than that of the impact area, with a minimum start quality of 5. |
| Risk of loss (%) without offset | <p>The existing threats to areas of habitat on private property are likely to include weed invasion, forestry, livestock, feral fauna species, ongoing clearing and underscrubbing for development and/or other activities such as agriculture/hobby farming. As such, a risk of loss without the offset has been identified as 30% in recognition of these threats.</p> <p>Note that the risk of loss without the offset for this species is larger than other species considering multiple offset sites would likely be required, which could potentially be widespread in the landscape including a range of threatening processes and different land uses.</p> |
| Future quality without offset (scale of 0-10) | Considering the likely existing threats to areas of habitat on private property, the future quality without offset has been reduced by a single point from the start quality. |
| Risk of loss (%) with offset | Considering an offset site would remove the majority of threat to potential habitat for the species on private properties a residual risk of 2% has been assigned. |
| Future quality with offset (scale of 0-10) | With the implementation of management and restoration measures including rehabilitation of cleared and modified lands, the future quality of the offset has been increased by one point from the start quality in recognition of the restoration efforts which are likely to be required on some offset sites. |
| Confidence in result (%) | There is a high confidence of a potential offset providing an improved outcome for Spotted-tailed Quoll provided adequate restoration, monitoring and management actions are implemented. |
| % of impact offset | This scenario would provide for at least 100% of the required offset, depending upon the attributes of any proposed offset, the values can be modified within reason to achieve a minimum of 90% of the offset. |
| Other measures (up to 10%) | There is potential to provide up to 10% of the offset as other measures. This may include restoration of areas of habitat and/or contributions towards research of Spotted-tailed Quoll. |

Swift Parrot (*Lathamus discolor*)

As the Swift Parrot is a semi-nomadic species that moves large distances in search of flowering resources, their presence in a particular area of coastal NSW is unpredictable and dependent on seasonal and local factors. Habitat for the species comprises flowering trees and shrubs, particularly winter-flowering species. For the purposes of this assessment, vegetation types with preferred feed trees within the project footprint were generally included as habitat for the species. This impact area would comprise a total of 773.24 hectares and excludes cleared areas, open freshwater wetlands and mangrove vegetation. The potential habitats impacted by the project represent non-breeding habitat for the species. Indirect impacts relating to potential modification of understorey floristics and weed invasion are considered to be minor for the species, which rely on flowering trees for foraging.

The PIR assessed impacts to 869.9 hectares of this species habitat. Habitat mapping was revised to exclude some habitat types originally included in the PIR mapping such as coastal cypress pine and rainforest. As such, impacts and offsetting requirements have reduced for this species.

Habitat quality scores were assigned for the species by considering the predominance of preferred feed trees, vegetation structure, habitat connectivity and likelihood of occurrence based on habitat presence and historical records. Habitat quality scores ranged from 2 to 8. The average score was fairly low (5.41) due to low/moderate likelihood of occurrence of the species and the absence of breeding habitat (species does not breed on mainland Australia).

According to the calculator, an offset supporting up to 1760.5 hectares of potential habitat would be sufficient to offset the impact on 773.24 hectares of potential habitat impacted. The values and a rationale for the offset measures are provided in Table C16.

Table C16. Swift Parrot– impacts and rationale for offset measures

| Attribute | Values | | | | | |
|---|--------|-------|--------|--------|--------|-------|
| | HQS 3 | HQS 4 | HQS 5 | HQS 6 | HQS 7 | HQS 8 |
| IMPACT AREA | | | | | | |
| Area (ha) | 83.27 | 47.49 | 327.62 | 111.56 | 192.27 | 11.03 |
| Start quality (scale of 0-10) | 3 | 4 | 5 | 6 | 7 | 8 |
| OFFSET AREA | | | | | | |
| Time over which loss is averted (max. 20 years) | 20 | 20 | 20 | 20 | 20 | 20 |
| Time until ecological benefit (years) | 10 | 10 | 10 | 10 | 10 | 10 |
| Area (ha) | 108.5 | 82.5 | 709.5 | 290 | 537 | 33 |
| Start quality (scale of 0-10) | 5 | 5 | 5 | 5 | 6 | 7 |
| Risk of loss (%) without offset | 30 | 30 | 30 | 30 | 30 | 30 |
| Future quality without offset (scale of 0-10) | 4 | 4 | 4 | 4 | 5 | 6 |

| Attribute | Values | | | | | |
|--|--------|-------|-------|-------|-------|-------|
| | HQS 3 | HQS 4 | HQS 5 | HQS 6 | HQS 7 | HQS 8 |
| Risk of loss (%) with offset | 2 | 2 | 2 | 2 | 2 | 2 |
| Future quality with offset (scale of 0-10) | 6 | 6 | 6 | 6 | 7 | 8 |
| Confidence in result (%) | 90 | 90 | 90 | 90 | 90 | 90 |
| % of impact offset | 100 | 100 | 100 | 100 | 100 | 101 |
| Other measures (up to 10%) | 10 | 10 | 10 | 10 | 10 | 10 |

| Attribute | Rationale |
|---|--|
| IMPACT AREA | |
| Area (ha) | A total area of 773.24 hectares of seasonal foraging habitat for the species will be impacted, comprising flowering trees and shrubs, particularly winter-flowering species. |
| Start quality (scale of 0-10) | The habitat quality scores were assigned based on the habitat values within the areas of potential habitat mapped for the species (see Attachment 1 for further detail). The average score was fairly low due to low/moderate likelihood of occurrence of the species and the absence of breeding habitat (species does not breed on mainland Australia). |
| OFFSET AREA | |
| Time over which loss is averted (max. 20 years) | Considering the offset is proposed to be established in perpetuity, the maximum risk-related time horizon was assigned. |
| Time until ecological benefit (years) | Restoration measures would likely be required on several offset sites including rehabilitation of cleared and modified land to manage/eliminate exiting threatening processes threatening processes and improve habitat quality attributes. Although an offset site would support areas of high quality habitats management activities to minimise existing threats are likely to be achieved within 10 years. |
| Area (ha) | A total area of 1760.5 hectares occupied by a mix of high quality habitat and disturbed/cleared areas where habitat restoration would be implemented would be sufficient to offset the impact on 773.24 hectares of habitat from the project. |
| Start quality (scale of 0-10) | Considering the expectation that offset sites will support a mix of high quality habitat and disturbed/cleared areas, start habitat quality of potential offset sites has been assumed to be similar to or slightly lower than that of the impact area, with a minimum start quality of 5. |

| Attribute | Rationale |
|---|--|
| Risk of loss (%) without offset | The existing threats to areas of habitat on private property are likely to include weed invasion, livestock, feral fauna species, ongoing clearing and underscrubbing for development and/or other activities such as agriculture/hobby farming. As such, a risk of loss without the offset has been identified as 30% in recognition of these threats. Note that the risk of loss without the offset for this species is larger than other species considering multiple offset sites would likely be required which could potentially be widespread in the landscape including a range of threatening processes and different land uses. |
| Future quality without offset (scale of 0-10) | Considering the likely existing threats to areas of habitat on private property, the future quality has been reduced by a single point from the start quality. |
| Risk of loss (%) with offset | Considering an offset site would remove the majority of threat to potential habitat for the species on private properties a residual risk of 2% has been assigned. |
| Future quality with offset (scale of 0-10) | It is envisaged with the implementation of management and restoration measures including rehabilitation of cleared and modified lands, the future quality of the offset has been increased by one point from the start quality in recognition of the restoration efforts which are likely to be required on some offset sites. |
| Confidence in result (%) | There is a high confidence of a potential offset providing an improved outcome for Swift Parrot with the protection of habitat and restoration, monitoring and management actions are to improve and maintain habitat quality. |
| % of impact offset | This scenario would provide for at least 100% of the required offset; depending upon the attributes of any proposed offset, the values can be modified within reason to achieve a minimum of 90% of the offset. |
| Other measures (up to 10%) | There is potential to provide up to 10% of the offset as other measures. This may include restoration of areas of non-breeding habitat and/or contributions towards research into Swift Parrot. |

Regent Honeyeater (*Anthochaera phrygia*)

Regent Honeyeaters occur in dry open forest and woodland, particularly Box-Ironbark woodland, riparian forests of River Sheoak and seasonally in coastal Swamp Mahogany woodland and Spotted Gum Forests. This species has specific foraging requirements (e.g. a specific list of species it will forage in) but will forage in disturbed habitats. For the purposes of this assessment, vegetation types with preferred feed trees were generally included as habitat for the species. This impact area comprises 722.73 hectares of vegetation and excludes cleared areas, open freshwater wetlands and mangrove vegetation. Indirect impacts relating to potential modification of understorey floristics and weed invasion are considered to be minor for the species, which rely on flowering trees for foraging.

The PIR assessed impacts to 869.9 hectares of this species habitat. Habitat mapping was revised to exclude some habitat types originally included in habitat mapping such as coastal cypress pine and rainforest. As such, impacts and offsetting requirements have reduced for this species.

Habitat quality scores were assigned for the species by considering the presence of preferred habitat, vegetation structure, habitat connectivity and likelihood of occurrence based on presence of over-wintering habitat and historical records. Habitat quality scores ranged from 2 to 8. The

average score was fairly low (5.2) due to low/moderate likelihood of occurrence of the species and low condition and/or habitat connectivity.

According to the calculator, an offset supporting up to 1594 hectares of potential habitat would be sufficient to offset the impact on 722.73 hectares of potential habitat potentially directly and indirectly impacted. The values and a rationale for the offset measures are provided in Table C17.

Table C17. Regent Honeyeater – impacts and rationale for offset measures

| Attribute | Values | | | | | | Rationale |
|---|--------|-------|--------|-------|--------|-------|---|
| | HQS 3 | HQS 4 | HQS 5 | HQS 6 | HQS 7 | HQS 8 | |
| IMPACT AREA | | | | | | | |
| Area (ha) | 108.34 | 37.20 | 337.32 | 77.42 | 151.52 | 10.93 | A total area of 722.73 hectares of foraging habitat for the species will be impacted, comprising vegetation types with preferred feed trees. |
| Start quality (scale of 0-10) | 3 | 4 | 5 | 6 | 7 | 8 | The habitat quality scores were assigned based on the habitat values within the areas of potential habitat mapped for the species (see Attachment 1 for further detail). The average score was fairly low due to low/moderate likelihood of occurrence of the species and low condition and/or habitat connectivity. |
| OFFSET AREA | | | | | | | |
| Time over which loss is averted (max. 20 years) | 20 | 20 | 20 | 20 | 20 | 20 | Considering the offset is proposed to be established in perpetuity, the maximum risk-related time horizon was assigned. |
| Time until ecological benefit (years) | 10 | 10 | 10 | 10 | 10 | 10 | Restoration measures would likely be required on several offset sites including rehabilitation of cleared and modified land to manage/eliminate existing threatening processes threatening processes and improve habitat quality attributes. Although an offset site would support areas of high quality habitats management activities to minimise existing threats are likely to be achieved within 10 years. |
| Area (ha) | 141 | 64.5 | 731 | 202 | 423 | 32.5 | A total area of 1594 hectares occupied by a mix of high quality habitat and disturbed/cleared areas where habitat restoration would be implemented would be sufficient to offset the impact on 722.73 hectares of habitat from the project. |

| Attribute | Values | | | | | | Rationale |
|---|--------|-------|-------|-------|-------|-------|---|
| | HQS 3 | HQS 4 | HQS 5 | HQS 6 | HQS 7 | HQS 8 | |
| Start quality (scale of 0-10) | 5 | 5 | 5 | 5 | 6 | 7 | Considering the expectation that offset sites will support a mix of high quality habitat and disturbed/cleared areas, start habitat quality of potential offset sites has been assumed to be similar to or slightly lower than that of the impact area, with a minimum start quality of 5. |
| Risk of loss (%) without offset | 30 | 30 | 30 | 30 | 30 | 30 | <p>The existing threats to areas of habitat on private property are likely to include weed invasion, livestock, feral fauna species, ongoing clearing and underscrubbing for development and/or other activities such as agriculture/hobby farming. As such, a risk of loss without the offset has been identified as 30% in recognition of these threats.</p> <p>Note that the risk of loss without the offset for this species is larger than other species considering multiple offset sites would likely be required which could potentially be widespread in the landscape including a range of threatening processes and different land uses.</p> |
| Future quality without offset (scale of 0-10) | 4 | 4 | 4 | 4 | 5 | 6 | Considering the likely existing threats to areas of habitat on private property, the future quality has been reduced by a single point from the start quality. |
| Risk of loss (%) with offset | 2 | 2 | 2 | 2 | 2 | 2 | Considering an offset site would remove the majority of threat to potential habitat for the species on private properties a residual risk of 2% has been assigned. |
| Future quality with offset (scale of 0-10) | 6 | 6 | 6 | 6 | 7 | 8 | It is envisaged with the implementation of management and restoration measures including rehabilitation of cleared and modified lands, the future quality of the offset could be increased by at least one point from the start quality in recognition of the restoration efforts which are likely to be required on some offset sites. |
| Confidence in result (%) | 90 | 90 | 90 | 90 | 90 | 90 | There is a high confidence of a potential offset providing an improved outcome for Regent Honeyeater with the protection of habitat and restoration, monitoring and management actions are to improve and maintain habitat quality. |

| Attribute | Values | | | | | | Rationale |
|----------------------------|--------|-------|-------|-------|-------|-------|---|
| | HQS 3 | HQS 4 | HQS 5 | HQS 6 | HQS 7 | HQS 8 | |
| % of impact offset | 100 | 100 | 100 | 101 | 100 | 100 | This scenario would provide for at least 100% of the required offset, depending upon the attributes of any proposed offset, the values can be modified within reason to achieve a minimum of 90% of the offset. |
| Other measures (up to 10%) | 10 | 10 | 10 | 10 | 10 | 10 | There is potential to provide up to 10% of the offset as other measures. This may include restoration of areas of non-breeding habitat and/or contributions towards research of Regent Honeyeater. |

Long-nosed Potoroo (*Potorous tridactylus*)

The Long-nosed Potoroo (*Potorous tridactylus*) was recorded in Wardell Heath in Section 10 associated with the wet and dry heath habitats on sandy soils. Known habitat and habitat likely to support the species was identified and scored by Ben Lewis (Lewis Ecological) based on survey and encompassed native vegetation communities that have sufficiently dense ground cover for refuge, patchy open areas and a substrate that enables the species to readily forage for their preferred food items (i.e. hypogeous fungi). Landscape factors such as patch size and/or relative connectivity were also considered. The project would directly impact an area of habitat for this species comprising 48.21 hectares, and would indirectly impact an additional 1.11 hectares of potential habitat that would be left isolated between carriageways, and would no longer represent habitat following construction.

Habitat quality scores were assigned by considering vegetation structure, habitat connectivity and the species presence and activity levels observed from targeted surveys. Habitat quality scores ranged from 8 to 10 with the average score being 8.79. Habitat scores were generally high as the species is only likely to occur in high quality habitat. It is sensitive to disturbance, making it unlikely to occur in areas with poor habitat quality.

According to the calculator, an offset supporting up to 137 hectares of potential habitat would be sufficient to offset the impacts on 48.21 hectares of habitat directly impacted and 1.11 hectares of habitat indirectly impacted. The values and a rationale for the offset measures are provided in Table C18.

Table C18. Long-nosed Potoroo – impacts and rationale for offset measures

| Attribute | Value | | | Rationale |
|-------------|-------|-------|--------|--|
| | HQS 8 | HQS 9 | HQS 10 | |
| IMPACT AREA | | | | |
| Area (ha) | 21.19 | 17.16 | 10.97 | The total area of habitat directly and indirectly impacted for this species is 49.32 hectares considering vegetation structure, presence of patchy open areas and a suitable substrate for foraging. |

| Attribute | Value | | | Rationale |
|---|-------|-------|--------|---|
| | HQS 8 | HQS 9 | HQS 10 | |
| Start quality (scale of 0-10) (average) | 8 | 9 | 10 | The habitat quality scores were assigned based on the habitat values within the areas of potential habitat mapped for the species (see Attachment 1 for further detail). |
| OFFSET AREA | | | | |
| Time over which loss is averted (max. 20 years) | 20 | 20 | 20 | Considering the offset is proposed to be established in perpetuity, the maximum risk-related time horizon was assigned. |
| Time until ecological benefit (years) | 10 | 10 | 10 | Restoration measures would likely be required on several offset sites including rehabilitation of cleared and modified land to manage/eliminate existing threatening processes threatening processes and improve habitat quality attributes. Although an offset site would support areas of high quality habitats management activities to minimise existing threats are likely to be achieved within 10 years. |
| Area (ha) | 54 | 46 | 37 | A total area of 137 hectares occupied by predominantly good quality habitat and some disturbed/cleared areas where habitat restoration would be implemented would be sufficient to offset the impact on 49.32 hectares of habitat from the project. |
| Start quality (scale of 0-10) | 7 | 8 | 10 | Habitat quality of a potential offset site is expected to be similar to or slightly lower than that of the impact site. |
| Risk of loss (%) without offset | 30 | 30 | 30 | The existing threats to areas of habitat on private property are likely to include weed invasion, forestry, livestock, feral fauna species, ongoing clearing and underscrubbing for development and/or other activities such as agriculture/hobby farming. As such, a risk of loss without the offset has been identified as 30% in recognition of these threats. |
| Future quality without offset (scale of 0-10) | 6 | 7 | 9 | Considering the specific habitat requirements of the species and the likely existing threats to areas of habitat on private property, the future quality has been reduced by a single point from the start quality. |
| Risk of loss (%) with offset | 2 | 2 | 2 | Considering an offset site would remove the majority of threat to potential habitat for the species on private properties a residual risk of 2% has been assigned. |
| Future quality with offset (scale of 0-10) | 8 | 9 | 10 | With the implementation of management and restoration measures including rehabilitation of cleared and modified lands, the future quality of the offset has been increased by one point from the start quality in recognition of the restoration efforts which are likely to be required on some offset sites. |
| Confidence in result (%) | 90 | 90 | 90 | There is a high confidence of a potential offset providing an improved outcome for Long-nosed Potoroo provided adequate restoration, monitoring and management actions are implemented. |

| Attribute | Value | | | Rationale |
|----------------------------|-------|-------|--------|--|
| | HQS 8 | HQS 9 | HQS 10 | |
| % of impact offset | 100 | 100 | 100 | This scenario would provide for 100% of the required offset, depending upon the attributes of any proposed offset, the values can be modified within reason to achieve a minimum of 90% of the offset. |
| Other measures (up to 10%) | 10 | 10 | 10 | There is potential to provide up to 10% of the offset as other measures. This may include restoration of areas of habitat and/or contributions towards research of Long-nosed Potoroo. |

Wallum Sedge Frog (*Litoria olongburensis*)

The Wallum Sedge Frog (*Litoria olongburensis*) was confirmed in project sections 8, 9 and 10. The species is found in coastal sandplain wallum swamps with an acidic pH (2.8-5.5). They were identified around 500 m east of ch.135800 in Broadwater National Park, Broadwater West, within 100 m of ch.142500 on Broadwater Beach Road, around 450 m west of ch.146750 and in a number of disturbed ponds on Ballina Shire Council land to the east of 148250-148650. Habitat is also in areas adjacent to ch.135800-136400, ch.136500-136800 and areas either side of ch.139900 during more favourable seasons.

Targeted surveys were conducted for the species in project sections 6 to 11 (Lewis and Smith 2014b). As a result of these surveys, no suitable habitat was identified in section 6 and the species was considered unlikely to occur in sections 7 and 11. As such, no habitat has been mapped outside of sections 8-10.

Habitat quality scores for this species were primarily driven by the recent surveys completed by Lewis and Smith (2014b). Known habitat and habitat likely to support the species was identified by Ben Lewis (Lewis Ecological). Habitat quality scores were assigned to the mapped habitat polygons based on habitat presence, connectivity, and species stocking rate using information from vegetation surveys and the Lewis and Smith (2014b) surveys; where information was lacking, conservative assumptions were made. The distinction between breeding and foraging habitat for the Wallum Sedge Frog was also considered when scoring species stocking rates.

Within Sections 8-10, 12.73 hectares of habitat for the species would be impacted by the project. Indirect impacts on adjacent areas of habitat are also possible, but mitigation measures would be implemented to minimise any indirect impacts; all areas of habitat within 10 metres of the clearing boundary have been included in offset calculations to account for indirect impacts on this species.

According to the calculator, an offset supporting up to 43.4 hectares with suitable habitat for the species would be sufficient to offset the impact on 12.73 hectares of potential habitat directly and indirectly impacted, provided sufficient management and restoration measures are implemented. The values and a rationale for the offset measures are provided in Table C19.

Table C19. Wallum Sedge Frog – impacts and rationale for offset measures

| Attribute | Values | | | Rationale |
|-------------|--------|-------|--------|---|
| | HQS 8 | HQS 9 | HQS 10 | |
| IMPACT AREA | | | | |
| Area (ha) | 10.63 | 1.28 | 0.82 | The project would directly and indirectly impact 12.73 hectares of habitat for the species. |

| Attribute | Values | | | Rationale |
|---|--------|-------|--------|---|
| | HQS 8 | HQS 9 | HQS 10 | |
| Start quality (scale of 0-10) (average) | 8 | 9 | 10 | The habitat quality scores were assigned based on the habitat values within the areas of potential habitat mapped for the species (see Attachment 1 for further detail). Habitat quality was generally high due to high activity levels for the species in habitat areas, good condition and connectivity of habitat. |
| OFFSET AREA | | | | |
| Time over which loss is averted (max. 20 years) | 20 | 20 | 20 | Considering the offset is proposed to be established in perpetuity, the maximum risk-related time horizon was assigned. |
| Time until ecological benefit (years) | 10 | 10 | 10 | Although an offset site would support some areas of high or known quality habitat, management activities to minimise existing threats or restoration of disturbed areas of habitat may be required and are likely to be achieved within 10 years. |
| Area (ha) | 34.8 | 4.5 | 4.1 | A total area of 43.4 hectares occupied by known habitat or high quality habitat and potentially some degraded areas of habitat which could be restored would be sufficient to offset the impact on 12.73 hectares of known and potential habitat from the project. |
| Start quality (scale of 0-10) | 7 | 8 | 10 | The habitat quality of the potential offset site is expected to be similar to or slightly lower than that of the impact site. |
| Risk of loss (%) without offset | 20 | 20 | 20 | The existing threats to areas of habitat on private property are likely to include poor water quality, availability of water, sedimentation and erosion, weed invasion, livestock, feral fauna species, ongoing clearing and underscrubbing for development and/or other activities such as agriculture/hobby farming. As such, a risk of loss without the offset has been identified as 20%. |
| Future quality without offset (scale of 0-10) | 6 | 7 | 9 | Considering the likely existing threats to areas of habitat on private property as riparian habitats can often be subject to disturbance from agricultural activities, the future quality has been reduced by a single point from the start quality. |
| Risk of loss (%) with offset | 5 | 5 | 5 | Considering the existing high level of threat to potential habitat a residual risk of 5% has been assigned. |
| Future quality with offset (scale of 0-10) | 8 | 9 | 10 | It is envisaged with the implementation of management and restoration measures (assuming there are some areas of degraded habitat within proposed offset sites), the future quality of the offset would be increased by one point above the start quality (or maintained at existing levels where start habitat quality is 10). |
| Confidence in result (%) | 90 | 90 | 90 | There is a high confidence of a potential offset providing an improved outcome for Wallum Sedge Frog provided adequate restoration, monitoring and management actions are implemented. |

| Attribute | Values | | | Rationale |
|----------------------------|--------|-------|--------|---|
| | HQS 8 | HQS 9 | HQS 10 | |
| % of impact offset | 101 | 102 | 100 | This scenario would provide for at least 100% of the required offset, depending upon the attributes of any proposed offset, the values can be modified within reason to achieve a minimum of 90% of the offset. |
| Other measures (up to 10%) | 10 | 10 | 10 | There is potential to provide up to 10% of the offset as other measures. This may include restoration of areas of habitat and/or contributions towards research of Wallum Sedge Frog. |

Grey-headed Flying-fox (*Pteropus poliocephalus*)

The Grey-headed Flying-fox (*Pteropus poliocephalus*) is a wide-ranging, highly mobile species known to use a diversity of habitat types. Its habitat was identified as intact native vegetation communities, dominated by Eucalyptus, Corymbia and/or Melaleuca species, rainforest communities and mangrove communities. Cleared areas were not scored although they may provide some marginal or stepping stone habitat values. Vegetation communities dominated by non-preferred tree species (i.e. Casuarina dominated communities, non-forested wetlands) or vegetation polygons in Section 11 described as *Cinnamomum camphora*, were excluded from habitat mapping. Direct impacts to this species habitat total 845.91 hectares.

Habitat quality scores were assigned for this species based on identification of preferred feed trees, known long-term roost sites and the species' dispersal range. Habitat quality scores ranged from 3 to 9 with the majority of habitat being of high-moderate quality scoring 6, 7 or 8.

According to the calculator, an offset supporting up to 2000.5 hectares of potential habitat would be sufficient to offset the impact on 845.91 hectares of potential habitat. The values and a rationale for the offset measures are provided in Table C20.

Table C20. Grey-headed Flying-fox – impacts and rationale for offset measures

| Attribute | Values | | | | | | |
|---|--------|-------|-------|--------|--------|--------|-------|
| | HQS 3 | HQS 4 | HQS 5 | HQS 6 | HQS 7 | HQS 8 | HQS 9 |
| IMPACT AREA | | | | | | | |
| Area (ha) | 33.45 | 13.36 | 35.89 | 114.80 | 185.86 | 407.54 | 55.01 |
| Start quality (scale of 0-10) | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| OFFSET AREA | | | | | | | |
| Time over which loss is averted (max. 20 years) | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| Time until ecological benefit (years) | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| Area (ha) | 37.5 | 20 | 67 | 257 | 445 | 1028 | 146 |
| Start quality (scale of 0-10) | 5 | 5 | 5 | 5 | 6 | 7 | 8 |
| Risk of loss (%) without offset | 30 | 30 | 30 | 30 | 30 | 30 | 30 |

| Attribute | Values | | | | | | |
|---|--------|-------|-------|-------|-------|-------|-------|
| | HQS 3 | HQS 4 | HQS 5 | HQS 6 | HQS 7 | HQS 8 | HQS 9 |
| Future quality without offset (scale of 0-10) | 4 | 4 | 4 | 4 | 5 | 6 | 7 |
| Risk of loss (%) with offset | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Future quality with offset (scale of 0-10) | 6 | 6 | 6 | 6 | 7 | 8 | 9 |
| Confidence in result (%) | 90 | 90 | 90 | 90 | 90 | 90 | 90 |
| % of impact offset | 101 | 101 | 100 | 100 | 100 | 100 | 101 |
| Other measures (up to 10%) | 10 | 10 | 10 | 10 | 10 | 10 | 10 |

| Attribute | Rationale |
|---|--|
| IMPACT AREA | |
| Area (ha) | The total area of habitat impacted for this species includes a range of vegetation types impacted by the project comprising 845.91 hectares. |
| Start quality (scale of 0-10) | The habitat quality scores were assigned based on the habitat values within the areas of potential habitat mapped for the species (see Attachment 1 for further detail). The majority of habitat is high-moderate quality scoring 6, 7 or 8. |
| OFFSET AREA | |
| Time over which loss is averted (max. 20 years) | Considering the offset is proposed to be established in perpetuity, the maximum risk-related time horizon was assigned. |
| Time until ecological benefit (years) | Restoration measures would likely be required on several offset sites including rehabilitation of cleared and modified land to manage/eliminate exiting threatening processes threatening processes and improve habitat quality attributes. Although an offset site would support areas of high quality habitats management activities to minimise existing threats are likely to be achieved within 10 years. |
| Area (ha) | A total area of 2000.5 hectares occupied by a mix of high quality habitat and disturbed/cleared areas where habitat restoration would be implemented would be sufficient to offset the impact on 845.91 hectares of habitat from the project. |
| Start quality (scale of 0-10) | Considering the potential for some offset sites to require restoration of cleared and modified land, the start quality for the offset has been reduced by one point below the impact start quality, with a minimum start quality of 5. |

| Attribute | Rationale |
|---|---|
| Risk of loss (%) without offset | <p>The existing threats to areas of habitat on private property are likely to include weed invasion, forestry, livestock, feral fauna species, ongoing clearing and underscrubbing for development and/or other activities such as agriculture/hobby farming. As such, a risk of loss without the offset has been identified as 30% in recognition of these threats.</p> <p>Note that the risk of loss without the offset for this species is larger than other species considering multiple offset sites would likely be required which could potentially be widespread in the landscape including a range of threatening processes and different land uses.</p> |
| Future quality without offset (scale of 0-10) | Considering the likely existing threats to areas of habitat on private property, the future quality has been reduced by a single point from the start quality. |
| Risk of loss (%) with offset | Considering an offset site would remove the majority of threat to potential habitat for the species on private properties a residual risk of 2% has been assigned. |
| Future quality with offset (scale of 0-10) | With the implementation of management and restoration measures including rehabilitation of cleared and modified lands, the future quality of the offset has been increased by one point from the start quality in recognition of the restoration efforts which are likely to be required on some offset sites. |
| Confidence in result (%) | There is a high confidence of a potential offset providing an improved outcome for Grey-headed Flying-fox provided adequate restoration, monitoring and management actions are implemented. |
| % of impact offset | This scenario would provide for at least 100% of the required offset, depending upon the attributes of any proposed offset, the values can be modified within reason to achieve a minimum of 90% of the offset. |
| Other measures (up to 10%) | There is potential to provide up to 10% of the offset as other measures. This may include restoration of areas of habitat and/or contributions towards research of Grey-headed Flying-fox. |