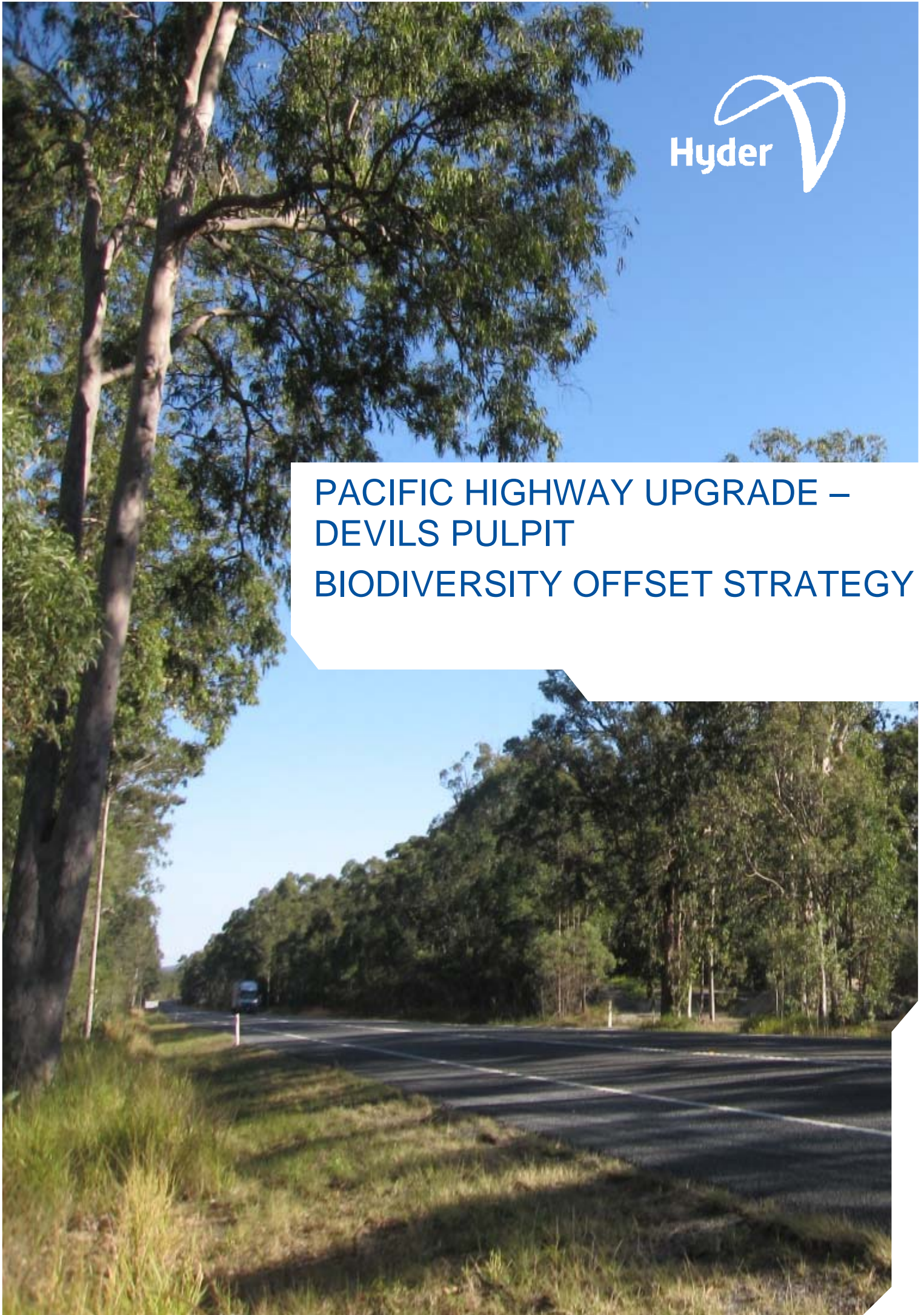




**PACIFIC HIGHWAY UPGRADE –
DEVILS PULPIT
BIODIVERSITY OFFSET STRATEGY**



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ROADS AND MARITIME SERVICES

PACIFIC HIGHWAY UPGRADE - DEVILS PULPIT

Biodiversity Offset Strategy

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Report No

Date 3 April 2012

This report has been prepared for Roads and Maritime Services in accordance with the terms and conditions of appointment for Pacific Highway Upgrade - Devils Pulpit dated 15 April 2011. Hyder Consulting Pty Ltd (ABN 76 104 485 289) cannot accept any responsibility for any use of or reliance on the contents of this report by any third party.

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1 INTRODUCTION

1.1 Background

NSW Roads and Maritime Services (RMS) are proposing to upgrade a 7.3 kilometre section of the Pacific Highway from a single carriageway to a two lane dual carriageway at Devils Pulpit in northern NSW (the Project). This 7.3 kilometre section forms part of the 33 kilometre Iluka Road to Woodburn project. These works are part of the Pacific Highway Upgrade Program, a joint commitment by the Australian and New South Wales (NSW) governments to improve the standard of the Pacific Highway between Hexham and the Queensland border. Figure 1 provides an overview of the proposal.

The Devils Pulpit upgrade consists of a Class M (motorway standard) upgrade comprising a four-lane divided road (two lanes each way) with a minimum median width of 12 metres (from lane edge to lane edge) allowing for the future addition of a third lane in each direction when needed. The existing Pacific Highway will be retained as a service road to the motorway standard upgrade.

The upgrade is being staged to suit available funding and project needs. The initial staging includes five kilometres of Class A (arterial standard) road which will utilise sections of the existing highway as part of the northbound carriageway, plus a new southbound carriageway.

The Devils Pulpit upgrade was given planning approval on 1 February 2011 and construction is scheduled to commence later in 2011 with completion scheduled for mid-2013.

Planning for the Devils Pulpit Upgrade, as for all projects within the Pacific Highway Upgrade Program, has generally followed a hierarchy of principles with regard to biodiversity values along the road corridor:

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

In some instances there are unavoidable impacts that cannot be mitigated. Where impacts are unavoidable, mitigation and management measures are incorporated into the project to reduce impacts. Residual impacts identified for the Devils Pulpit Upgrade include:

- A loss of native vegetation, including the endangered ecological community Subtropical Coastal Floodplain Forest of the NSW North Coast Bioregion.
- A loss of habitat for a variety of protected and threatened native fauna species.

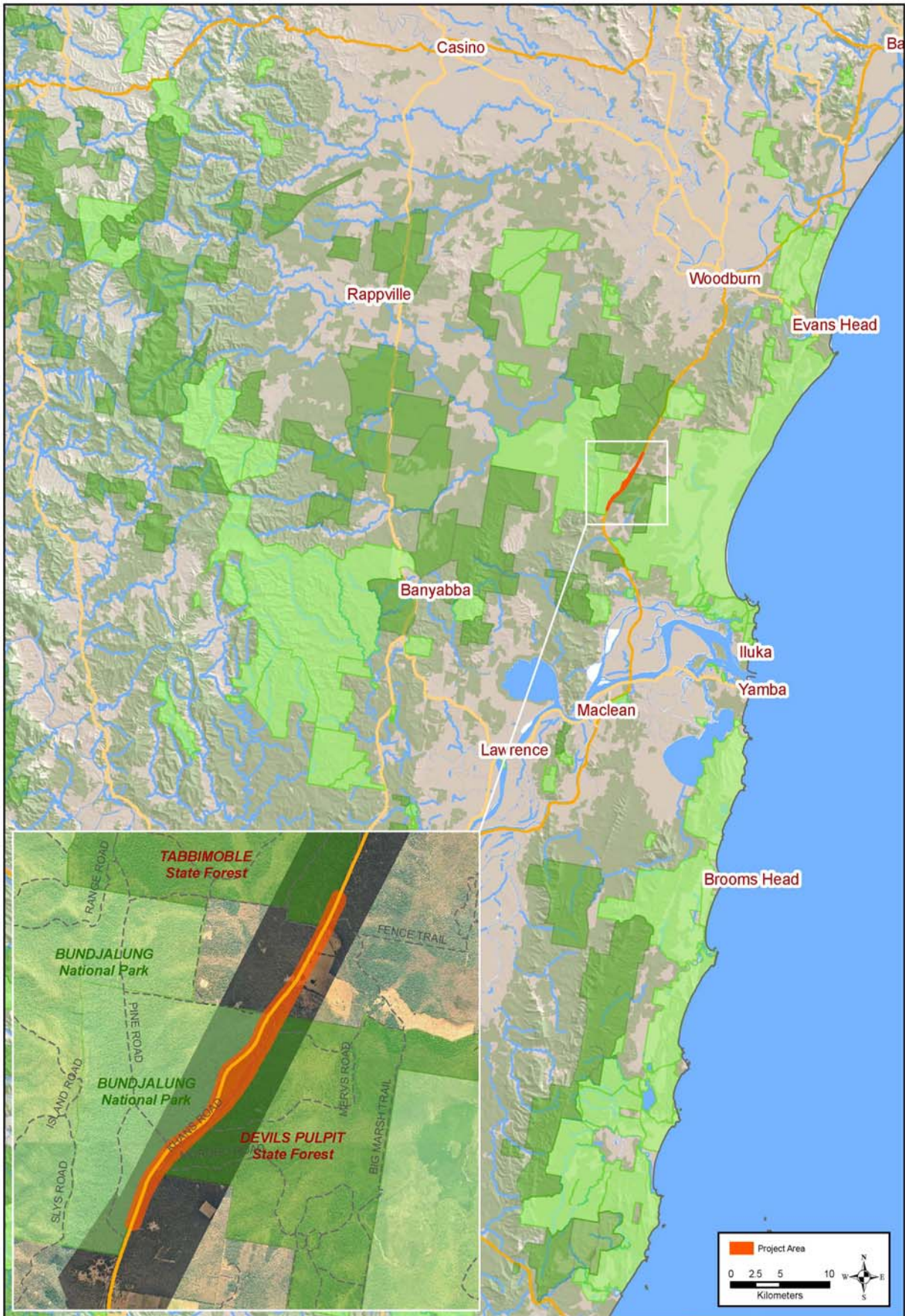


Figure 1: Location of project area

1.2 Purpose of this report

The Devils Pulpit Upgrade has been approved under Part 3A of the NSW *Environmental Planning and Assessment Act 1979*. The conditions of approval required the development of a Biodiversity Offset and Mitigation Strategy and Package. This report has been prepared to satisfy the Minister's Condition of Approval B4 as detailed below.

*B4. The Proponent shall develop a **Biodiversity Offset Strategy** to outline how the ecological values of threatened species and their habitat and EECs lost as a result of the project will be offset. The Strategy shall be developed in consultation with DECCW and DSEWPC, and shall include, but not necessarily be limited to:*

- (a) a minimum requirement to provide 80 hectares of native vegetation to offset direct and indirect impacts of the project on Dry Sclerophyll Forest vegetation;*
- (b) a minimum requirement to provide 72 hectares of Subtropical Coastal Floodplain Forest to offset direct and indirect impacts of the project on this community;*
- (c) a minimum requirement to provide a 60 metre wide vegetated connectivity corridor at the northern end of the project between Ch 70200 – Ch 71900 to improve habitat connectivity in the Tabbimoble Floodways No. 2 and No. 3 area;*
- (d) the objectives and outcomes that would be sought through the biodiversity offset package;*
- (e) consider the biodiversity management measures or activities identified in the documents set out in condition A1 or elsewhere in these conditions of approval, including:
 - (i) fauna crossing measures, including vegetated medians, fauna structures and associated fauna fencing to be installed as part of the project.*
 - (ii) revegetation measures.*
 - (iii) translocation plans;*
 - (iv) any other biodiversity/fauna and flora mitigation measures.*
 - (v) any ongoing biodiversity or threatened species monitoring requirements.**
- (f) details of the available offset measures that have been selected to compensate for the loss of threatened species and EECs, such as the provision for, or contributions towards the regeneration and/or management of the habitat of threatened species on nearby lands. The measures shall achieve a neutral or net beneficial outcome for all threatened species and endangered ecological communities; and*
- (g) 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.*

The Biodiversity Offset Strategy shall be submitted to, and approved by, the Director General prior to the commencement of any construction work that would result in the disturbance of any threatened species and/or endangered ecological community, unless otherwise agreed by the Director General.

Additionally the Minister's Condition of Approval B5 requires the development of a Biodiversity Offset package as outlined below.

B5. *Within 12 months of the approval of the Biodiversity Offset Strategy, unless otherwise agreed by the Director General, the Proponent shall prepare and submit the **Biodiversity Offset Package** for the approval of the Director General. The Package shall be developed in consultation with DECCW and DSEWPC, and shall include, but not necessarily be limited to:*

- (a) the final suite of the biodiversity offset measures selected in accordance with the Biodiversity Offset Strategy;*
- (b) the management and monitoring requirements for compensatory habitat works and other ecological amelioration measures proposed under the Package to ensure the outcomes of the Strategy are achieved; and*
- (c) timing and responsibilities for the implementation of the provisions of the Package over time.*

The requirements of the Package shall be implemented by the responsible parties according to the timeframes set out in the Package.

The Devils Pulpit Upgrade was deemed to be a controlled action under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*. On 14 February 2011 the Commonwealth Department of Sustainability, Environment, Water, Population and Communities (DSEWPC) approved the Project, subject to conditions. The conditions of approval include a requirement for an offset plan, as detailed below:

- 7. *The person taking the action must submit an Offset Plan for approval by the Minister within 12 months of the date of this approval to provide for the conservation and management in perpetuity of a minimum of 152 hectares of habitat for the Grey-headed Flying-fox, the Spotted-tail Quoll, the Regent Honeyeater and the Swift Parrot. The approved plan must be implemented. The Offset Plan must include, but not be limited to:*
 - a. *The acquisition and conservation of land containing a minimum of 152 hectares of habitat for the Grey-headed Flying-fox, the Spotted-tail Quoll, the Regent Honeyeater and the Swift Parrot that is of equal or greater quality to that to be removed for **the Pacific Highway Upgrade**;*
 - b. *The land referred to at condition 7(a) must be located within 50km of the Pacific Highway upgrade at Devil's Pulpit, unless otherwise agreed to by **the department**;*
 - c. *The land referred to at condition 7(a) must be protected by a legal instrument under relevant nature conservation legislation on the title of the area within 18 months of the date of this approval.*
 - d. *The instrument referred to in condition 7(c) must provide for:*
 - i. *The protection of the land in perpetuity*
 - ii. *Prevent any future development activities*
 - iii. *Ensure the active management of the land;*
 - i. *The land referred to at Condition 7(a) must provide linkages to existing habitat for the species of concern.*
 - e. *The Offset Plan must include a clear commitment to ongoing management of the land at Condition 7(a). Management works must be consistent with advice from a **suitably qualified expert**. These measures must commence within 3 months of the legal protection of the land.*

- f. The Plan must include key milestones, performance indicators, corrective actions and timeframes for the completion of all actions outlined in the Plan.*
- g. The Plan must include clear outline of funding for the management in perpetuity of the land at Condition 7(a).*
- h. The Plan must be developed in consultation with the **department**.*

1.3 Objectives of the Biodiversity Offset Strategy

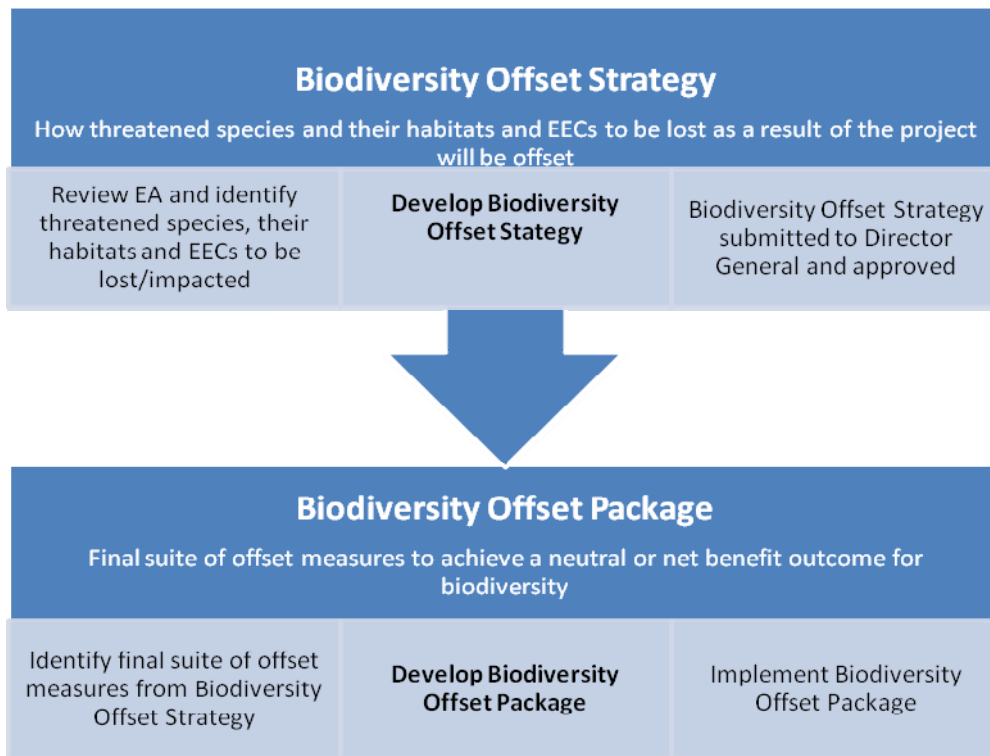
The objective of the Biodiversity Offset Strategy is to deliver a Biodiversity Offset Package that achieves a net regional biodiversity benefit as a result of the upgrade project. The measures used to gauge success of this objective will be:

- An outcome that maintains or improves biodiversity values
- Successfully securing the long-term (in perpetuity) protection and management of lands containing endangered ecological communities and habitat for threatened species (key habitat).
- Meeting the minimum requirements for offsets as specified in the NSW and Commonwealth conditions of approval.
- The total area of lands used to offset the biodiversity impacts shall exceed the direct and indirect (edge effects) impacts of the project.
- The process for setting the scope and quantum of the biodiversity offsets is transparent and justifiable on environmental, social and economic grounds.

1.4 Integration with other ecological reports

The Biodiversity Offset Strategy is part of a suite of reports that document how the biodiversity impacts of the Devils Pulpit Upgrade will be mitigated or offset, and how mitigation actions will be managed and monitored. These reports address the Minister's Conditions of Approval B4, B5 and B6 and DSEWPC condition 7.

The process for the development of these reports is outlined below.



1.5 Structure of this report

The structure of this Biodiversity Offset Strategy is as follows:

- Section 2 identifies the impacts of the upgrade.
- Section 3 details the management of biodiversity impacts, following the principles of avoiding, mitigating and offsetting impacts, and presents the decision-making framework for determining offset measures.
- Section 4 provides conclusions.

1.6 Nomenclature

In this report plant species are referred to by both their scientific and common names (if applicable) when first mentioned. Subsequent references to these species cite the scientific name only. Conversely, animal species are referred to by both their common and scientific names when first mentioned, and subsequently by their common names only.

2 PROJECT IMPACTS

2.1 Impact of the upgrade

The Project runs generally parallel to the eastern side of the existing Pacific Highway and traverses a previously acquired RMS corridor adjacent to Devils Pulpit State Forest. The project crosses Tabbimoble Floodways No. 2 and 3, an unnamed drainage line and Pine Road Creek in the central and southern portions of the study area.

Two broad vegetation formations were identified in the project study area: Dry Sclerophyll Forest and Subtropical Coastal Floodplain Forest. Dry Sclerophyll Forest includes three vegetation communities in the study area: Blackbutt Dry Sclerophyll Forest, Scribbly Gum Dry Sclerophyll Forest and Spotted Gum Dry Sclerophyll Forest. The Dry Sclerophyll Forest communities were assessed to be in good quality overall, with characteristic stands all with strong resilience and low exotic vegetation encroachment. The methodology for assessing vegetation condition was described in section 4.2.1 of the Ecology Technical Working Paper (Appendix D of the EA) and was based on the Good, Moderate and Poor condition categories in the Draft Biobanking Assessment Methodology (DECC 2007).

Subtropical Coastal Floodplain Forest in the study area is comprised of two vegetation communities: Eastern Red Gum Floodplain Forest and Forest Red Gum Floodplain Forest. Subtropical Coastal Floodplain Forest in the NSW North Coast Bioregion is listed as an endangered ecological community under the *NSW Threatened Species Act 1995* (TSC Act). The Subtropical Coastal Floodplain Forest in the study area was found to be in moderate to good condition with exotic vegetation only evident amongst the lowest drainage points or alongside roads and access tracks.

The Environmental Assessment for the project (Hyder Consulting 2010a) estimated that there would be direct impacts on approximately 53.76 hectares of vegetation as a result of the project. Following the Environmental Assessment, the length of the project was extended from 6.4 kilometres to 7.3 kilometres, which increased the area of direct impacts to approximately 58 hectares, as specified in the preferred project report (Hyder Consulting 2010b) and in the project approval. Subsequent design adjustments have resulted in a reduced area of direct impacts of approximately 55.5 hectares for the Class M upgrade.

Based on the final vegetation clearing footprint for both the Class A and Class M upgrades, the Project will result in direct impacts to approximately 55.5 hectares of vegetation. Direct impacts were calculated for both the initial staging and the motorway upgrade with a 12.5 metre disturbance buffer around the proposed alignments. This 12.5 metre buffer takes into account clearing associated with the project footprint, the realignment of Khans Road and construction of other access tracks as well as ancillary areas.

A comprehensive review on edge effects and their compensation (Bali 2000 & 2005) suggests that only 60% of the 50 metre strip of edge affected habitat should apply to all key habitats removed along the new road corridor. This takes into account that edge effects reduce the quality of habitat, but do not completely remove their habitat values. Therefore edge effects have been based on a 30 metre wide edge from the construction footprint, but only where a new edge is created (Figure 2, Figure 3 and Figure 4).

Table 1 provides a summary of the impacts of the upgrade on each vegetation community, including the 12.5 metre disturbance buffer around the alignments as part of the directly impacted area and additionally the areas of indirect impacts as a result of edge effects.

Table 1: Vegetation communities impacted by the Devils Pulpit Upgrade

Vegetation Community	Area to be directly impacted, including 12.5 metre disturbance buffer (hectares)	Edge effects (hectares)	Total (hectares)
Blackbutt Dry Sclerophyll Forest	26.32	9.04	35.35
Scribbly Gum Dry Sclerophyll Forest	9.57	3.63	13.20
Spotted Gum Dry Sclerophyll Forest	4.30	0.07	4.37
Total Dry Sclerophyll Forest	40.18	12.74	52.92
Eastern Red Gum Floodplain Forest (EEC)	9.02	1.36	10.39
Modified Eastern Red Gum Floodplain Forest (EEC)	4.64	0.00	4.64
Forest Red Gum Floodplain Forest (EEC)	1.63	1.22	2.85
Total Subtropical Coastal Floodplain Forest	15.30	2.58	17.88
Total all vegetation types	55.48	15.32	70.80

One threatened flora species, *Cyperusaquatilis* (Water Nutgrass), and one regionally significant flora species, *Artanemafimbriatum* (Koala Bells) have previously been recorded within the route, and potential habitat for another threatened species, *Maundiatriglochinooides*, was also identified.

One hundred and twenty eight (128) fauna species were recorded during the surveys undertaken for the environmental assessment process, comprising six amphibian, 15 reptile, 32 mammal and 74 bird species. Of these, eighteen (18) species are threatened and are listed in Table 2 below.

Table 2 Threatened and migratory fauna species identified during the field survey of the study area

Common Name (Scientific name)	NSW ¹	Commonwealth ²
Birds		
Brown Treecreeper (<i>Climacterispicumnusvictoriae</i>)	V	-
Glossy Black-Cockatoo (<i>Calyptorhynchuslathamii</i>)	V	-
Barking Owl (<i>Ninoxconnivens</i>)	V	-
Masked Owl (<i>Tytonovaehollandiae</i>)	V	-
Powerful Owl (<i>Ninoxstrenua</i>)	V	-
Little Lorikeet (<i>Glossopsittapusilla</i>)	V	-
Black-chinned Honeyeater (<i>Melithreptusgularis</i>)	V	-
Mammals		-

Common Name (Scientific name)	NSW ¹	Commonwealth ²
Squirrel Glider (<i>Petaurusnorfolcensis</i>)	V	-
Yellow-bellied Glider (<i>Petaurusaustralis</i>)	V	-
Grey-headed Flying-Fox (<i>Pteropuspoliocephalus</i>)	V	V
Southern Myotis (<i>Myotismacropus</i>)	V	-
Greater Broad-nosed Bat (<i>Scoteanaxrueppellii</i>)	V	-
Eastern False Pipistrelle (<i>Falsistrellustasmaniensis</i>)	V	-
Yellow-bellied Sheath-tail Bat (<i>Saccolaimusflaviventris</i>)	V	-
Little Bentwing-bat (<i>Miniopterusaustralis</i>)	V	-
Eastern Bentwing-bat (<i>Miniopteruschreibersiiioceanensis</i>)	V	-
Hoary Wattle Bat (<i>Chalinolobusnigrogriseus</i>)	V	-
Eastern Cave Bat (<i>Vespadelustroughtoni</i>)	V	-

1. Listed under the NSW Threatened Species Conservation Act 1995 (TSC Act): V = Vulnerable
2. Listed under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act): V = Vulnerable

In addition to the 18 threatened species detected during surveys, the study area was considered to represent potential habitat for another ninethreatened fauna species (Table 3).

Table 3:Threatened and migratory fauna species with potential habitat in the study area

Common Name (Scientific name)	NSW ¹	Commonwealth ²
Birds		
Grey-crowned Babbler (<i>Pomatostomus temporalis temporalis</i>)	V	-
Emu (<i>Dromusnovaehollandiae</i>)	EP	-
Amphibians		
Green-thighed Frog (<i>Litoriabrevipalmata</i>)	V	-
WallumFroglet (<i>Criniatinnula</i>)	V	
Mammals		
Koala (<i>Phascolarctoscinerus</i>)	V	-
Spotted-tail Quoll (<i>Dasyurusmaculatus</i>)	V	E
Brush-tailed Phascogale (<i>Phascogale tapoatafa</i>)	V	-
RufousBettong (<i>Aepyprymnusrufescens</i>)	V	-
Eastern Freetail Bat (<i>Mormopterusnorfolkensis</i>)	V	-

1. Listed under the NSW Threatened Species Conservation Act 1995(TSC Act): V = Vulnerable, EP = Endangered Population
2. Listed under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act): V = Vulnerable, E = Endangered

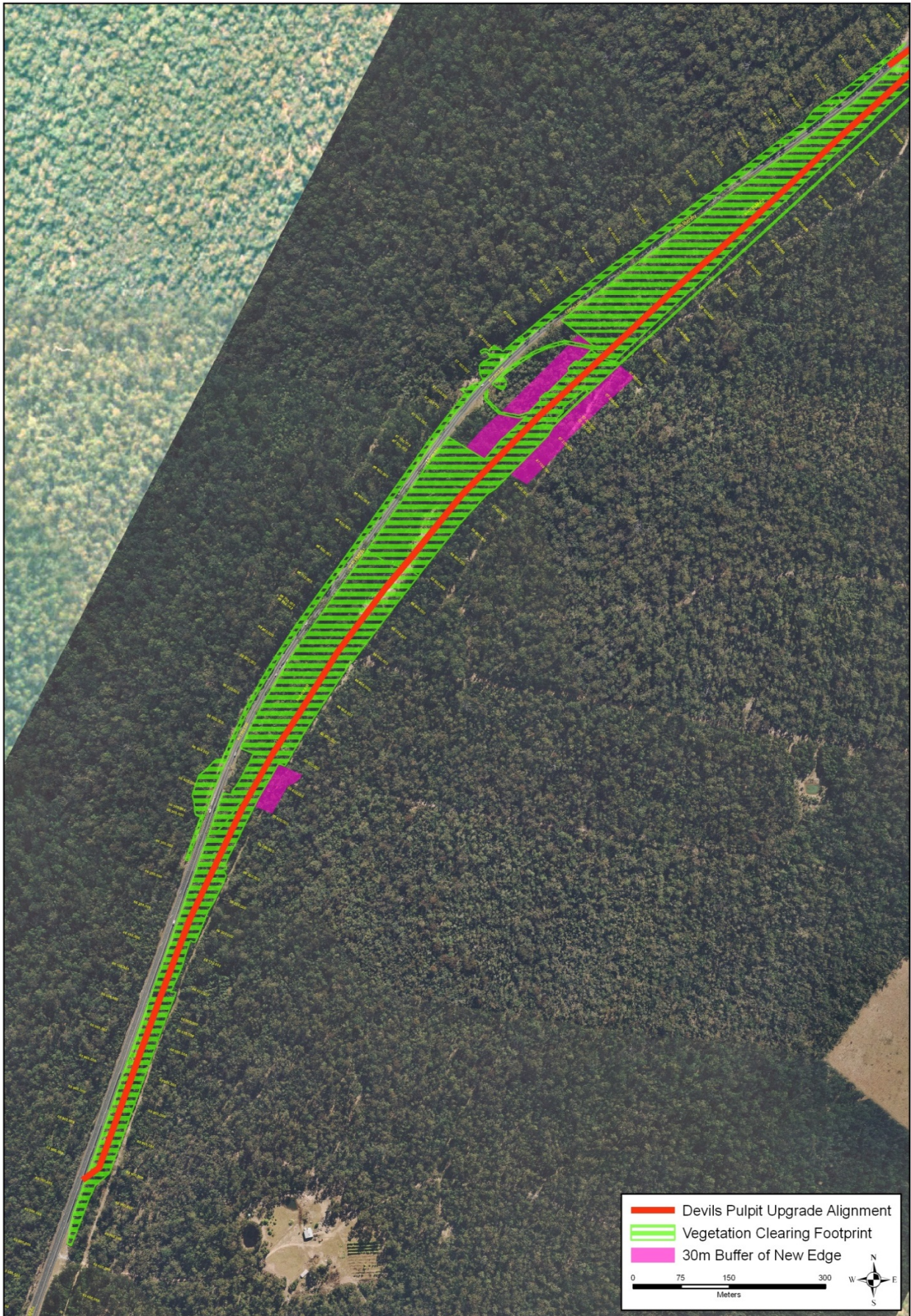


Figure 2: Vegetation clearing footprint and 30m buffer of new edges (Ch. 69 650 to 72 300).

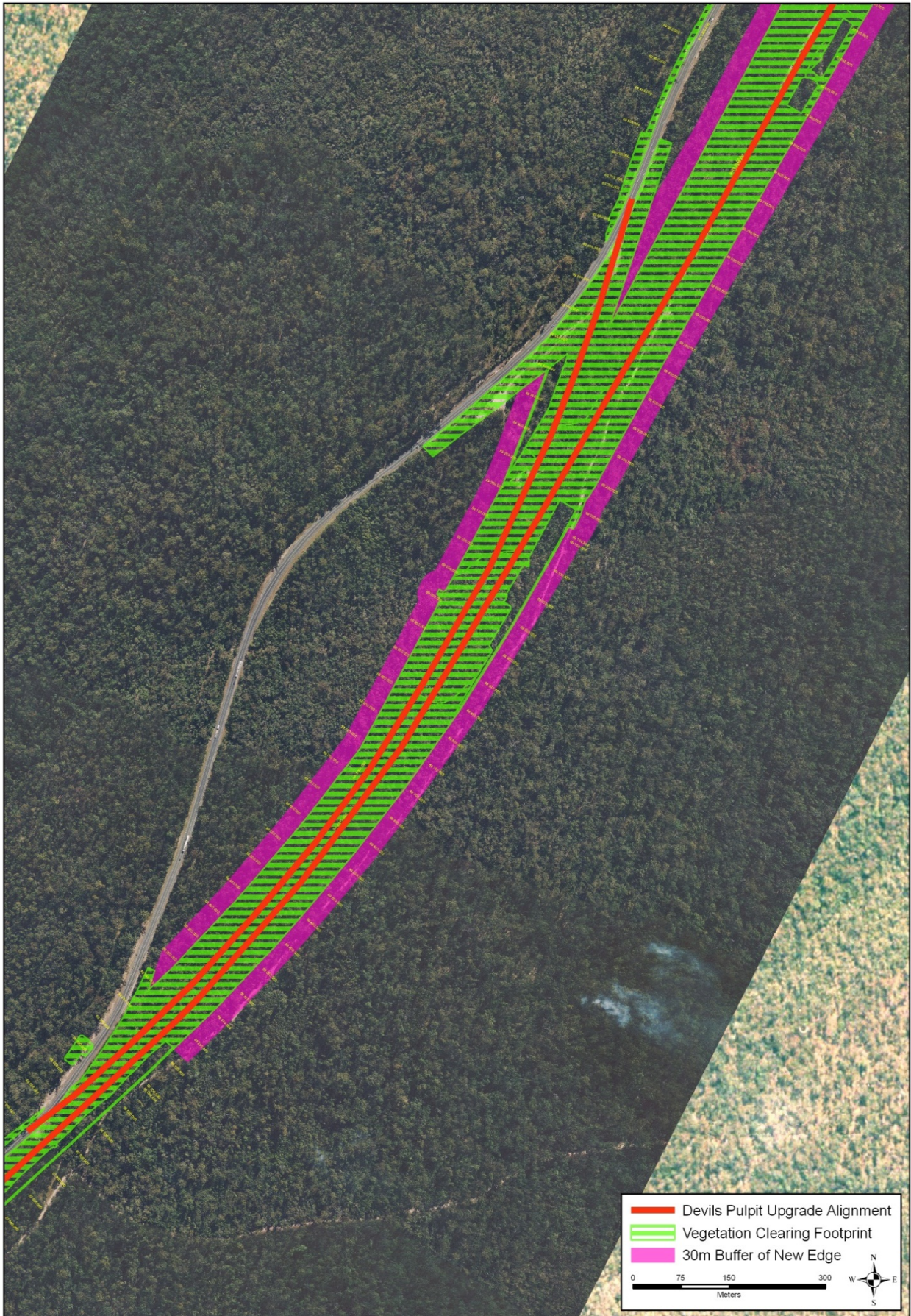


Figure 3: Vegetation clearing footprint and 30m buffer of new edges (Ch. 67950 to 69 650)

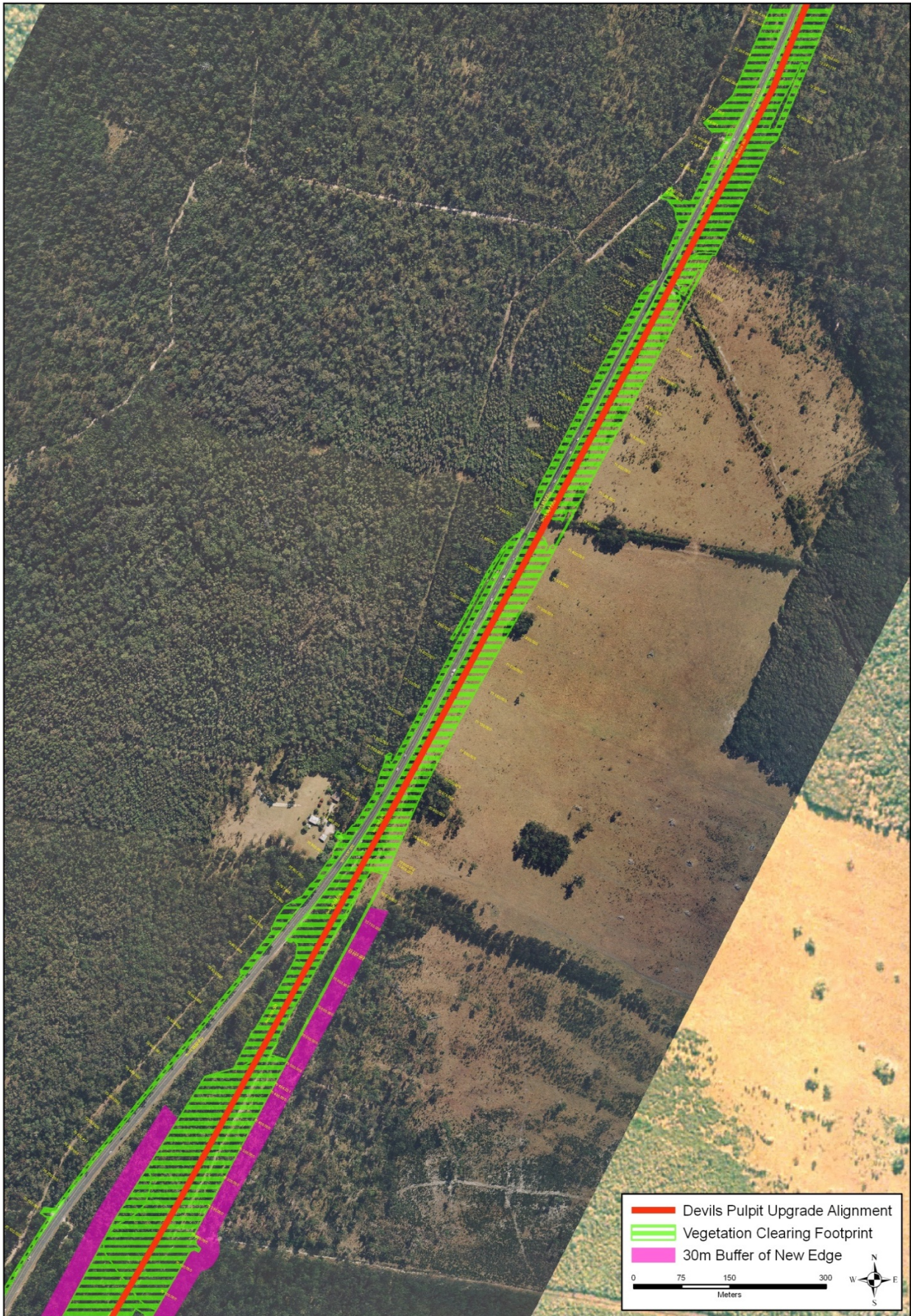


Figure 4: Vegetation clearing footprint and 30m buffer of new edges (Ch. 65 600 to 67 950)

With regard to potential habitat for Emus occurring in the Devils Pulpit study area, the Environmental Assessment predicted that this species may occur based on the presence of Wildlife Atlas records within 4.5 kilometres of the study area and reports of possible emu tracks approximately three kilometres east of the study area. Although there are local sub-populations recorded to the west of the site in Bungawalbin catchment and to the east of the site in Bundjalung National Park, it was considered that any potential population movements would most likely occur through cleared and fragmented forest north of Devils Pulpit State Forest.

The sub-population of Emus in Bundjalung National Park, to the east of the project study area, is the smallest of the three sub-populations of the species that make up the endangered population. In 2006 the Bundjalung sub-population was estimated to have only 20 birds. No Emus were recorded in Bundjalung National Park during the 2010 annual community survey of the species, despite consistent counts of birds in this location over the last 10 years. There is concern that this population may be locally extinct, possibly as a result of large-scale wildfires as well as road fatalities (SKM 2011). Given the lack of evidence for Emus using the study area and the possible extinction of the closest sub-population of the species, offsetting of habitat for Emus has not been addressed in this strategy.

One threatened aquatic species listed under the *Fisheries Management Act 1994* (FM Act) and the Commonwealth EPBC Act, the endangered Oxleyan Pygmy Perch (*Nannopercaoxleyana*) was recorded in the study area, in Tabbimoble Floodways 2 and 3. Potential habitat for another endangered fish species, the Purple-spotted Gudgeon (*Mogurndaadsversa*), was also considered to be present in a similar habitats to the Oxleyan Pygmy Perch.

Assessments of the impact of the project on threatened ecological communities, populations and species were undertaken as part of the Environmental Assessment. The assessments were based on the heads of consideration detailed in the Draft Guidelines for Threatened Species Assessment for Part 3A applications (DEC and DPI 2005) and, where applicable, the EPBC Act Significant Impact Guidelines (Commonwealth of Australia 2009). Species were considered for assessment based on database records, species identified during surveys for the Environmental Assessment and presence of suitable core habitat and distribution ranges. The environmental assessment found that the Devils Pulpit Upgrade was not likely to have a significant impact on any of the threatened communities, populations or species considered, provided the mitigation safeguards recommended under the environmental assessment are adopted.

Full details of the impact assessments are provided in the *Devils Pulpit Upgrade Environmental Assessment Appendix D Technical Working Paper – Ecology*.

2.2 Barrier Impacts

The project adjoins the forested areas of Devils Pulpit and Tabbimoble State Forests and Bundjalung National Parks, with some cleared rural lands in the north of the project area (Figure 5). Two regional corridors and one sub-regional corridor were mapped in the study area by Scotts (2003). Focal species identified within this corridor network by Scotts (2003) include the Yellow-bellied Glider and Brush-tailed Phascogale (*Phascogale tapoatafa*). The Koala, Rufous Bettong, Spotted-tail Quoll and Squirrel Glider are also considered to be focal species that are likely to be subject to barrier impacts as a result of the project. The corridors are already fragmented by the existing Pacific Highway, although without appropriate mitigation measures the Devils Pulpit Upgrade could create additional barriers to fauna movement, particularly at the local scale.



Figure 5: Key fauna habitat and fauna corridors

Road-killed fauna (macropod species) were recorded in the vicinity of Tabbimoble Overflows 2 and 3 during field surveys for the Environmental Assessment, indicating that fauna movements occur in this area. The wider gap created by the upgrade would result in reduced crossing attempts by some species, particularly those that are slow moving and/or dependent on cover, and increased levels of vehicle strike for ground and arboreal species that do not perceive the increased gap as a barrier to movement. The increased gap would exceed glide distances for small gliders, potentially causing some individuals to move along the ground to complete a crossing.

The upgrade will not represent a barrier to all species; bats and most birds are readily capable of traversing the gap created by a dual carriageway, and would fly between the canopies above traffic height. Species that fly at lower elevations, such as Glossy Black-cockatoos and Grey-crowned Babblers (*Pomatostomus temporalis temporalis*) would be at increased risk of vehicle strike; potential impacts can be reduced by planting feed trees a short distance (10 metres) from the carriageways.

The magnitude of barrier effects differs substantially between the motorway and likely initial staging upgrades; the likely initial staging upgrade includes two large vegetated medians within the Bundjalung National Park/Devils Pulpit interface and would have less barrier effect for all species than the motorway.

Details on the types of fauna crossing measures and associated fauna fencing to be implemented as part of mitigation strategies for the project are provided in Section 3.

2.3 Hollow bearing trees

According to the Devil's Pulpit Upgrade Environmental Assessment, "hollow bearing trees were abundant within and adjacent to the proposed alignment" (Hyder Consulting 2010a p64). The EA found that there were approximately 3.6 hollow bearing trees per 0.5 hectare in the upgrade area. Approximately 508 hollow bearing trees have been identified within or immediately adjacent to the highway upgrade during ground-truthing surveys by the project ecologist; in addition, 43 hollow logs have been identified.

3 MANAGEMENT OF BIODIVERSITY IMPACTS

Measures to manage the impact of the upgrade on biodiversity have been developed as part of the environmental assessment for the project. These are outlined in Section 7.4 and Appendix D of the Devils Pulpit Upgrade Environmental Assessment. Management measures for biodiversity impacts were developed following the general principles, in order of preference:

1. Avoiding impacts
2. Mitigating impacts
3. Offsetting impacts

A summary of the key measures relevant to biodiversity impacts are outlined below. For further detail refer to the Devils Pulpit Upgrade Environmental Assessment Section 7.4 and Appendix D and the revised Statement of Commitments.

3.1 Avoid

The environmental assessment and design processes were closely interfaced throughout the development of the project. Impacts on biodiversity values were avoided wherever possible

through the route selection process and development of the concept design alignment. The changes to the route and alignment in response to identified biodiversity impacts include:

- The project alignment has been refined to minimise impact on environmentally sensitive areas. The identification of endangered ecological communities influenced the locations of the carriageways.
- For the Class A configuration (initial staging), use of the existing pavement area has been maximised. Vegetation clearing has been restricted to the minimum area possible.
- A population of the regionally significant plant species *Artanemafimbriatum* was avoided and the impact on Subtropical Coastal Floodplain Forest was reduced when selecting the rest area location.

3.2 Mitigate

Management measures designed to reduce impacts on biodiversity include:

- Fauna crossing measures
- Revegetation measures
- Threatened flora protection and potential translocation
- Other fauna mitigation measures
- Biodiversity monitoring measures

3.2.1 Fauna Crossing Measures

Construction of a range of fauna crossing measures, including fauna underpasses, combined fauna drainage/bridge structures and associated fauna fencing, rope bridges and vegetated medians, will be implemented on the Devils Pulpit Upgrade Project. Table 4 identifies the indicative sizes, lengths and locations of the proposed fauna crossing points and structures that are planned to provide fauna passage.

Table 4: Locations of fauna underpasses

Chainage	Reference	Dimensions	Length (m)	Type	Comment
Northbound carriageway for likely initial stage					
66.270	C3	3 x 2400mm x 900mm RCBC	54.11	Combined fauna structure	Fauna passage in combined fauna structures is facilitated by the inclusion of wet and dry cells and the installation of fauna furniture.
67.170	C6	1 x 2100mm x 2100mm RCBC	14.75	Combined fauna structure	<p>Associated with ephemeral drainage, will provide passage for Oxleyan Pygmy Perch during high flow periods</p> <p>Bench for fauna allows dry passage during high flow periods</p> <p>Refuge poles installed at each end of culvert</p> <p>2.9m high timber climbing pole at each end of culvert</p> <p>Escape and rest fork</p> <p>Timber posts and rail to extend 4m beyond the entrances of the culvert</p> <p>Posts and rails to be roughened</p> <p>Sandy/dirt mix applied to culvert floor</p>
69.025 (Southbound chainage)	C9	2 x 2400mm x 1500mm RCBC	49.19	Combined fauna structures	Fauna passage in combined fauna structures is facilitated by the inclusion of wet and dry cells. Provides passage for mammals, reptiles, frog and Oxleyan Pygmy Perch
69.100	C10	2 x 2400mm x 2400mm RCBC	59.03	Combined fauna structures	<p>Associated with drainage, will provide passage for Oxleyan Pygmy Perch during high flow periods</p> <p>Series of culverts would include wet and dry cells</p> <p>Due to the ephemeral nature of drainage, the culvert would be available for use during all but the wettest periods.</p>

Chainage	Reference	Dimensions	Length (m)	Type	Comment
71.480	-	Large bridge over TabbimobleFI oodway No. 3	12.04	Combined fauna structure designed to Class 1 waterway standard	Existing bridge has dryland fauna passage on both sides of a well-defined drainage channel ; provides passage of Oxleyan Pygmy Perch. Benching beneath bridge to allow for dry passage of fauna such as Quolls, Bettongs and Phascogales 2.5 m high timber climbing poles, 1.7m posts Rails extend through from new bridge to other side of existing bridge Posts and rails to be roughened. Revegetation proposed.
71.900	-	Large bridge over TabbimobleFI oodway No. 2	10.00	Combined fauna structure designed to Class 1 waterway standard	Existing bridge has dryland fauna passage on both sides of a well-defined drainage channel ; provides passage of Oxleyan Pygmy Perch. Benching beneath bridge to allow for dry passage of fauna such as Quolls, Bettongs and Phascogales 2.9 m high climbing poles, 2.4 metre posts Rails extend through from new bridge to other side of existing bridge Posts and rails to be roughened.
Southbound carriageway for initial stage/ Motorway upgrade					
66.270	C3	3 x 2400mm x 900mm RCBC	54.11	Combined fauna structures	Fauna passage in combined fauna structures is facilitated by the inclusion of wet and dry cells and the installation of fauna furniture. Passage for small mammals, reptiles and frogs
67.185	C7	2 x 2400mm x 1500mm RCBC	19.67	Combined fauna structures	Series of culverts would include wet and dry cells Linked to dedicated fauna structure (67 170) Passage for Oxleyan Pygmy Perch

Chainage	Reference	Dimensions	Length (m)	Type	Comment
67.250	C8	2 x 2400mm x 2400mm RCBC	22.13	Combined fauna structure.	Associated with ephemeral drainage channel; provides passage for Oxleyan Pygmy Perch. Series of culverts would include wet and dry cells. May offer passage to Quolls during dry periods. Linked to dedicated fauna structure (67.170) Due to the ephemeral nature of drainage, the culvert would be available for use during all but the wettest periods
69.025	C9	2 x 2400mm x 1500mm RCBC	49.10	Combined fauna structures	May provide passage for mammals, reptiles, frogs and Oxleyan Pygmy Perch
69.100	C10	2 x 2400mm x 2400mm RCBC	59.03	Combined fauna structures	Associated with drainage channel; provides passage for Oxleyan Pygmy Perch. Due to the ephemeral nature of drainage, the culvert would be available for use during all but the wettest periods. Quolls may use structure in dry periods. Series of culverts would include wet and dry cells
71.480	-	Large bridge over TabbimobleFl oodway No. 3	12.04	Combined fauna structure designed to Class 1 waterway standard	Existing bridge has dryland fauna passage on both sides of a well-defined drainage channel; passage for Oxleyan Pygmy Perch. Benching beneath bridge to allow for dry passage of fauna such as Quolls, Bettongs and Phascogales 2.5 mhigh timber climbing poles, 1.7m posts Rails extend through from new bridge to other side of existing bridge Posts and rails to be roughened.

Chainage	Reference	Dimensions	Length (m)	Type	Comment
71.900	-	Large bridge over Tabbimoble Floodway No. 2	10.00	Combined fauna structure designed to Class 1 waterway standard	Existing bridge has dryland fauna passage on both sides of a well-defined drainage channel; passage for Oxleyan Pygmy Perch. Benching beneath bridge to allow for dry passage of fauna such as Quolls, Bettongs and Phascogales 2.9 m high climbing poles, 2.4 metre posts Rails extend through from new bridge to other side of existing bridge Posts and rails to be roughened.

Fauna fencing will be installed for a distance of 200m each side of four of the crossing structures along the proposed upgrade route, to guide fauna towards crossing structures and prevent access to the carriageway. Fauna fencing will comprise diamond-weave fencing with a 400mm “floppy-top” mesh overhanging vegetated side of the fence. Detailed design of fauna fencing may be modified in consultation with the NSW Environment Protection Authority (EPA).

Table 5:Locations of fauna fencing

Chainage	Comments
67180	Associated with combined fauna structures at Ch67170 (northbound carriageway) and Ch67185 and 67250 (southbound carriageway) Combined fencing between carriageways
69060	Associated with combined fauna structure at Ch69100 Combined fencing between culverts
71480	Tabbimoble Floodway No. 3 Combined fencing between carriageways
71840	Tabbimoble Floodway No. 2 Combined between carriageways

Frog fencing will also be required at a distance of 100m each side of these structures and will be combined with the fauna fencing.

The design, location and extent of fauna fencing will be reviewed and modified as required based on results of ecological monitoring.

In addition to the fauna underpasses listed above, it is proposed to retain vegetated medians and install rope bridges to facilitate movement of arboreal mammals, such as Yellow-bellied Gliders, Squirrel Gliders and Greater Gliders (*Petauroidesvolans*) and possum species, across the project. Table 6 shows the indicative locations of rope bridges and glider crossings; the exact locations will be determined in consultation with EPA.

Table 6:Location of rope bridges and glider crossings

Chainage	Proposed structure – Class A	Proposed structure – Class M	Fauna impact mitigation measure
66300-67800	Retain vegetated median and minimise clearing widths	Retain vegetated median and minimise clearing widths	Gliders will be able to use vegetated median to move between Devils Pulpit State Forest and Bundjalung National Park due to short glide distances.
68300-68700	1 x rope bridge and minimise clearing width	1 x rope bridge and minimise clearing width	Rope bridge extending over both carriageways linking Devils Pulpit State Forest and Bundjalung National Park.
69300-70700	Retain vegetated median and minimise clearing widths	2 x rope bridges	Gliders will be able to use vegetated median to move between Devils Pulpit State Forest and Bundjalung National Park due to short glide distances.

All waterway crossings that involve new water crossing structures or replacement of an existing structure will be designed to minimise impact on fish passage in accordance with Department of

Industry and Investment guidelines (Fairfull and Witheridge 2003). Crossings will be appropriate to the requirements of the Oxleyan Pygmy Perch.

3.2.2 Revegetation Measures

Revegetation and rehabilitation of areas disturbed as a result of construction of the upgrade, including ancillary areas, will progressively occur as construction works are completed in successive areas along the alignment for each of the major construction stages. A vegetated fauna movement corridor will be established in the 60 metre wide strip of degraded Subtropical Coastal Floodplain Forest at the northern end of the project. The primary purpose of the corridor is to provide connectivity for ground fauna such as the Spotted-tail Quoll and Rufous Bettong.

Revegetation measures will include planting a range of locally occurring native shrubs, trees and ground covers and where possible, linking bushland remnants. Species selected are from the Dry Sclerophyll Forest and Subtropical Coastal Floodplain Forest communities that will be impacted by the upgrade. A soil seedbank will be established during clearing operations, and revegetation will be undertaken using local native species from this seedbank. Revegetation measures will be implemented through the Urban Design and Landscaping Plan which will be developed during the detailed design phase of the project in consultation with the NSW Environment Protection Authority (EPA).

Riparian vegetation will be restored and rehabilitated in and around watercourses affected by the project in consultation with EPA, Industry and Investment NSW (I&I) and DSEWPC. Restoration and rehabilitation measures shall be developed in consultation with these agencies, including timeframes and reporting on completion of works.

Revegetation and rehabilitation works will include measures to provide or enhance fauna habitat features for threatened species, such as:

- Planting preferred foraging species, such as *Allocasuarinaspp* for Glossy Black-cockatoos; *Eucalyptus propinqua* (Small-fruited Grey Gum) for Koalas; Eucalypts, Corymbias and Angophoras for Little Lorikeets, Gliders and Grey-headed Flying-fox; Ironbarks and *Eucalyptustereticornis* (Forest Red Gum) for Black-chinned Honeyeaters. Care will be taken to ensure species used in landscaping close to the highway will not attract wildlife for feeding or other purposes.
- Provide fringing vegetation around waterbodies to enhance habitat for amphibians including Green-thighed Frogs and Wallum Froglets.
- Incorporation of fauna structures retained from pre-construction works, such as hollow logs, to provide shelter habitat for ground fauna such as Quolls.

A 60 m wide strip of degraded Subtropical Coastal Floodplain Forest at the northern end of the project will be rehabilitated to improve connectivity and provide a fauna movement corridor in the area of the Tabbimoble No. 2 and No. 3 bridges. The area to be rehabilitated is to the east of the existing alignment and extends from Chainage 70 200 to 71 900.

The entire corridor will be hydromulched with seeds as listed in the Landscape Drawings (HBO+ EMTB Urban and Landscape Design dated October 2010). Where shown on the landscape plan, stripped topsoil from Eastern Red Gum Floodplain Forest will be returned, with the soil likely containing sufficient seed for rapid germination of species of this vegetation community.

In addition, trees will be planted within the corridor where shown on the landscape plan, at a density of one tree per two square metres, with plantings including characteristic species of Subtropical Coastal Floodplain Forest Endangered Ecological Community. Canopy species to be planted include *Eucalyptus resiniferasubsp.hemilampra* (Red Mahogany), *E. seeana* (Narrow-leaved Red Gum), *E. siderophloia* (Grey Ironbark) and *E. tereticornis* (Forest Red

Gum). Mid-storey species include *Corymbia intermedia* (Pink Bloodwood) and *Cupaniopsis parviflora* (Small-leaved Tuckeroo), while shrubs will include *Acacia concurrens* (Hickory Wattle) and *Banksia aemula* (Wallum Banksia). A full list of species is provided in the Landscape Drawings (HBO+ EMTB Urban and Landscape Design dated October 2010).

The land supporting the corridor has been leased from the current landholder, for the duration of construction and the revegetation works (including monitoring and maintenance), until the corridor is established. RMS or its agents may access the corridor during this time. Upon expiration of the lease, the land will be burdened by a Restriction on Use under the *Conveyancers Act 1994*. The terms of restriction on the use of the perpetually burdened land include:

- No development shall be carried out or action taken other than those specified for revegetation activities without prior consent in writing of RMS;
- Farm animals are to be excluded from the revegetated area until the vegetation is well established and written permission is granted by the RMS for the area to be grazed;
- The fences and any gates around the land burdened must remain in place and be kept in functional repair to prevent uncontrolled grazing by farm animals; and
- No vegetation is to be removed, cut or interfered with in any way with the exception of noxious weeds.

Weeds in areas disturbed by construction activities will be managed for a minimum of one year after construction completion for each major project stage; revegetation will be undertaken according to a Weed Management Plan. Further details on monitoring measures are provided in the Ecological Monitoring Program (Hyder Consulting 2012).

3.2.3 Threatened flora protection and translocation

The upgrade is unlikely to impact on *Cyperusaquatilis*, which was represented by only one record in marginal habitat immediately west of the study area on Tabbimoble Floodway 2, and is also unlikely to impact the potential habitat for *Maundiatriglochinoidea*; habitat for both species occurs outside the project footprint.

As a precautionary measure, temporary fencing will be installed to regulate access into the area where *C. aquatilis* has been previously located to ensure any individuals that were not detected are protected during construction, and sediment controls will be installed along the alignment boundary along Tabbimoble Floodway No. 2 and the highway embankment to ensure construction works minimise the impact on the riparian environment during construction.

Pre-clearing surveys targeting threatened flora species will be undertaken in the clearing footprint; it is possible that nine threatened flora species, comprising eight small shrubs/herbs and one tree, occur in the project footprint. The species are listed in Table 7. All species flower in spring-summer, increasing their likelihood of detection during surveys conducted at this time.

Table 7: Threatened flora species to be targeted during pre-clearing surveys

Scientific name (Common name)	Potential habitat
<i>Cryptostylis hunteriana</i> (Leafless Tongue Orchid)	Swamp-heath and woodland
<i>Cyperusaquatilis</i> (Water Nutgrass)	Ephemerally wet areas
<i>Hibbertia marginata</i> (Bordered Guinea Flower)	Grassy or shrubby dry eucalypt forest
<i>Lindsaea incisa</i> (Slender Screw Fern)	Dry eucalypt forest on sandstone or poorly drained sites along creeks

Scientific name (Common name)	Potential habitat
<i>Melaleucairbyana</i> (Weeping Paperbark)	Open eucalypt forest in swampy or poorly drained sites
<i>Persicariaelator</i> (Tall Knotweed)	Beside streams
<i>Phaiusaustralis</i> (Southern Swamp Orchid)	Swampy grassland or swampy forest
<i>Prostantherapalustris</i> (Swamp Mint-bush)	Shrubland to heathland

If a threatened flora species is identified within the clearing limits, a minimum 10metre buffer around the individual would be established and the appropriate authorities would be advised immediately.

A qualified ecologist will identify vegetation to be retained within the construction corridor (including Subtropical Coastal Floodplain Forest endangered ecological community and individuals of the regionally significant plant species *Artanemafimbriatum*) and clearly delineate this vegetation on work plans. Flagging/fencing, erected before the start of construction, will delineate this vegetation on the project site for the duration of the construction and site restoration periods.

If avoidance of significant plants is not possible, investigations will be undertaken with EPA to examine the feasibility of translocating clusters of Koala Bells into appropriate habitat close to the present location. If Koala Bells is proposed to be translocated a translocation strategy will be developed in consultation with EPA. Protective measures, such as sediment fencing, would be installed prior to vegetation clearing and highway construction to protect individual plants.

The Construction Flora and Fauna Management Plan (John Holland 2011a) for the project includes further details on measures to be implemented during construction to mitigate potential impacts on the significant species of flora, fauna and vegetation communities.

3.2.4 Other Fauna Mitigation Measures

Additional commitments identified in the Environmental Assessment and Statement of Commitments include:

- A suitably qualified ecologist will undertake pre-clearance surveys, including stag watching, spotlighting, call-playback detection and searches of nests and hollow-bearing trees, to identify fauna species at risk of injury that require relocating to alternative, nearby suitable habitat. More detailed descriptions of the pre-clearing survey methods are provided in the Ecological Monitoring Plan (HyderConsulting 2012). Follow-up inspections immediately before clearing and during construction will confirm that the sites subject to pre-clearance surveys remain free of fauna.
- On detection of any additional or unexpected threatened species, the “unexpected threatened species finds procedure” described in the RMS Biodiversity Guidelines (2011) will be followed.
- Appropriate natural habitat features and resources (such as hollow logs, felled branches and bush rocks) removed from the project site will be relocated to adjacent areas, where feasible, to provide alternative temporary or permanent habitat for displaced fauna. Such relocation will be undertaken in a manner to limit damage to existing vegetation and will not occur in high condition remnant vegetation.
- Habitat trees (hollow-bearing trees, trees currently in flower, sap feeding trees, trees supporting nests or dreys) would be avoided where possible. The distribution of potential hollow-bearing trees would be mapped during the preliminary design phase of the project.

- Sediment basins would be designed to avoid habitat trees wherever possible.
- Sediment basins would be designed and/or managed to reduce their suitability as Cane Toad breeding sites.
- Appropriate erosion and sediment controls would be applied throughout the project, and specifically when working in the vicinity of floodplain areas that represent potential breeding habitat for Green-thighed Frog (*Litoria brevipalmata*) and Wallum Froglet (*Crinia tinnula*).
- Temporary frog exclusion fencing would be installed where haul roads or other high-volume traffic areas cross floodplain habitats for Green-thighed Frog or Wallum Froglet, or are adjacent to riparian areas.

The EPA will be consulted in the event of any new finds and unexpected additional impacts on threatened species. A Spotted-tail Quoll Management Plan is currently being prepared to specifically address the potential threats to resident Spotted-tail Quoll populations in the locality of the upgrade, in accordance with DSEWPC conditions of approval.

3.2.5 Biodiversity Monitoring Measures

An Ecological Monitoring Program is being prepared to address the requirements for biodiversity monitoring measures in the Department of Planning MCoA B6. The program is being developed in consultation with EPA, DSEWPC, and suitably qualified ecologists.

The broad objective of the Ecological Monitoring Program is to monitor the effectiveness of the mitigation measures for threatened species directly impacted by the project. Monitoring of target species will likely commence in Year 3 after completion of the Project, to allow for the habitation of species to the upgrade, rehabilitation of construction-related disturbance and increase vegetation cover in revegetated areas. Subsequent monitoring periods will occur in Years 4 and 6. Timing of target species surveys has been developed in consultation with EPA and may require amendment in accordance with the actual completion date of the Project.

Mitigation measures which will be monitored include:

- Pre-clearing and clearing procedures;
- Fauna crossing structures (culverts, underpasses and rope bridges);
- Fauna fencing;
- Vegetated median; and
- Vegetated connectivity corridor.

3.3 Offsets

The Office of Environment and Heritage (OEH) have developed principles for the use of biodiversity offsets in NSW, to provide a framework for considering environmental impacts and developing offset proposals (OEH 2011). The principles have been used in the development of this Biodiversity Offset Strategy and have been addressed as follows:

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

Management measures for biodiversity impacts for the Pacific Highway Upgrade at Devils Pulpit were developed following these general principles, in order of preference:

- Avoiding impacts.
- Mitigating impacts

- **Offsetting impacts**

A summary of the key measures implemented to avoid and mitigate biodiversity impacts have been provided in Sections 3.1 and 3.2 of this strategy. Offset measures have also been proposed to address residual impacts.

2 All regulatory requirements must be met

The Biodiversity Offset Strategy is being implemented to address biodiversity impacts and satisfy the Minister's Conditions of Approval as part of the project approval under Part 3A 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.

3 Offsets must never reward ongoing poor performance

Land for offsets will be chosen based on the criteria outlined in Section 3.4, and any land found to address these criteria would not be deliberately degraded in order to increase the value from the offset.

4 Offsets will complement other government programs

The Biodiversity Offset Strategy for the Upgrade has been developed to complement other government programs, including other offset strategies along the Pacific Highway corridor and the establishment and management of new national parks, nature reserves and state conservation areas. RMS is working with EPA to ensure offsets complement existing conservation areas and are of sufficient quality and are managed appropriately to ensure the offsets are secured in perpetuity.

The NSW Biodiversity Strategy and the Mid and Far North Coast Regional Conservation Plan will be consulted when identifying offset options:

RMS acknowledges the NSW Stateplan'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).

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 has been provided in Section 3.3.2.

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

The total offset ratio resulting from this proposed offset strategy is 3.2 :1 (detailed below in Section 3.3.1). 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 Upgrade.

As discussed in Section 3.3.2, one of the criteria for selecting offsets will be 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.

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, detailed in Section 3.3.2, include a requirement for the offset to be appropriate for ongoing management for conservation through an appropriate legal instrument. This ensures any land selected under the criteria will be secured in perpetuity.

8 Offsets should be agreed prior to the impact occurring.

As per the Ministers Condition of Approval B4 the Biodiversity Offset Strategy must be submitted to, and approved by, the Director General prior to the commencement of construction work that would result in the disturbance of any threatened species and/or endangered ecological community, unless otherwise agreed.

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

A quantitative assessment has been undertaken to determine the precise area that requires offsetting. This area includes construction buffers, potential ancillary areas and also accounts for edge effects to ensure the true impact of the Upgrade is offset. The impact assessments for the Devils Pulpit Environmental Assessment were conducted in accordance with the relevant guidelines to ensure impacts were accurately estimated. Details of the impact assessments can be found in Section 2.1 of this strategy.

10 Offsets must be targeted.

Offsets for the Upgrade will be chosen using a number of criteria (see Section 3.3.2) 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 EECs and key threatened species habitat are offset with areas that have equal or greater conservation status than the area to be impacted.

11 Offsets must be located appropriately.

All offsets will be located within the NSW North Coast Bioregion. The criteria for offsets, as specified in section 3.3.2, include a requirement for offset to be located within 30 kilometres of the project, extending to 100 kilometres with agreement from EPA and DoP where it can be demonstrated that a suitable offset cannot be found.

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.

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.

The Biodiversity Offset Strategy proposes three options for consideration. These are:

- Option A** Secure additional native vegetation protected through an appropriate legal instrument that ensures the land is managed for conservation.
- Option B** Additional revegetation in strategic locations that have the potential to complement existing regional natural resource management activities. Under this secondary option, similar vegetation communities of similar conservation status to those impacted by the project would be targeted.
- Option C** Investment in management research related to the rehabilitation and protection of relevant threatened species, such as Yellow-bellied Gliders, Squirrel Glider and/or Oxleyan Pygmy Perch.

Option A is the RTA's first priority to achieve the objectives of the Biodiversity Offset Strategy. Option B and Option C would only be considered after every reasonable effort has been made towards offsetting under Option A, and would require further consultation with EPA and Department of Planning; refer to Section 3.4 Decision Making Framework.

3.3.1 Delivery of Option A

The Minister for Planning's Condition of Approval (MCoA) B5 states the Biodiversity Offset Strategy must provide a minimum of 152 hectares of native vegetation, comprising 80 hectares of Dry Sclerophyll Forest and 72 hectares of Subtropical Coastal Floodplain Forest, to offset the direct and indirect impacts of the project. The requirement for an offset comprising 152 hectares of native vegetation is reiterated in Condition 7 of the DSEWPC conditions of consent, which further states that this 152 ha must provide habitat for the Grey-headed Flying-fox, the Spotted-tail Quoll, the Regent Honeyeater and the Swift Parrot that is equal or greater quality to that being removed.

RMS aims to meet MCoA B5 and the objectives of the Biodiversity Offset Strategy by using variable offset ratios depending on the biodiversity value of the vegetation communities impacted by the project. Endangered Ecological Communities (EEC) and poorly conserved vegetation communities impacted by the project would be offset at a ratio of 4:1 and non-EEC vegetation communities impacted by the project would be offset at a ratio of 2:1. Poorly conserved ecological communities are those vegetation types identified as being more than 75 per cent cleared in the catchment management area as identified in the OEH vegetation types database (DECCW 2009).

The proposed methodology will also take into account the value of key fauna habitat when determining appropriate offsets. This has been done by first matching vegetation type to corresponding habitat type. The 26 threatened species identified in the study area or considered highly likely to occur in the study area were then matched up with appropriate habitat type. A search of the OEH Threatened Species Profile Database was conducted to determine whether any of the threatened species have additional habitat requirements that cannot be offset by vegetation type alone.

Offsetting vegetation communities

RMS previously acquired a corridor through the State Forest for the purposes of upgrading the Pacific Highway. The majority of the Devils Pulpit project is located within this corridor. A portion of land required for the project (12.79 hectares) is still within the Devils Pulpit State Forest holding. Of this area, 3.46 hectares will be cleared as a result of the current upgrade.

RMS is negotiating with the Department of Industry and Investment (Forests) to compensate for the loss of State Forest land. Compensation could take the form of native vegetation or cleared land to allow for the establishment of plantations. Where native vegetation is provided as compensation it is recognised that there will be biodiversity benefits accruing from State Forests management of the land. In recognition of this the RMS proposes to discount the biodiversity offset requirement.

This essentially means that in addition to providing Department of Industry and Investment (Forests) the equivalent area of land directly impacted by the project, further land would be acquired for the biodiversity offset at a 1:1 ratio on a like for like basis. This would apply only to land that is not EEC nor greater than 75 percent cleared within the catchment management areas (DECCW 2009). For areas where the project impacts on Forestry Management Zones (FMZ) that have been established for conservation purposes, a biodiversity offset ratio of 4:1 would be applied for these lands on a like for like basis. However, no FMZ zones 1 or 2 are impacted by the upgrade. It is important to note that no land acquired for compensation State Forests will be used as offset land unless there are conservation forestry management zones placed on the land.

Table 8 demonstrates how the proposed offset ratios would be applied for EEC/poorly conserved vegetation communities and non-EECs impacted by the upgrade for state forest lands and non-state forest lands.

Table 8: Biodiversity Offset Ratio for EEC and Non EEC vegetation on State Forest and non State Forest lands.

	EEC/Poorly Conserved Vegetation Community	Non –EEC (Native Vegetation)
State Forest Land	4:1	2:1# 1:1#
Other Lands (Non- State Forests)	4:1	2:1

In instances where it is agreed with Department of Industry and Investment (Forestry) to compensate for the loss of working State Forest by providing existing native forests a biodiversity offset ratio of 1:1 applies. If other forestry offset measures are used such as funding for establishment of plantations then the biodiversity offset ratio that is applied will be 2 : 1.

Table 8 highlights that, regardless of land tenure and how Department of Industry and Investment–Forests (DI & I Forests) are compensated, if EECs or poorly conserved vegetation communities occur within State Forests and are impacted by the upgrade then the biodiversity offset is set at the higher ratio (4:1).

Table 9 below provides the types of vegetation community impacted within State Forest land, including Forestry Management Zones (conservation) and indicative biodiversity offset areas required.

Table 9: Indicative biodiversity offset areas required as a result of clearing impacts from the motorway upgrade project within State Forests

Vegetation Community	Equivalent Vegetation type (OEH Vegetation Types Database)	Broad Vegetation Type	Habitat Type	Area impacted under State Forests; includes edge effects (ha)	Offset Ratio Applied	Offset Area required (ha)
Blackbutt Dry Sclerophyll Forest	Blackbutt - Spotted Gum shrubby open forest on sandstones of the lower Clarence Valley of the North Coast	Dry Open Sclerophyll Forest (Non-EEC)	Dry Sclerophyll Forest	3	2:1	6
Scribbly Gum Dry Sclerophyll Forest	Scribbly Gum - Red Bloodwoodheathy open forest of the coastal lowlands of the North Coast					
Eastern Red Gum Floodplain Forest	Narrow-leaved Red Gum woodlands of the lowlands of the North Coast	Subtropical Coastal Floodplain Forest (EEC)	Forested Wetlands	0.6	4 :1	2.4

Vegetation Community	Equivalent Vegetation type (OEH Vegetation Types Database)	Broad Vegetation Type	Habitat Type	Area impacted under State Forests; includes edge effects (ha)	Offset Ratio Applied	Offset Area required (ha)
TOTAL				3.6		8.2

As derived from Table 9, a total offset area of 8.2 hectares would be required as a result of the project clearing impacts within State Forest lands – assuming that DI & I (Forests) are compensated for the loss of ‘working forests’ through the provision of cleared land/funding for the establishment of a forestry plantation(s).

Table 10: Indicative biodiversity offset areas required as a result of clearing impacts from the motorway upgrade project (including areas both within and outside of State Forests)

Vegetation Community	Vegetation type (OEH Vegetation Types Database)	Broad Vegetation Type	Habitat Type	Area impacted, includes edge effects(ha)	Offset Ratio Applied	Offset Area required (ha)
Blackbutt Dry Sclerophyll Forest	Blackbutt - Spotted Gum shrubby open forest on sandstones of the lower Clarence Valley of the North Coast	Dry Open Sclerophyll Forest (Non- EEC)	Dry Sclerophyll Forest	53	2:1	106
Scribbly Gum Dry Sclerophyll Forest	Scribbly Gum - Red Bloodwoodheathy open forest of the coastal lowlands of the North Coast					
Spotted Gum Dry Sclerophyll Forest	Spotted Gum - Grey Ironbark - Pink Bloodwood open forest of the Clarence Valley lowlands of the North Coast					
Eastern Red Gum Floodplain Forest	Narrow-leaved Red Gum woodlands of the lowlands of the North Coast	Subtropical Coastal Floodplain Forest (EEC)	Forested Wetlands	18	4 :1	72
Forest Red Gum Floodplain Forest	Forest Red Gum - Swamp Box of the Clarence Valley lowlands of the North Coast					
TOTAL				71		178

Using the proposed methodology, indicative offset requirements for the Devils Pulpit upgrade will be 178 hectares (Table 10). This exceeds the minimum requirement for 152 hectares as outlined in the Minister for Planning's Conditions of Approval. The direct clearing area (discounting edge effects) to compensatory habitat ratio equates to 178ha :55.5 ha, an overall ratio of approximately 3.2: 1.

Offsetting habitat for threatened species

Of the 26 threatened fauna species known or likely to occur in the study area, 24 are known to be associated with all vegetation types recorded in the study area, according to the Threatened Species Profile Database (TSPD)(OEH 2011); one (Black-chinned Honeyeater) is known to be associated with three of the five vegetation types in the study area; and one (Eastern False Pipistrelle) is not known to be associated within any of the vegetation types in the study area.

The Anabat record of the Eastern False Pipistrelle was considered in the Ecology Technical Working Paper to be doubtful as this species is more typically found in higher elevation forests (Hyder Consulting 2010a). The Northern Rivers Regional Biodiversity Management Plan (DECCW 2010) lists the Eastern False Pipistrelle as occurring in sclerophyll forest and rainforest habitats in escarpment and tableland landscapes.

The BioBanking assessment methodology establishes two classes of biodiversity credits: ecosystem credits and species credits. Ecosystem credits can be created or required for all impacts on biodiversity values (including threatened species that can be reliably predicted by habitat surrogates), except the threatened species or populations that require species credits. Threatened species recorded or predicted to occur in the study area that would require ecosystem credits are listed in Table 11.

Table 11: Threatened fauna species recorded or predicted to occur in the study area that require ecosystem credits

Common Name (Scientific name)	Associated Vegetation Types – from TSPD
Recorded in study area	
Brown Treecreeper (<i>Climacterispicumnusvictoriae</i>) Glossy Black-Cockatoo (<i>Calyptorhynchuslathamii</i>) Barking Owl (<i>Ninoxconnivens</i>) Masked Owl (<i>Tytonovaehollandiae</i>) Powerful Owl(<i>Ninoxstrenua</i>) Little Lorikeet (<i>Glossopsittapusilla</i>)	All vegetation types in study area
Black-chinned Honeyeater (<i>Melithreptusgularis</i>)	Clarence Lowlands Spotted Gum, Lowland Red Gum, Narrow-leaved Red Gum
Squirrel Glider (<i>Petaurusnorfolcensis</i>) Yellow-bellied Glider(<i>Petaurusaustralis</i>) Greater Broad-nosed Bat (<i>Scoteanaxruepellii</i>) Yellow-bellied Sheath-tail Bat (<i>Saccolaimusflaviventris</i>) Hoary Wattleed Bat (<i>Chalinolobusnigrogriseus</i>)	All vegetation types in study area
Eastern False Pipistrelle(<i>Falsistrellustasmaniensis</i>)	Not known to be associated with any of the vegetation types in study area (record dubious)
Predicted to occur in study area	

Common Name (Scientific name)	Associated Vegetation Types – from TSPD
Grey-crowned Babbler (<i>Pomatostomus temporalis temporalis</i>)	All vegetation types in study area
Koala (<i>Phascolarctoscinereus</i>) Spotted-tail Quoll (<i>Dasyurus maculatus</i>) Eastern Freetail Bat (<i>Mormopterus norfolkensis</i>)	All vegetation types in study area

Given that the Eastern False Pipistrelle requires offset via ecosystem credits, if the records of the species in the study area were valid and the species is using the habitat in the study area, it is proposed to offset for this species using ecosystem credits for the vegetation types in the study area instead of the known vegetation associations for this species.

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. None of the three species that are identified as requiring a species credit were actually recorded within the study area, but all were considered likely to occur. Only one of these species, the Green-thighed Frog, has habitat requirements specified in the Threatened Species Characteristics by CMA database (TSCCD). Indicative habitat requirements for the other two species have been provided based on the habitat descriptions in the TSPD for each species and the habitat within the study area.

Table 12: Threatened fauna species predicted to occur in the study area that require species credits

Common Name (Scientific name)	Potential habitat in Devils Pulpit study area (from Hyder Consulting 2010a)	Habitat specified in TSPD	Habitat requirements specified in TSCCD
Green-thighed Frog (<i>Litoria brevipalmata</i>)	Prefer ephemeral wetlands in Dry Open Forests often with a grassy understorey; breed in ephemeral pools following storm events. In the study area potential breeding habitat occurs around most drainage lines and on the west side of the highway in the vicinity of chainage 69 700.	Breeding habitat is semi-permanent or ephemeral ponds or depressions in a range of vegetation communities, including rainforest, wet and dry forest, heath and grassland. Shelter/foraging habitat: leaf litter or vegetation within 300m of breeding habitat.	Land within 100 m of semi-permanent or ephemeral ponds or depressions containing leaf litter.
Wallum Froglet (<i>Crinia tinnula</i>)	Potential foraging habitat widespread on the west side of Tabbimoble Overflow No. 2	Moist microhabitats in swamps, or wet or dry heaths, or sedge grasslands or swamps	Land within 40 m of swamps, wet or dry
Brush-tailed Phascogale (<i>Phascogale tapoatafa</i>)	Prefer dry open forests with sparse ground cover and dense leaf litter. Ideal habitat patchily distributed in the study area, although most of the Dry Open Forest in Devils Pulpit State Forest is suitable.	Breeding habitat: Hollow trees, logs or stumps with entrances > 2.5 cm wide. Foraging habitat: trunks and branches of trees in open forest or woodland as per vegetation type. This species is known to be associated with all vegetation types in the study area.	Not specified

Rufous Bettong (<i>Aepyprymnus rufescens</i>)	Prefer open grassy forests where they forage on a variety of herbs, grasses and tubers. The species is predicted to reside in the study area and move between Bundjalung NP and Devils Pulpit SF.	Breeding habitat: As per vegetation type. Foraging habitat: As per vegetation types; favouring areas with grassy understorey adjacent to dense understorey. This species is known to be associated with all vegetation types in the study area.	Not specified
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The area of habitat that will be impacted can be estimated for the Green-thighed Frog and the Wallum Froglet, as the habitat requirements specified in the TSCCD provide a quantifiable measure of “land within 100 m of semi-permanent or ephemeral ponds or depressions containing leaf litter” for the Green-thighed Frog and “land within 40 m of swamps, wet or dry” for the Wallum Froglet. Habitat for the Green-thighed Frog has been estimated at 13.1 ha based on a 100 metre buffer around all drainage lines in the study area. Subtropical Coastal Floodplain Forest offers potential habitat for the Wallum Froglet, so the offsetting of this broad vegetation type should adequately offset habitat for this species.

Although no habitat is defined in the TSCCD for the Brush-tailed Phascogale, the TSPD defines breeding habitat for this species as “hollow trees, logs or stumps with entrances > 2.5 cm wide”.

Specific habitat requirements for the Rufous Bettong are not provided in the TSCCD nor in the TSPD; the TSPD states that breeding and foraging habitat are as per vegetation type, with preferred foraging habitat in areas with grassy understorey adjacent to dense understorey. It is not possible to estimate the area of specific habitat that will be impacted based on this description.

Based on the habitat requirements for the three threatened species requiring species credits that may occur in the study area, the proposed offset site should contain:

- A minimum of 13.1 hectares of land within 100 m of drainage lines
- Hollow trees, logs or stumps with entrances > 2.5 cm wide

It is proposed to offset habitat for the Rufous Bettong based on vegetation type as per ecosystem credits, in the absence of any specific and quantifiable habitat requirements. The Wallum Froglet will also be adequately offset through ecosystem credits as the defined habitat requirements are very general.

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 five 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 Southern Myotis), it is likely that the habitat within the study area for these species can be offset by vegetation type. Potential breeding/shelter habitat for the Southern Myotis under the bridges at Tabbimoble Floodways No. 2 and 3 will not be removed, and additional habitat may be provided through the duplication of these bridges. The five species are associated with all vegetation types in the study area (OEH 2011).

Table 13: Threatened fauna species recorded in the study area for which credit type is not defined

Common Name (Scientific name)	Potential habitat in Devils Pulpit study area (from Hyder Consulting 2010a)	Breeding/shelter habitat as specified in TSPD
Grey-headed Flying-Fox (<i>Pteropuspoliocephalus</i>)	The study area represents foraging habitat only. It is likely that flying-foxes would be present in the study area for most of the year.	Canopy trees associated with rainforest, or coastal scrub or riparian or estuarine communities and with sufficient forage resources available within 40km.
Southern Myotis (<i>Myotis macropus</i>)	Recorded at Tabbimoble Overflows 2 and 3; has a strong association with riparian habitats and roosts in a variety of structures close to water.	Live and dead hollow-bearing trees, under bridges or other artificial structures, in caves, or in dense foliage
Little Bentwing-bat (<i>Miniopterus australis</i>)	Abundant in study area, forages throughout study area. Typically roost in caves; predicted to roost in nearby ranges and move into study area to forage.	Caves, often limestone
Eastern Bentwing-bat (<i>Miniopterus schreibersii oceanensis</i>)	Probable record in north of study area. Typically roost in caves; predicted to roost in nearby ranges and move into study area to forage.	Caves
Eastern Cave Bat (<i>Vespadelustroughtoni</i>)	One Eastern Cave Bat was captured at the northern end of Devils Pulpit State Forest. It is predicted that this species roosts in the nearby escarpment and move into the study area to forage; predicted to use the study area on an occasional basis and probably in small numbers.	Caves or rocky outcrops or cliffs or scarps or old mine workings

Mitigation measures proposed for the five bat species include: pre-clearing, fauna rescue protocol, avoidance of hollow-bearing trees and inspection of large pipes beneath the existing highway prior to removal. These measures are described in more detail in Section 4.1.1 and Table 8 of the Ecological Monitoring Program (Hyder Consulting 2012).

Four threatened fauna species were identified in DSEWPC condition 7 as 'species of concern': Grey-headed Flying-fox, Spotted-tail Quoll, Regent Honeyeater and Swift Parrot. Of the four species, only one (Grey-headed Flying-fox) was recorded in the project study area, and potential habitat for the other three species may occur (Table 14).

Table 14: Potential habitat for species of concern identified by DSEWPC

Common Name (Scientific name)	Habitat as specified in TSPD	Potential habitat within Devils Pulpit study area
Grey-headed Flying-Fox (<i>Pteropuspoliocephalus</i>)	Canopy trees associated with rainforest, or coastal scrub or riparian or estuarine communities and with sufficient forage resources available within 40km.	The study area represents foraging habitat only. It is likely that flying-foxes would be present in the study area for most of the year.

Common Name (Scientific name)	Habitat as specified in TSPD	Potential habitat within Devils Pulpit study area
Spotted-tail Quoll (<i>Dasyurus maculatus</i>)	Known from a variety of habitats including rainforest, open forest, woodland, coastal heathland and inland riparian forest; preferred habitat generally comprises structurally diverse forest. Breeding habitat: hollow-bearing trees, fallen logs, small caves, rock crevices, boulder piles, rocky-cliff faces or animal burrows.	Dry Open Forests. Potential foraging and denning (hollow logs) habitat is widespread in the study area, although if present, Quolls would occur in low densities due to large home range size.
Regent Honeyeater (<i>Anthochaera phrygia</i>)	Occurs in dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River Sheoak. Nests usually constructed in eucalypts, casuarinas or mistletoes. Forage for nectar and arthropods. Semi-nomadic; every few years non-breeding flocks migrate to flowering coastal Swamp Mahogany and Spotted Gum forests, particularly on the central coast and occasionally on the upper north coast of NSW.	The study area would represent seasonal foraging and roosting habitat only.
Swift Parrot (<i>Lathamus discolor</i>)	In northern New South Wales, Narrow-leaved Red Ironbark/ Forest Red Gum forest and Yellow Box forest and several Endangered Ecological Communities, including subtropical coastal floodplain forest and swamp sclerophyll forest, provide roosting and foraging habitat for the species.	The study area would represent seasonal foraging and roosting habitat only.

Based on the habitat requirements for the four species of concern, the proposed offset site should contain:

- A high diversity and abundance of nectar producing species that would provide foraging resources for the Grey-headed Flying Fox, Regent Honeyeater and Swift Parrot.
- Potential foraging and denning habitat (hollow logs) for the Spotted-tail Quoll.
- Linkages to existing habitat for the species of concern.

Expert opinion from a suitably qualified ecologist will be sought to determine whether the proposed offset land is suitable for the identified species of concern.

Hollow Bearing Trees and Logs

Approximately 508 hollow bearing trees and 43 hollow logs have been identified within or immediately adjacent to the highway upgrade by the project ecologist. The number of hollow bearing trees and logs will be totalled upon finalisation of clearing to determine the number of hollow bearing trees and logs required on offset lands.

Assessment of the suitability of potential offset sites will include an assessment of the number of hollow bearing trees. The proposed offset site should contain a commensurate number of tree hollows and hollow logs to the impacted areas,

3.4 Decision Making Framework

All biodiversity offsets would be located within the NSW North Coast Bioregion with the aim of offsetting on a like for like basis based on broad vegetation type, which would encompass ecosystem credits for those species listed in Table 10. The offset areas will be assessed to ensure that the additional fauna habitat features identified in Table 11 are included in offset areas. Foraging habitat for the bat species listed in Table 12 will be offset through ecosystem credits. 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. Any offsets that are not comprised of lands within 50 km of the project site would need to be agreed to by DSEWPC, as required by condition 7b of the Commonwealth conditions of approval.

It is recognised that the availability and suitability of land for inclusion in the offset package will be uncertain until the detailed investigation of suitable sites and finalisation of negotiations with landholders occurs. As a result it is necessary to have a staged approach to determining the suitability of sites for inclusion in the package.

Priority 1

The first phase of the offset strategy would be to identify land that could be included in the package that meets the following criteria:

- Properties located within a 30km radius of the of the project extending to 100km with the agreement of the Department of Planning and EPA where it can be demonstrated that a suitable offset could not be found. The DSEWPC conditions require that offset lands be located within 50km of the project unless otherwise agreed with the Department.
- Offset land would contain vegetation communities as per Table 9.
- Land would be assessed as to its suitability as habitat for the threatened species impacted by the project (including patch sizes) based on OEH threatened species profiles databases.
- Offset land would comprise vegetation of at least moderate to good condition (according to OEH native vegetation benchmarks database).
- Offset land would comprise land that enables connectivity between adjacent areas of vegetation.
- Offset land must be suitable for ongoing management for conservation through an appropriate legal instrument.

Tools used to identify potential offset land include, but are not limited to, the OEH twenty-five (25) year investment layer, RMS property databases, direct contact with private property owners and possibly through advertisements for expression of interest for the provision of land for conservation purposes. The RMS will consult with the EPA regarding the methodology used to assess potential offset sites and the suitability of these sites as offsets.

The RMS has identified land that is considered likely to be suitable as an offset for the project, and will be progressing this in consultation with relevant agencies and subject to a separate report that demonstrates how the identified land meets the Biodiversity Offset Strategy.

The offset strategy is consistent with OEH's offset principles. RMS has made a commitment to conservation of offset lands in perpetuity. There are a number of mechanisms to do this, including transfer of ownership to the National Parks estate or through a Deed of Agreement process developed under the NSW Nature Conservation Trust Act 2001 which has the same status as a conservation agreement developed under the National Parks and Wildlife Act 1974. These agreements are recognised as protected areas under the Commonwealth Protected Area and National Reserve System. In determining a hierarchy of mechanisms EPA will be given the opportunity to have potential offset lands incorporated into National Parks, however there may be cases where lands are not suitable for inclusion into the National Parks estate, but do have suitable biodiversity values to be included as part of the biodiversity offset package required under CoA B5.

RMS acknowledges the NSW Stateplan's commitment to continue to build and establish national parks and nature reserves as the primary biodiversity conservation mechanism. RMS 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).

To deliver the biodiversity offset the RTA would engage the services of an appropriate organisation to act as a third party offset agent to negotiate with landholders to secure conservation management of the land and negotiate appropriate covenant or agreements. Third party offset agents could include conservation organisations established for this purpose. There are also a number of private companies that offer specialist services in finding biodiversity offset lands. If suitable, RMS would also consult with EPA to pursue opportunities to purchase land that may be suitable for reserve estate with the EPA.

Condition and habitat assessment of the proposed offset lands would be undertaken to ensure the potential offset land(s) consist of appropriate vegetation type(s) and are of adequate condition that meets the decision-making framework outlined above. This assessment would be undertaken by suitably qualified ecologists and the report prepared would be included in the Biodiversity Offset Package. The offset package will also meet the requirements for an Offset Plan as specified in condition 7 of the DSEWPC conditions of approval.

Priority 2

The second phase, if required, would be to identify other land that either comprises properties located within the broader North Coast Bioregion or consists of similar vegetation communities of similar conservation status within the broad vegetation types as identified in Table 9. The other criteria included in Priority 1 would still apply to lands considered under Priority 2.

The second phase would only be undertaken if the offset requirements could not be met from Priority 1 criteria and after consultation with EPA and Department of Planning. The package would clearly identify the outcomes of the assessment of properties under Priority 1 criteria and identify if any Priority 2 properties were required to be included in the package to meet the objectives of the Strategy.

Priority 3

In the event that every reasonable effort has been made and offset land cannot be found through the investigation process outlined in Priority 1 and/or Priority 2 above, then RMS would consult further with the EPA and Department of Planning before proceeding with the delivery of Option B and Option C as described in Section 3.3.

To deliver Option B, RMS would invest in the strategic revegetation of the Endangered Ecological communities impacted by the project adjacent to the road corridor or within the region. Locations of revegetation would be guided by outcomes of the further investigation and specialist advice from EPA and / or other specialist ecologists. Revegetation would be focused particularly at increasing key habitat for Squirrel Gliders, Yellow Bellied Gliders and Glossy Black Cockatoo.

To deliver Option C, RMS would work with EPA and other relevant government agencies and stakeholders to identify some key projects aimed at threatened species management in the region that would lead to future opportunities for improving biodiversity outcomes. The amount of investment in this option will depend on outcomes of the other options above.

3.5 Potential Compensatory Habitat in the Region

Table 15. shows that there are substantial tracts of land potentially available for consideration for the biodiversity offset package mapped within 50 km of the study area.

Table 15: Maximum vegetation to be cleared during construction

Vegetation Community	Area occupied within study area (ha)	Total clearing including ancillary areas (ha)	% removed from study area	Approximate area available within 50 km of alignment (ha)
Blackbutt Dry Sclerophyll Forest	47.42	26.32	56%	34,199
Scribbly Gum Dry Sclerophyll Forest	9.72	9.57	98%	5,994
Spotted Gum Dry Sclerophyll Forest	5.06	4.3	85%	70,257

Vegetation Community	Area occupied within study area (ha)	Total clearing including ancillary areas(ha)	% removed from study area	Approximate area available within 50 km of alignment (ha)
Eastern Red Gum Floodplain Forest	21.0	13.66	65%	1,224
Forest Red Gum Floodplain Forest	3.78	1.63	43%	50,311

3.6 Management of unforeseen additional impacts

Throughout the construction period there is a possibility of design changes that may impact on additional areas of native vegetation. Where additional clearing is proposed to be undertaken outside of the construction clearing limits, a consistency assessment will be undertaken against the Minister for Planning's Conditions of Approval for the project. Consistency assessment(s) will take into account the vegetation type, quality and habitat, the total area to be cleared, any threatened flora or fauna species or their habitat that may be impacted, and whether translocation of any species is required.

If the design change is deemed inconsistent with the Minister for Planning's Conditions of Approval then a modification under Section 75 W of the Environmental Planning and Assessment Act 1979 will be lodged for determination by the Minister for Planning. This process will also enable a detailed record of any additional clearing impacts outside of what was anticipated in the Biodiversity Offset Strategy. In addition a survey at the end of the construction phase of the project will be undertaken to compare the area cleared for construction against what was envisaged in the Biodiversity Offset Strategy. In the event that there is an increase in the area of native vegetation impacted above what was anticipated in the Biodiversity Offset Strategy then additional offset measures will be implemented. The extent of any additional measures will be determined in consultation with the OEH and Department of Planning.

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

- Secure additional native vegetation protected through covenants (or other equivalent protection mechanism).
- Additional revegetation in strategic locations.
- Investment in management research related to the rehabilitation and protection of relevant threatened species such as the Yellow Bellied Glider, Squirrel Glider and Glossy Black Cockatoo.

3.7 Biodiversity Offset Package

Within 12 months of the approval of this strategy, RMS will submit to the Department of Planning a Biodiversity Offset Package. The package shall be prepared in consultation with OEH and DSEWPC and will include details of the final suite of measures selected 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 under Options A, B and C.

RMS has commenced investigations on an approximately 810 ha parcel of land that has the potential to fulfil the offset requirement for the Devils Pulpit project and future Pacific Highway upgrades. The land adjoins the north-east of the northern extent of the Devils Pulpit project area (Figure 6). An assessment of the suitability of this property as compensatory habitat to offset

habitat loss from the Pacific Highway Upgrade at Devils Pulpit, with reference to the offset criteria specified in MCoA B4 and DSEWPC condition 7, has been undertaken.

The compensatory habitat assessment found that the proposed offset site adjoins conserved lands with high biodiversity values, including Bundjalung National Park (a declared Wilderness Area), Tabbimoble Swamp Nature Reserve and several state forests. There is good connectivity between the vegetation on the site and adjoining areas, including conservation areas, and it forms part of a regional fauna corridor.

A flora and fauna survey of the study area was undertaken in early March 2011. Preliminary mapping of the proposed offset site identified five different vegetation communities (Table 16).

Table 16: Vegetation communities on the proposed offset site and equivalent communities in the Devils Pulpit study area

Identified vegetation community on proposed offset site	Equivalent community mapped in Devils Pulpit project area (Hyder 2010a)	Estimated area within proposed offset site
Clarence Lowlands Spotted Gum	Spotted Gum Dry Sclerophyll Forest	40.82 ha
Heathy Scribbly Gum	Scribbly Gum Dry Sclerophyll Forest	365.64 ha
Dry Heathy Blackbutt-Bloodwood	Blackbutt Dry Sclerophyll forest	35.14 ha
Total Dry Sclerophyll Forest		441.6 ha
Lowland Red Gum	Forest Red Gum Floodplain Forest	226.47 ha
Paperbark	-	139.13 ha
Total Coastal Floodplain Forest		365.60 ha

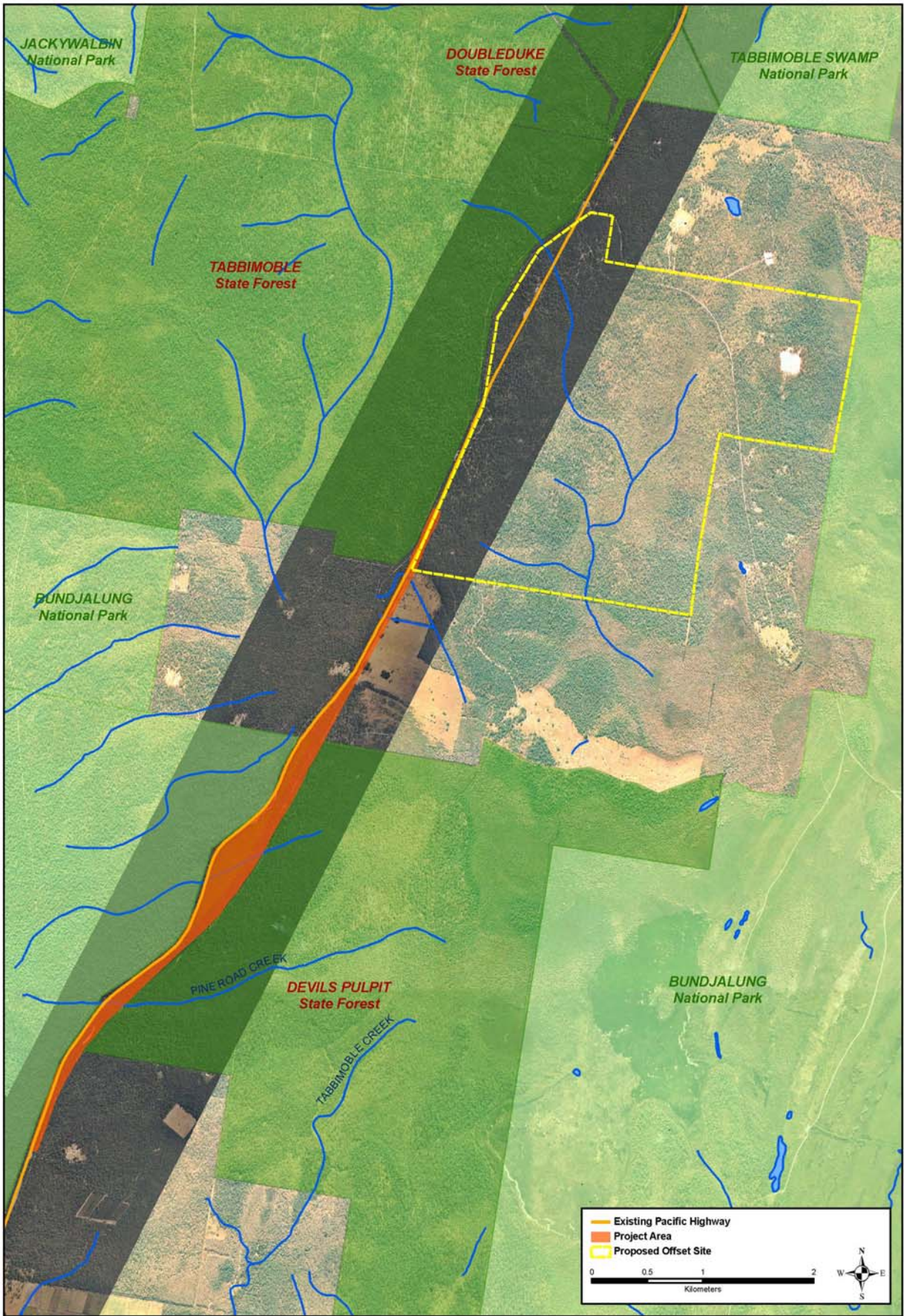


Figure 6: Location of proposed offset site

The vegetation of the proposed offset site has previously been disturbed by fires and selective logging, as well as minor fragmentation by roads and access tracks. There is a quarry in the north-eastern section of the study area. Despite this disturbance it was considered to be in good condition, with high plant species diversity, all structural layers present and a low incidence of weeds.

In terms of the suitability of the site as a potential biodiversity offset for the Devils Pulpit project, there are similarities between the identified vegetation communities and the suite of flora and fauna species, including threatened species, which are expected to occur in both areas. In terms of the identified vegetation types, four of the communities present on the offset site are equivalent to impacted vegetation communities in the Devils Pulpit project area and meet the requirements for broad vegetation types as specified in the Minister's Condition of Approval B4. The presence of the equivalent vegetation communities, as well as the proximity of the site to the Devils Pulpit project area, indicate that a portion of the site could represent an appropriate offset for the vegetation to be cleared for the upgrade of the Pacific Highway at Devils Pulpit.

As specified in the Commonwealth conditions of consent for the Devils Pulpit project, the Biodiversity Offset Package will include a plan for the acquisition and active management of the offset site. The plan will incorporate key milestones, performance indicators, corrective actions and timeframes for the completion of all actions outlined in the plan.

Recommended management actions for the offset site include:

- Preparation of a management plan for the offset site, including restoration of currently disturbed areas and management of tracks and access points across the site.
- Rehabilitation of the existing quarry on the site.
- Gating of access tracks to prevent illegal vehicle access across the study area.
- Consider translocation of tree hollows and logs cleared from the Devils Pulpit project area to selected locations in the study area.
- Preparation of a bushfire management plan.

It is proposed to progress the offset package through consultation with agencies, purchase of the selected offset property and approval of the final Biodiversity Offset Package. The indicative timeframe for delivery of the Biodiversity Offset Package is presented in Table 17.

Table 17: Indicative timeframe for delivery of the Biodiversity Offset Package

Action	Indicative timeframe
Submission of draft offset strategy	August 2011
Approval of offset strategy by agencies	March 2012
Submission of final offset package to agencies	August 2012
Approval of final offset package by agencies	October 2012
Commence implementation of management plans associated with Biodiversity Offset Package	November 2012

4 CONCLUSIONS

Measures for managing biodiversity impacts arising from the Devils Pulpit Project were developed following the general principles of avoiding, mitigating and offsetting impacts. Impacts on biodiversity values within the region have been avoided 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 and monitoring measures.

The Project will result in direct impacts to approximately 55.5 hectares of vegetation and indirect impacts (edge effects) on an additional 15 ha. Based on offset ratios of 4:1 for endangered ecological communities and 2:1 for non-EEC vegetation communities impacted by the project, indicative offset requirements for the Devils Pulpit upgrade will be 178 hectares. This exceeds the minimum requirements of 152 hectares as outlined in the Minister for Planning's Condition of Approval.

There are substantial tracts of land potentially available for consideration for the biodiversity offset package within 50 km of the study area, and RMS has commenced investigations on a potential biodiversity offset site adjacent to the Devils Pulpit project, which appears to represent a suitable offset for the vegetation to be cleared for the project.

Within 12 months of the approval of this strategy, RMS will submit to the Department of Planning a Biodiversity Offset Package, to be prepared in consultation with OEH and DSEWPC and including details of the final suite of measures selected in accordance with this strategy.

5 REFERENCES

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