Sapphire to Woolgoolga Upgrade

Proposed Biodiversity Offset and Mitigation Strategy

May 2010

About this release

Title	Sapphire to Woolgoolga Pacific Highway Upgrade– Proposed Biodiversity Offset and Mitigation Strategy

Approval and authorisation		Name	Effective date
Prepared by	Scott Lawrence & Kevin Roberts		
Approved by	Bob Higgins		

Location	File name

Document status	Date
Final	

Version	Date	Revision Description
Draft	30/11/09	Draft version 1
Draft	15/02/10	Draft version 2
Final	27/05/10	Final

Contents

1 Introduction

1.1 Background

The NSW Roads and Traffic Authority (RTA) is planning to upgrade the 25 kilometre section of the Pacific Highway commencing approximately eight kilometres north of Coffs Harbour on the Mid- North Coast New South Wales and extending to Arrawarra Beach Road north of Woolgoolga. The proposed upgrade forms part of the Pacific Highway Upgrade Program, a joint commitment by the NSW State Government and the Federal Government to upgrade the Pacific Highway between Hexham and the Queensland border. The project involves upgrading the existing highway to dual carriageways with the introduction of local service roads, generally within or adjacent to the existing road reserve from Sapphire to south Woolgoolga and a western bypass around Woolgoolga to Arrawarra, where the project road alignment rejoins the existing highway at Arrawarra Beach Road.

The project includes five grade separated interchanges. These are situated at Gaudrons Road/Spilt solitary Road, Sapphire; Moonee Beach Road/ Hoys Road, Moonee Beach; Fiddaman Road/Graham, Drive South, Emerald Beach; Graham Drive North, south Woolgoolga; and Arrawarra Beach Road, Arrawarra. Figure 1.1 provides an overview of the proposal.

The Sapphire to Woolgoolga upgrade was given planning approval on the 13 January 2009 and the RTA plans to commence construction of the main highway works in August / September 2010. Early utility relocation works commenced in October 2009.

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

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

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

- A loss of native vegetation
- A loss and modification of habitat for a variety of protected and threatened native fauna species

1.2 Purpose of this report

The Sapphire to Woolgoolga upgrade has been approved under Part 3A of the NSW *Environmental Planning and Assessment Act 1979*. The conditions of approval required the development of Biodiversity Offset and Mitigation Strategy and Package. This report has been prepared to satisfy the Minsters Condition of Approval (MCoA) outlined below.

MCoA 2.12:

The Proponent shall develop and submit for the approval of the Director-General, a Biodiversity Offset Strategy. The Strategy shall provide a framework for developing the Biodiversity Offsets Package required by Condition 2.13 and shall be developed in consultation with the DECC. The Strategy shall:
include a minimum requirement to provide 98.8 hectares of native vegetation to offset direct and indirect impacts of the proposal
identify the extent and types of habitat/vegetation communities that would be lost or degraded

as a result of the project;
describe the quality of the habitat/vegetation communities identified in point b);
identify the objectives and outcomes to be met by the final Biodiversity Offset Package;
consider the biodiversity management measures or activities identified in the documents set out in condition 1.1 or elsewhere in these Conditions of Approval, including:
fauna crossing measures, including vegetated medians, fauna structures and associated fauna fencing to be installed as part of the project.
revegetation measures.
translocation plans.
any other fauna mitigation measures such as nest boxes and frog breeding ponds.
any ongoing biodiversity or threatened species monitoring requirements.
provide details of available compensatory habitat in the region to offset the loss of Endangered Ecological Communities and habitat for threatened fauna species as a result of the project. This may include other non land based management measures or actions to deliver a beneficial outcome for the region;
provide a decision-making framework to be used in selecting the priority ranking of compensatory habitat options available in the region; and
a process to address additional impacts associated with unforeseeable impacts including:

- *i) changes to footprint due to design changes;*
- *ii) changes to predicted impacts resulting from changes to mitigation measures; and*
- *iii) additional impacts associated with ancillary facilities*

Unless otherwise agreed, the Biodiversity Offset Strategy shall be submitted to the Director-General for approval no later than 6 weeks prior to the commencement of any construction that would result in the disturbance of Endangered Ecological Communities or threatened fauna species' habitat or not later than 12 months from the date of this approval. To avoid any doubt, disturbance of Endangered Ecological Communities or threatened fauna habitat cannot commence until the Director-General has approved the strategy.

Nothing in this condition or this approval precludes the Proponent from implementing a suitable offsets package which addresses impacts from multiple Pacific Highway Upgrade Projects (including the Sapphire to Woolgoolga Upgrade) within the North Coast Bio-region (Manning-Macleay sub region). Any such agreement made with the Department of Environment and Climate Change must be made in consultation with the Department and approved by the Director-General.

Additionally the Minster's Condition of Approval also requires the development of a Biodiversity Offset Package as outlined below.

MCoA 2.13

Within 12 months of the approval of the Biodiversity Offset Strategy, or as otherwise agreed by the Director-General, the Proponent shall submit the Biodiversity Offset Package for the approval of the Director-General. The Package shall be developed in consultation with the DECC and:
shall detail the final suite of biodiversity offset measures selected in accordance with the Strategy; and
include a program (timeline) to achieve the implementation of the final suite of measures. Where possible, this should include purchase of land, development of agreements with identified land management authorities (e.g. DECC, local council etc.) for long term management and funding of offsets and mitigation measures, and installation of identified mitigation measures.

Fig 1.1 Overview of the Sapphire to Woolgoolga Project

1.3 Objectives of the Biodiversity Offset Strategy

The objective of the Biodiversity Offset Strategy is to deliver a Biodiversity Offset Package that aims to achieve a beneficial biodiversity outcome for the region as a result of the upgrade project. The measures used to gauge success of this objective will be:

- Successfully securing the long-term (in perpetuity) protection and management of

lands containing endangered ecological communities and habitat for threatened species (key habitat).

- The total area of lands used to offset the biodiversity impacts shall significantly exceed the direct and indirect (edge effects) impacts.
- The process for setting the scope and quantum of the biodiversity offsets is transparent and justifiable on environmental, social and economic grounds.

1.4 Impact of the upgrade

The Project impacts on areas of key habitat that comprises endangered ecological communities and habitat for threatened species. Impacts on native vegetation will occur predominately on the bypass section west of Woolgoolga that traverses Wedding Bells State Forest and private forested land. Since the preparation of the *Sapphire to Woolgoolga Environmental Assessment (RTA 2007)* further detailed analysis on the advanced concept design has been undertaken and it has been determined that approximately 89 hectares of native vegetation would be directly removed as a result of the project and a further 18 hectares is considered edge effected. Twelve (12) vegetation communities are impacted of which seven correspond with four endangered ecological communities.

The *Sapphire to Woolgoolga Environmental Assessment (RTA 2007)* predicted that 83.1 hectares would be directly removed as result of the project compared to updated figure of 89 hectares. Of the six (6) additional hectares (including associated edge effects), 5.7 hectares is attributed to the widen median through Wedding Bells State Forest to allow gilder crossing movements required through MCoA 2.3. This design refinement was agreed with DECCW and DoP. The remaining additional areas of 0.3 hectares are attributed to the inclusion of water quality basins in Wedding Bells State Forest. *Table 1.1* below provides a summary the vegetation communities impacted by the upgrade incorporating edge effects and clearing for ancillary activities.

Table 1.1 Summary of vegetation and habitat impacts

Broad Vegetation Community	Area impacted including ancillary activities & edge effects	General Condition of Vegetation Community/Habitat	Key Habitat?/ Habitat Type
Coastal Hills Moist Open Sclerophyll Forest (Non EEC)#	86.3	The most abundant vegetation and habitat type impacted by the upgrade and is the dominant community within the northern section where the project traverses Wedding Bells State Forest. The vast majority of this vegetation/habitat type has been disturbed through logging cycles over the last 100+ years. Despite the logging history, hollow bearing trees occur with this vegetation type and it is considered to be generally in moderate to good condition with other habitat features such as fallen timber and leaf litter.	Yes- (Moist Open Forest)
Littoral Rainforest (EEC)	1.1	Project impacts this vegetation community on the western side of existing highway near Sapphire Beach. Vegetation community/habitat type is generally degraded due to the adjacent cleared land and surrounding residential areas.	Yes- (Rainforest/Closed Forest)
Lowland Rainforest on Floodplain	1.0	Project would remove one hectare from a larger area of Lowland Rainforest that is in moderate to good condition.	Yes- (Rainforest/Closed Forest)
Swamp Sclerophyll Forest (EEC)##	13.1	The Environmental Assessment identified that much of this community impacted occurs within the existing road reserve consisting of young regrowth with moderate to high levels of common exotic species in the understory. Small sections (1.1Ha) of this community within Wedding Bells State Forest are in better condition with less weed invasion. This vegetation community also provides winter flowering species which are important seasonal food source.	Yes- (Forested Wetlands)
Swamp Oak Floodplain Forest (EEC)	5.5	Project generally impacts on this community within the existing road reserve and is mostly confined to relatively young regrowth in poor condition	Yes – (Forested Wetlands)
Total Area Impacted	107.1		

Note: clearing of plantation lands not included

Comprises Blackbutt Dry Sclerophyll forest (56.9ha), Spotted Gum (10.0ha) Grey Gum/iron Bark (8.9ha), Flooded Gum (5.7 ha) and Narrow Leave White Mahogany (4.8ha),

Comprises Red Mahogany (2.1 Ha), Smooth Barked Apple (0.03Ha), Broad-leaved Paperbark (8.3Ha) and Swamp Mahogany (1.5Ha)

Edge effects have been based on a 50 metre wide edge from the construction footprint. A comprehensive review on edge effect and their compensation (Bali 2000 & 2005) suggest that only 60% of 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.

Seven threatened species were recorded within or adjacent to the route these include; Slender Marsdenia *(Marsdenia longiloba), Lindsaea incisa, Rough-shelled Bush Nut (Macadamia tetraphylla), Rusty Plum (Niemeyera whitei), Red Bopple Nut (Hicksbeachia pinnatifolia) Moonee Quassia (Quassia sp. Moonee Creek)* and *Tylophora woollsii*

Populations of *Macadamia tetraphylla, Hicksbeachia pinnatifolia,* and *Moonee Quassia* and would not be directly affected by the project. Eleven *Niemeyera whiteni* individuals (formerly identified as *Amporphospermum whitei*) will be directly impacted by the project.

The project would also directly impact on approximately 60m^2 *Lindsaea incisa* at Orara East State Forest and one individual of *Marsdenia longiloba* and *one* individual of *Tylophora woollsii* at Newmans Road underpass.

One hundred and eighty four (184) fauna species were recorded during the surveys undertaken as part of the route selection and environmental assessment process, comprising 16 threatened species and four migratory bird species which are detailed in *Table 1.2* below.

Significance assessments on threatened ecological communities as well as threatened plant and animal species were undertaken as part the Environmental Assessment. The significance assessments were based on the heads of consideration detailed in the draft *Guidelines for Threatened Species Assessment* (Department of Environment and Conservation 2005b). Species were considered for assessment based on species recorded during Environmental Assessment surveys, the presence of suitable core habitat and distribution ranges. The significance assessment concluded that none of the endangered ecological communities recorded are considered likely to be significantly affected by the Project. The detailed significance assessments are provided in the *Sapphire to Woolgoolga Environmental Assessment Appendix G*

No unique fish assemblages or fish passage would be significantly affected by the project. A coastal saltmarsh endangered ecological community is located approximately 75 metres downstream of Double Crossing Creek and would not be directly impacted by the project. Additionally it is anticipated that there will be no impacts on sensitive aquatic habitats such as seagrasses or mangroves.

Table 1.2 Terrestrial fauna species of conservation significance recorded during the survey of the study area

SCIENTIFIC NAME	COMMON NAME	CONSERVATION STATUS	
		TSC Act[1]	EPBC Act[2]
Litoria brevipalmata	Green-thighed Frog	V	-
Crinia tinnula	Wallum Froglet	V	-
Calyptorhynchus lathami	Glossy Black-Cockatoo	V	-
Coracina lineata	Barred-Cuckoo-shrike	V	-
Pandion heliaetus	Osprey	V	-
Ninox strenua	Powerful Owl	V	-
Cercartetus nanus	Eastern Pygmy-possum	V	-
Petaurus norfolcensis	Squirrel Glider	V	-
Petaurus australis	Yellow-bellied Glider	V	-
Pteropus poliocephalus	Grey-headed Flying-Fox	V	V
Myotis adversus	Large-footed Myotis	V	-
Miniopterus australis	Little Bent-wing Bat	V	-
Miniopterus schreibersii	East Bent-wing Bat	V	-
Scoteanax rueppellii	Greater Broad-nosed Bat	V	-
Syconycteris australis	Eastern Blossom Bat	V	-
Mormopterus norfolkensis	East Coast Freetail Bat	V	-
Haliaeetus leucogaster	White-bellied Sea-Eagle	-	M
Hirundapus caudacutus	White-throated Needletail	-	M
Monarcha melanopsis	Black-faced Monarch	-	M
Rhipidura rufifrons	Rufous Fantail	-	M

1. listed under the Threatened Species Conservation Act 1995 – V = vulnerable, E = endangered
2. listed under the Environmental Protection and Biodiversity Conservation Act 1999 – V = vulnerable, E = endangered, M = migratory, C = conservation dependent

None of the threatened fauna species recorded or with the potential to occur are considered likely to be significantly affected by the project, under either NSW or Commonwealth legislation. Detailed assessment of the threatened and migratory species impacted by the project can be found in Chapter 17 of the Sapphire to Woolgoolga Environmental Assessment

1.5 Barrier Impacts

The southern and central sections of the project, which comprise duplication of the existing highway and provision of local access roads, pass through a mosaic landscape consisting of residential, rural residential and cleared land, as well as patches of remnant bushland. The Environmental Assessment found that due to the already fragmented nature of the landscape and the presence of the existing highway, the project in the southern and central sections would not cause additional isolation or fragmentation of any substantial areas of remnant bushland. Measures to improve connectivity between the eastern and western side of the highway are detailed Chapters 7 and 17 of the Sapphire to Woolgoolga Environmental Assessment and Section 2.2 of this report

The northern part of the bypass section passes through Wedding Bells State Forest has the potential to act as a barrier to ground dwelling and arboreal fauna movement within the local

area.

Highly mobile species such as birds and bats are less likely to be affected by physical barriers created by new roads compared to ground dwelling and arboreal fauna which are generally less mobile, such as reptiles and amphibians. However, ground dwelling fauna are known to use fauna underpasses, culverts and bridge openings to cross between areas of habitat separated by the project

Dual carriageways can be a large barrier for arboreal mammal movement. The potential impact to arboreal fauna movement is likely to be greatest at the bypass section of the project within Wedding Bells State Forest where glider species have been recorded on both sides of the proposed highway alignment and where no barrier to fauna movement currently exists. Mitigation measures specifically designed for arboreal mammals are required to provide pathways for movement.

Further details on the types of fauna crossing measures and associated fauna fencing are provided in Section 2.2.

It is anticipated that little to no impact would occur on fish passage given that all replacement structures that cross waterways will comply with Department of Industry and Investment Guidelines '*Why do fish need to cross the road? Fish Passage requirements for Waterway Crossings, Fairfull, S & Witheridge, G (2003).*

.

2 Management of biodiversity impact

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 17.4 and Appendix A of the Sapphire to Woolgoolga Environmental Assessment. Management measures for biodiversity impacts were developed following the general principles, in order of preference:

- Avoiding impacts.
- Mitigating impacts
- Offsetting impacts

A summary of the key measures relevant to biodiversity impacts are outlined below.

2.1 Avoid

Impacts on biodiversity values within the region have been avoided through the route selection process and development of the concept design alignment. Impacts on biodiversity was a key factor in the route selection process with other possible route options having significantly higher biodiversity impacts compared to the route that was finally selected for the Sapphire to Woolgoolga project. Further details on the route selection process are detailed in the Sapphire to Woolgoolga Route Options Development Report RTA 2002, the Sapphire to Woolgoolga Section Supplementary Options Report RTA 2004 and the Coffs Harbour Highway Planning Strategy Preferred Option Report, RTA 2004.

The changes to the preferred route and alignment in response to biodiversity impacts include:

- Refinement of concept design to avoid impacts on a substantial population (75-100 stem individuals) of the threatened flora species *Marsdenia longiloba* near Gaudrons Road. Additionally, population of *Marsdenia longiloba* at Newans Road south was avoided by re-design of water quality basin

- Refinement of the alignment to avoid direct impacts on *Moonee Quassi sp,* at Moonee Beach South
- Provision of arch bridge structure over Poundyard creek avoid sensitive aquatic habitat impacts and minimise impacts to the Lowland rainforest vegetation community
- Provision of widened vegetated medians through Wedding Bells State Forest to allow 'natural' crossing point for gliders to be maintained

Further future measures that would be employed to avoid impact upon biodiversity include:

- All possible engineering solutions to minimise direct impact would be investigated at the detailed design stage to limit the extent of vegetation to be removed.
- Fencing will be installed to mark the limits of clearing (i.e. "no-go" areas) surrounding the footprint to ensure that vehicles and other direct disturbances associated with the road construction, including construction compounds and stockpile sites do not enter adjacent areas of vegetation outside the footprint.
- Construction staff would be educated with regards to the status and location of protected areas during site induction and/or tool box talks.

2.2 Mitigate- Biodiversity Management Measures

Management measures designed to reduce impacts on biodiversity include:

- Fauna crossing measures
- Revegetation measures
- Salvage and translocation of threatened flora species directly impacted by the project
- Installation of nest boxes in accordance with Nest Box Management Plan

Fauna Crossing Measures

Construction of fauna underpasses and combined fauna and drainage/bridge structures and associated fauna fencing will be implemented on the Sapphire to Woolgoolga Project. Fauna underpass structures have been designed to coincide within identified fauna corridors that include both dedicated fauna crossing structure and combined drainage and fauna structures. Table 2.1 taken from the *Sapphire to Woolgoolga Environmental Assessment* identifies the minium sizes that will be used to provide fauna passage.

Table 2.1 Fauna Crossing Structures: Sapphire to Woolgoolga Project

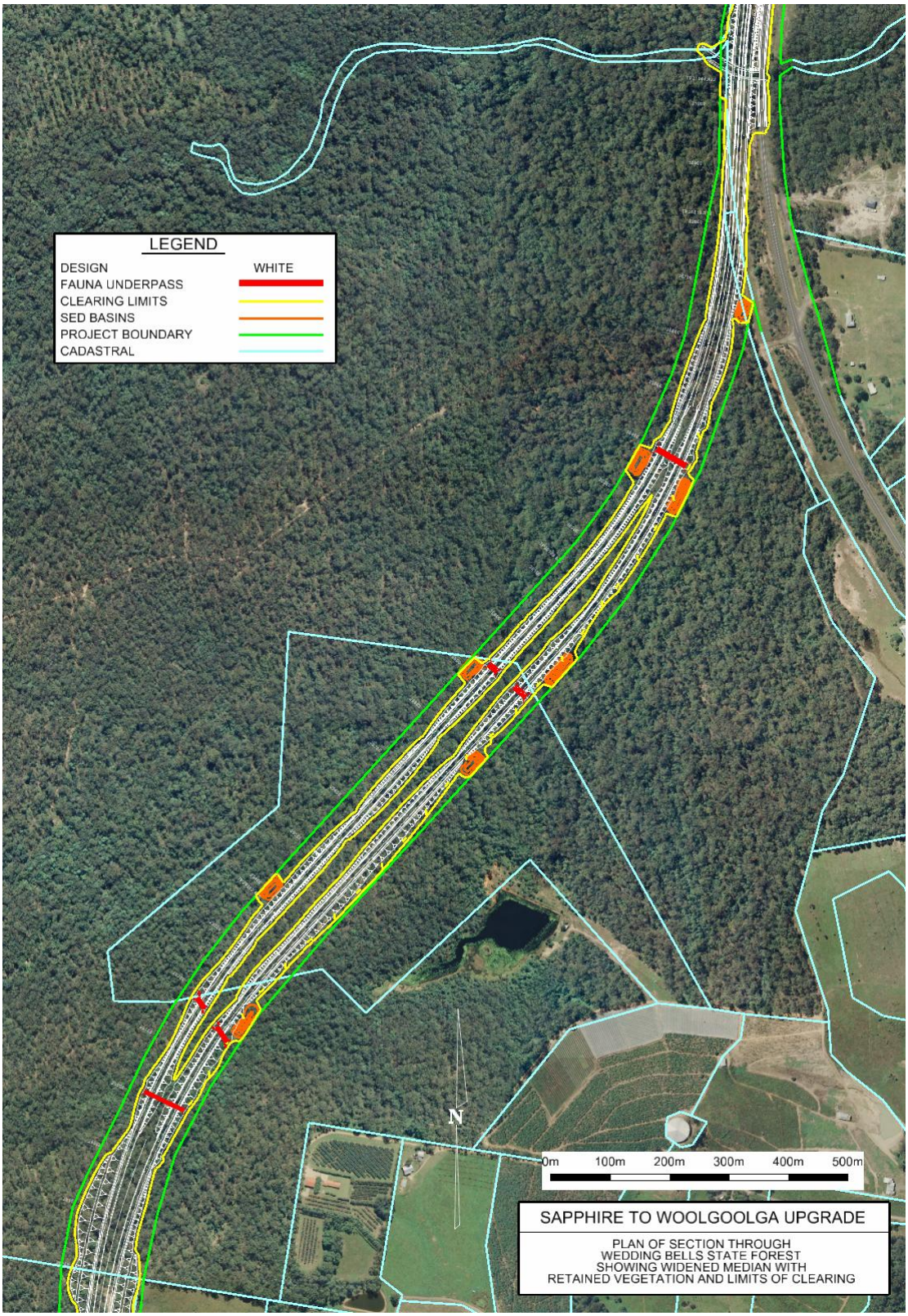
APPROXIMATE CHAINAGE	DESCRIPTION	TYPE OF FACILITY
9.250 km		Small drainage culvert, incidental fauna passage with no additional fauna measures.
10.400 km		Small drainage culvert, incidental fauna passage with no additional fauna measures.
11.500 km	South of Maccues Road	Additional 2400 mm x 2400 mm box culvert for dedicated fauna passage adjacent and higher than, existing major culvert.
12.600 km	Cunninghams Creek	Bridge over Cunninghams Creek with provision for fauna access (not less than 1 metre to 1.5 metres wide) on either side of the creek during normal flows.
14.200 km	Skinners Creek	Bridge over Skinners Creek with provision for fauna access (not less than 1 metre to 1.5 metres wide) on either side of the creek during normal flows.

APPROXIMATE CHAINAGE	DESCRIPTION	TYPE OF FACILITY
15.660 km	5 cell 2400 mm x 1800 mm box culvert	Potential combined fauna and drainage culvert.
17.100 km to 17.500 km	Moonee Creek floodplain	Large pipe culverts (up to 1800 mm diameter), incidental fauna passage with no additional fauna measures.
17.725 km	Moonee Creek	Extension of existing box culverts (2 Cell 2400 mm x 1800 mm), combined fauna and drainage culvert.
19.600 km to 20.300 km	Sandy Beach floodplain	Numerous box culverts, incidental fauna passage with no additional fauna measures. (up to 2440 x 1220 mm box culverts).
21.850 km	Double Crossing Creek	Bridge over Double Crossing Creek with provision for fauna access (1 metre to 1.5 metres wide) under bridge during normal flows.
24.960 km	2 cell 2400 mm x 2400 mm box culvert	Combined fauna and drainage culvert.
25.450 km	Woolgoolga Creek	Bridge over Woolgoolga Creek with provision for fauna access (not less than 1 metre to 1.5 metres wide) on either side of the creek during normal flows.
26.780 km	Poundyard Creek	Large arch structure over Poundyard Creek with provision for fauna access (not less than 1 metre to 1.5 metres wide) on either side of the creek during normal flows.
29.000 km		Dedicated fauna structure 3050 mm x 3050 mm adjacent to box culverts.
29.380 km		Dedicated fauna structure 3050 mm x 3050 mm.
29.930 km		Dedicated fauna structure 3050 mm x 3050 mm adjacent to box culverts.
30.400 km	Little Arrawarra Creek	Dedicated fauna structure 3050 mm x 3050 mm adjacent to box culverts.
31.100 km	Arrawarra Creek	Bridge over Arrawarra Creek with provision for fauna access (not less than 1 metre to 1.5 metres wide) on either side of the creek during normal flows.

All Waterway crossings that involve new water crossing structure(s) or replacement of an existing structure will be designed to minimise impact on fish passage in accordance with Department of Industry and Investment guidelines (Why do fish need to cross the road? Fish Passage requirements for Waterway Crossings, Fairfull, S & Witheridge, G (2003))

The potential impact of the project on terrestrial fauna movement has been mitigated through the provision of fauna passage under bridge structures, dedicated fauna structures and fauna friendly culverts. In addition, where the bypass section traverses Wedding Bells State Forest a widened median with retained vegetation will be incorporated between CH 29.100km and CH 30.200km to allow for glider crossing movements. Refer to Figure 2.1 below.

Fig 2.1 Widen median through Wedding Bells State Forest



Revegetation Measures

Re-vegetation and rehabilitation of disturbed areas within the road reserve of the project boundaries will progressively occur toward the end of the construction phase of the project. Revegetation measures will include, planting a range of locally occurring native shrubs, trees and ground covers and linking bushland remnants, where possible. Revegetation measures will be implemented through the Urban Design and Landscaping Plan which will be developed during detailed design phase of the Sapphire to Woolgoolga Project in consultation with DECCW. Weeds in areas disturbed by construction activities will be managed for a minimum of one year after construction completion.

Salvage Translocation Plan

A salvage translocation plan has been developed for threatened flora directly impacted by the project (refer Section 1.4). The translocation plan has been developed in consultation with the DECCW and will provide significant increases in the understanding of threatened species habitat, plant morphology, disturbance response behaviour and population dynamics. The translocation plan has been structured according to the format and content recommended in the *Guidelines for the Translocation of Threatened Plants 2nd Edition, Australian Network for Plant Conservation* (2004)

Nest Box Management Plan

A detailed Nest Box Management Plan (NBMP (2009) has been prepared in consultation with the DECCW for the Sapphire to Woolgoolga Project. The purpose of the NBMP is to maximise the effectiveness of nest boxes in compensating for tree hollows to be removed during the construction phase of the project and has been prepared in accordance with Minster for Planning's Condition of Approval (MCoA) 2.9.

Implementation of the NBMP will occur prior to and during construction with the installation of 174 nest boxes in six hollow replacement areas adjacent the highway upgrade. The required number of each nest box type for each of the six hollow replacement areas was determined with consideration of:

- the known or predicted tree hollow preferences of native hollow-using fauna species known or likely to occur in the locality;
- the sizes, types and quantities of potential tree hollows to be removed; and
- the sizes, types and quantities of tree hollows existing in adjacent areas

Details on the type and number placed in each hollow replacement area, including methods of installation and target species are described in the NBMP(2009)

Approximately 70 percent of the nest boxes will be installed up to one month prior to the commencement of clearing operations to provide alternative shelter for hollow-dependent fauna displaced during the clearing phase. The remaining 30 percent of nest boxes will be installed either as required for releasing rescued fauna during clearing operations or once the abundance of actual tree hollows removed has been confirmed by post clearing monitoring. The delayed installation will enable the nest box requirements to be re-assessed based on the actual density and types of tree hollows removed, which may result in changes to nest box requirements.

Monitoring and maintenance of nest boxes will be undertaken during construction and operational phases of the project over a total of ten years. Details of the monitoring and maintenance regime is provided in the NBMP (2009)

Other Fauna Mitigation Measures

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

.

- Implementing clearing protocols for habitat area including;
    - Preparation of an inventory of tree and hollows to be removed (under the Nest Box Management Plan- see below)
    - Checking hollow-bearing trees for fauna and nests prior to removal and Implementing a 2- stage clearing process
    - Safe relocation of animals found to be occupying trees.
- Surveys will be undertaken for threatened bat species to identify any roosting bats prior to the demolition of the existing highway bridges at Double Crossing, Skinners and Cunninghams Creeks and the existing Hoys Road bridge over Cunninghams Creek. The surveys will include bridge inspections by a suitably qualified ecologist to identify any roosting bats. If found, any bats will be moved and relocated following consultation with DECCW. Installation of appropriate bat boxes and associated monitoring will also be undertaken.
- The large nest located approximately 100 metres south of the Wedding Bells State Forest boundary (approximate Chainage 28700) will be inspected to determine if it is being used by an Osprey or a White-bellied Sea Eagle. If in use, expert advice will be sought regarding the feasibility/need of translocation of the nest tree. Note - anecdotal evidence from previous Pacific Highway project have shown that Osprey have successfully nested and bred directly adjacent to highway construction sites.
- Strategies will be developed as part of the Flora and Fauna Management Sub-Plan to deal with incidents involving individual animals during construction activities in consultation with DECCW.
- Habitat features and resources for native fauna (such as hollow-bearing trees, hollow logs and bush rocks) will be distributed along the route of the Project where feasible and reasonable. Such relocation will be undertaken in a manner to limit damage to existing vegetation and will not occur in high condition remnant vegetation.
- Design and implementation of best practice erosion, sediment and water quality controls (in accordance with the blue book? Add reference)

Biodiversity Monitoring Measures

An Ecological Monitoring Program (2009) has been prepared for the project in consultation with the DECCW as part of meeting the Department of Planning Minister's Condition of Approval (MCoA) N0. 3.1. The primary aim of the Ecological Monitoring Program is to allow the effectiveness of mitigation measures to be assessed and allow for their modification if necessary.

The agreed scope of the monitoring program was to focus on monitoring and assessing nine mitigation measures proposed as part of the Sapphire to Woolgoolga Project. These measures are:

- pre-clearing and clearing protocols;
- midslope fauna underpass structure at approximate Chainage 29200;
- fauna underpass structure at Chainage 11500;
- combined drainage/fauna underpass structure at Chainage17500;
- combined drainage/fauna underpass structure at Chainage17720;
- retention of a vegetated median between Chainages 29.10 and 30.20;
- installation of wildlife nest boxes;

- protection of in-situ threatened flora populations; and
- establishment of translocation areas for affected threatened flora species.

The Ecological Monitoring Program provides details on the timing of monitoring, monitoring procedure and potential indicators of success.

The Ecological Monitoring Program also provides details on potential contingency measures that would be implemented in the event of changes to habitat usage patterns directly attributable to the construction or operation of the project. These contingency measures are provided in *Table 2.2* below taken from the Ecological Monitoring Plan (2009)

Table 2.2: Potential problems and contingency measures associated with each mitigation measure.

Mitigation Measure	Potential Problems	Potential Contingency Measures
Clearing Procedures	• High rates of fauna injury and mortality resulting from clearing operations; • Poor success at capturing and releasing affected fauna.	• Review clearing procedures; • Increase habitat tree retention times; • Increase staff numbers.
Fauna Underpass	• High rates of feral predator activity; • Low levels of native fauna movement and species diversity in underpasses; • No use of underpasses by cover-dependent species or species with low mobility; • High rates of fauna road mortality.	• Modify habitat structure near underpass entrances; • Modify underpass "fauna furniture"; • Modify or add potential groundcover resources; • Modify exclusion fencing design, location or extent depending on the species and location of mortalities.
Vegetated Median	• No evidence given of use of the median vegetation by the target glider species.	• Install alternative crossing structures (e.g. glider poles and/or rope bridges)
Nest Box Installation	• High rate of nest box occupancy of feral species; • nest boxes used by a limited number of native fauna species; • species use is incompatible with nest type; • Poor nest box durability.	• Modify nest box designs to exclude undesirable species or relocate affected nest boxes to more appropriate habitat; • Review the selection and abundance of nest box designs; • Identify causes of nest box failure and modify nest box design or construction accordingly.

Mitigation Measure	Potential Problems	Potential Contingency Measures
Translocation Areas	• Unsatisfactory survival rates for transplanted individuals; • No flowering/seeding occurs in transplanted individuals; • The new or enhanced populations have different growth characteristics to the natural populations; • Threatening processes including weed invasion are inadequately controlled.	• Increase number of enhancement plantings; • Review site characteristics at translocation sites that potentially impact on plant fertility; • Extend the duration and/or frequency of monitoring to observe any impacts of different growth characteristics; • Review and modify weed management measures.

The monitoring period will extend over a ten year period covering both construction and operational phases of the project. For further details on the timing of monitoring episodes refer to the Ecological Monitoring Program 2009

The results of the pre-clearing and clearing procedures monitoring will be compiled, analysed in a report and a copy of the report will be submitted to the Director-General of Planning and the DECCW.

Monitoring results for all other mitigation measures identified above will be compiled, analysed and discussed in annual reports which will also be submitted to the Director-General of Planning and the DECCW.

2.3 Offsets

Options for Offsets

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.

Option C Investment in management research related to the rehabilitation and protection relevant threatened species, such as the Yellow-bellied glider, Squirrel Glider and/or Glossy Black Cockatoo.

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 further consultation with DECCW and Department of Planning refer to Section 2.3.2 Decision Making Framework..

2.3.1 Delivery of Option A

The Minster for Planning Condition of Approval (MCoA) 2.12 (a) states the Biodiversity Offset Strategy must provide a minimum 98.8 hectares of native vegetation to offset the direct and indirect impacts of the project.

The RTA aims to meet MCoA 2.12 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 percent cleared in the catchment management area as identified in DECCW vegetation types database.

The RTA is negotiating with the Department of Industry and Investment (Forests) to compensate for the loss of State Forest land. Compensation to the Department of Industry and Investment (Forests) could be in the form of native vegetation or cleared land to allow for the establishment of plantations. Where native vegetation is provide as compensation it is recognised that there will be biodiversity benefits accruing from State Forests management of the land. In recognition of this the RTA 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) have been established for conservation purposes these lands will have biodiversity offset ratio of 4:1 on a like for like basis.

Table 2.3 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 2.3: 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 2.3 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 2.4 below provides the types of vegetation community impacted within state forest land, including Forestry Management Zones (conservation) and indicative biodiversity offset areas required.

Table 2.4 Indicative biodiversity offset areas required as a result of clearing impacts from the project within State Forests

Vegetation Community	Broad Vegetation Type	Corresponding Habitat Type	Area impacted under State Forests includes edge effects ancillary areas (Ha)##	Offset Ratio Applied	Offset Area required# (Ha)
Blackbutt Dry Sclerophyll Forest Spotted Gum Flooded Gum	Coastal Hills Moist Open Sclerophyll Forest (Non- EEC)	Moist Open Forest	32.4	2:1	64.8.
Red Mahogany Broad- Leaved Paperbark	Swamp Sclerophyll Forest (EEC)	Forested Wetlands	4.4	4:1	17.6
Additional FMZ (conservation areas)	N/A	Moist Open Forest	0.01 (Spotted Gum)	4 :1	0.04
TOTAL			36.8		82.4

Area calculated from Table 2.4 and assumes DI & I (Forests) are compensated through provision of cleared land/funding for forestry plantation(s)
Excludes area as a result of the widened median for glider crossing (5.7Ha).

As derived from *Table 2.4* a total of 82.4 hectares would be required as a result of the projects clearing impacts within State Forest land and assuming that DI & I (Forests) are compensated for the loss of 'working forests' through the provision of cleared land/funding for the establishment a forestry plantation(s). If DI & I (Forests) compensated through the provision of

existing native forests then the total biodiversity offset required would be 50 hectares on a like for like basis within the NSW North Coast Bioregion.

Table 2.5 Indicative biodiversity offset areas required as a result of clearing impacts from the project outside of State Forests

Vegetation Community	Broad Vegetation Type	Corresponding Habitat Type	Area Impacted Non- State Forest (Ha)	Offset Ratio Applied	Offset Area required (Ha)
Blackbutt Dry Sclerophyll Forest	Coastal Hills Moist Open Sclerophyll Forest (Non- EEC)	Moist Open Forest	48.2	2:1	96.4
Spotted Gum					
Flooded Gum					
Grey Gum/Grey Iron Bark					
Narrow Leaved White Mahogany					
Red Mahogany	Swamp Sclerophyll Forest (EEC)	Forested Wetlands	8.7	4:1	34.8
Broad- Leaved Paperbark Swamp Mahogany Smooth Barked Apple					
Littoral Rainforest	Subtropical Rainforest (EEC)	Rainforest/ Closed Forest	1.1	4:1	4.4
Rainforest on Floodplain	Lowland Rainforest on Floodplain (EEC)	Rainforest/ Closed Forest	1.0	4:1	4.0
Swamp Oak	Swamp Oak Floodplain (EEC)	Forested Wetlands	5.5	4:1	22.0
TOTAL			64.6		161.6

Note: no vegetation communities within the broad vegetation type 'Coastal Hills Moist Open Sclerophyll Forest are identified as being more than 75 percent cleared in the catchment management area

From *Table 2.4* and *Table 2.5* the biodiversity offset areas required for the Sapphire to Woolgoolga Upgrade would be 244 hectares assuming DI & I (Forests) are compensated through plantation forestry or 211.6 hectares if DI & I (Forests) compensated through provision of existing native forests.

Using the proposed methodology, indicative offset requirements will be between 211.6 hectares and 244 hectares. This exceeds the minimum requirement of the 98.8 hectares outlined in the Minster for Planning Condition of Approval.

It is proposed that the only exception to using the variable offset ratio approach as described above would be in case(s) where the potential biodiversity offset lands have the following attributes;

- exemplary conservation value within the Coffs Coast Region (as agreed by DECCW);
- are under significant development pressure and;
- due to the offset land location provides significant social and cultural values to the community.

This approach takes into consideration that such lands are likely to require significant public funds to purchase and in such case(s) the offset ratio may be less than variable offset ratio, however, as a minimum, the area purchased would meet the MCoA 2.12 requirements to provide at least 98.8 hectares of native vegetation.

2.3.2 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. The offset areas will be assessed to ensure that habitat for impacted threatened species is included in offset areas. 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 DECCW.

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 30km radius of the of the project extending to 100km with the agreement of the Department of Planning and DECCW where it can be demonstrated that a suitable offset could not be found.
- Offset land would contain vegetation communities as per Table 2.5
- Land would be assessed as to its suitability as habitat for the threatened species impacted by the project (including patch sizes) based on DECCW threatened species profiles databases
- Offset land would comprise vegetation of at least moderate to good condition (according to DECCW 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.

Priority 2.

The second phase, if required would be to identify other land that either comprise 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 2.5 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 DECCW 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.

Notwithstanding the above and as outlined in the MCoA 2.10 the Sapphire to Woolgoolga Offset package may also be part of a larger offset package where other Pacific Highway projects between Port Macquarie and Arrawarra may be included. The scope of this larger offset package would be determined using the same methodology as described in this Strategy/Report (subject to Conditions of Approval) and would potentially allow larger more continuous areas of land to be acquired leading to improved conservation outcomes and economies of scale. Conservation organisations have shown interest in this approach and are interested in working with RTA to identify and manage such lands.

Tools used to identify potential offset land include, but are not limited to, the DECCW twenty five (25) year investment layer, RTA property databases and possibly through advertisements for expression of interest for the provision of land for conservation purposes.

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, the RTA would also consult with DECCW to pursue opportunities to purchase land that may be suitable for reserve estate with the DECCW.

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 of adequate condition that meet the decision-making framework outlined above. This assessment would be undertaken by suitable qualified ecolologists and the report prepared would be included the Biodiversity Offset Package

Priority 3

In the event that offset land can not be found through the investigation process outline in Priority 1 and/or Priority 2 above then the RTA would consult further with the DECCW and Department of Planning before proceeding with the delivery of Option B and Option C as described in Section 2.3

Delivery of Option B

To deliver Option B, the RTA would invest in the strategic revegetation of the Endangered Ecological communities impacted by the project adjacent to the road corridor or within the Coffs Coast Region. Locations of revegetation would be guided by outcomes of the further investigation and specialist advice from DECCW and / or other specialist ecologists. Revegetation would be focused particularly at increasing key habitat for Squirrel Gliders, Yellow Bellied Gliders and Glossy-black cockatoo.

Delivery of Option C

To delivery Option C, the RTA would work with DECCW 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.

2.4 Potential Compensatory Habitat in the Region

Table 2.7 below provides an indication of the availability of land within 30 kilometres of the project alignment supporting communities affected by the project, not including lands that are within the conservation reserve system. The land is under private tenure and is theoretically available to be considered as part of any offset package

Maximum Vegetation to be cleared during construction

Vegetation Community	Area Occupied within Study Area (ha)	Total Clearing (ha)[8]	% Removed from Study Area	Total area available within 30 km of alignment (ha)
Littoral Rainforest	4.1	1.1	26.8	?
Lowland Rainforest on Floodplain	5.0	1.0	20.0	?
Blackbutt	148.4	44.6	27.6	21,576
Flooded Gum	28.1	5.7	20.3	3,246
Grey Gum – Ironbark	32.4	8.9	27.5	9,118
Spotted Gum	23.7	7.0	29.5	5,171
Narrow-leaved White Mahogany	25.8	4.8	18.6	1,834
Red Magogany[1]	4	2.1	52.5	16
Smooth-barked Apple	1.0	0	0	3
Broad-leaved Paperbark – Swamp Mahogany	78.4	8.3	10.6	1,336
Swamp Oak[2]	9.6	5.5	57.3	30
Swamp Oak – Saltwater Couch[3]	0.4	0	0	632
Total	360.9	89		42,962

[1] Community correlates with Swamp Sclerophyll Forest
[2] Community correlates with Swamp Oak Floodplain Forest
[3] Community correlates with Coastal Saltmarsh

Table 2.7 shows that there are substantial tracts of land potentially available for consideration in a biodiversity offset package although areas greater than 30km from the alignment are likely to be required to fulfil some or all of the biodiversity offset obligations.

The RTA, following agreement from DECCW, is currently negotiating for the purchase of approximately 20 hectares of high conservation value land near Bonville that adjoins Bongil Bongil National Park (Part Lot 333 DP 75553). A detailed ecological assessment (Benwell 2007) on the land, which was undertaken prior to agreement from DECCW, and dentifies the following vegetation communities.

- Swamp Sclerophyll Forest (EEC) 4.4 hectares
- Coastal Hills Moist Open Sclerophyll (wet sclerophyll forest) 15.6 hectares.

The area was found to support high quality fauna habitat, due to the long absence of fire, plentiful tree hollows and logs, extensive vegetation ecotones between swamp sclerophyll and wet sclerophyll forest and the productive lowland environment (Benwell 2007).

In principal agreement has been reached with DECCW for this parcel of land to be used as compensatory habitat for future Pacific Highway upgrading projects and has the potential to be

included as part of the Sapphire to Woolgoolga Biodiversity Offset Package.

2.5 Management of Unforseen 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 Minster for Planning's Conditions of Approval for the project. Consistency assessment(s) will take into account the vegetation type, quality and habitat. If the design change is deemed inconsistent with the Minster 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 Minster 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 a significant increase in the area of native vegetation impacted above what was anticipated in the Biodiversity Offset Strategy then additional offset measures will be implemented. A significant increase would be determined by the quality of the habitat removed and the mitigation measures implemented to restore the disturbed areas (where this is possible). The extent of any additional measures will be determined in consultation with the DECCW 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 Glossy Black Cockatoo and Yellow Bellied Glider

2.6 Biodiversity Offset Package

Within 12 months of the approval of this strategy, the RTA will submit to the Department of Planning a Biodiversity Offset Package. The package will be prepared in consultation with DECCW and will include details of the final suite of measures to be implemented as a result of this strategy. The package will identify a timeline for implementation and the detail of measures, including arrangements for ongoing management of offset lands, to be undertaken under Options A, B and C.

References

Bali, R 2000, *Discussion Paper- Compensating for Edge Effects,* Biosis Research for the NSW Roads and Traffic Authority, Sydney

Bali, R 2005, *Discussion Paper- Compensating for Edge Effects,* Ecosense Consulting for the NSW Roads and Traffic Authority, Sydney

Benwell, A 2008, *Ecological Assessment of Lot 333 (DP 755553) Bonville (O'Donnell Property),* Ecos Environmental for the NSW Roads and Traffic Authority, Pacific Highway Office, Grafton

Ecological Monitoring Program 2009, *Pacific Highway Upgrade Sapphire to Woolgoolga Ecological Monitoring Plan,* Benchmark Environmental Management for the NSW Roads and Traffic Authority.

Environmental Assessment Documentation Sapphire to Woolgoolga Pacific Highway Upgrade

NBMP, 2009, *Pacific Highway Upgrade Sapphire to Woolgoolga Nest Box Management Plan,* Benchmark Environmental Management for the NSW Roads and Traffic Authority.

RTA 2007, *Coffs Harbour Highway Planning Sapphire to Woolgoolga Section, Environmental Assessment November 2007,* Connell Wagner for the NSW Roads and Traffic Authority

RTA 2004, *Sapphire to Woolgoolga Section Supplementary Options Report* , *February 2004*

RTA 2004*, Coffs Harbour Highway Planning Strategy Preferred Option Report, November 2004*

RTA 2002, *Sapphire to Woolgoolga Route Options Development Report, December 2002.*

Scotts, D 2003, *Key habitat corridors for forest fauna. A landscape framework for conservation in north-east New South Wales. Occasional Paper 32*, NSW National Parks and Wildlife Service, Sydney.