



Great Northern Highway Muchea to Wubin Upgrade - Stage 2

MAIN ROADS WESTERN AUSTRALIA

Walebing to Wubin - SLK 147.7 - 256.5 |
Environment | EPBC 2016/7761 - Preliminary Documentation

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Appendix A. Ecological Survey Reports (Phoenix 2015; 2016a; 2016b; 2016c)

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Glossary

Abbreviation	Description
AADT	Annual Average Daily Traffic
AASHTO	American Association of State Highway and Transportation Officials
AHA	<i>Aboriginal Heritage Act 1972</i>
AHD	Australian Height Datum
AHIS	Aboriginal Heritage Inquiry System
APHA	American Public Health Association
ARI	Average Recurrence Interval
ARRB	Australian Road Research Board
AS	Australian Standards
ASD	Approach Sight Distance
ASJV	Arup Jacobs Joint Venture
ASRIS	Australian Soil Resource Information System
ASS	Acid Sulfate Soils
ASST	Applied Scientific Services and Technology
ASTM	American Society for Testing and Materials
ATLM	Audio tactile line marking
ATLS	Atterberg Limits and linear shrinkage
AUL	Auxiliary Left turn treatment
AUR	Auxiliary Right turn treatment
BAL	Basic Left turn treatment
BAM Act	<i>Biosecurity and Agriculture Management Act 2007</i>
BAR	Basic Right turn treatment
BGL	Below ground level
BH	Borehole
BoM	Bureau of Meteorology
CARS	Crash Analysis Reporting System
CBR	California Bearing Ratio
CEMP	Construction Environmental Management Plan
Cha	Chainage
CHL	Channelised Left
CHR	Channelised Right
CN	Contract Number
CN0X	Contract XX – [Contract Name]
CPTED	Crime prevention through environmental design
CSIRO	Commonwealth Scientific and Industrial Research Organisation

Abbreviation	Description
DAA	Department of Aboriginal Affairs
DAFWA	Department of Agriculture and Food WA
DBYD	Dial Before You Dig
DCP	Dynamic Cone Penetrometer
DEM	Digital Elevation Model
DER	Department of Environment and Regulation
DGS	Digital Ground Survey
DoEE	Department of the Environment and Energy
DoW	Department of Water
DSEWPaC	Department of Sustainability Environment Water Planning and Community
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EPA	Environmental Protection Authority
EP Act	<i>Environmental Protection Act 1986</i>
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
ESA	Environmentally Sensitive Area
FWD	Falling Weight Deflectometer
GDA94	Geocentric Datum of Australia 1994
GDE	Groundwater Dependent Ecosystems
GIS	Geographic Information System
GNH	Great Northern Highway
GPS	Global Positioning System
ha	Hectare
HWL	High Wide Loads
IBA	Important Bird Area
IBRA	Interim Biogeographic Regionalisation of Australia
ICP-OES	Inductively coupled plasma optical emission spectrometry
IRIS	Integrated Road Information System
IS	Infrastructure Sustainability
IUCN	International Union for Conservation of Nature
km	Kilometre
LGA	Local Government Authority
LISC	Low Impact Screening List (Main Roads)
m	Metre
Ma	Mega-annum (period of 1 million years)
Main Roads	Main Roads Western Australia

Abbreviation	Description
Ma	Mega-annum (period of 1 million years)
MC	Moisture content
MDCS	Maximum dry compressive strength
MDD	Maximum Dry Density
MGA94	Map Grid of Australia 1994
MI	Municipal Inventory
MNES	Matters of National Environmental Significance
mm	Millimetre
MMDD	Maximum Modified Dry Density
M2W	Muchea to Wubin
M2W team	Muchea to Wubin Integrated Project Team, comprising Main Roads and industry partners Jacobs and Arup
NATA	National Association of Testing Authorities
NNTT	National Native Title Tribunal
NVCP	Native Vegetation Clearing Permit
OMC	Optimum Moisture Content
OSOM	Over Size Over Mass
Parks and Wildlife	Department of Parks and Wildlife
PAG	Project Advisory Group
PDNH	Perth to Darwin National Highway
PDO	Property Damage Only
PEC	Protected Ecological Communities
PEIA	Preliminary Environmental Impact Assessment
Project Area	Refers to the entire upgrade project. The project area extends 218 km between Muchea and Wubin along the GNH.
PP	Pavement pit
PSD	Particle size distribution
RAV	Restricted Access Vehicle
RCBC	Reinforced Concrete Box Culvert
RCP	Reinforced Concrete Pipe
Regolith	Layer of loose material covering the bedrock of the earth and moon, etc, comprising soil, sand, rock fragments, volcanic ash, glacial drift etc.
RISC	Roadside Impact Severity Calculator
RIWI	Rights in Water and Irrigation (Act)
RRM	Road Reference Marks
RRPM	Retro-reflective Pavement Markers
RTE	Road and Traffic Engineering Branch of Main Roads WA

Abbreviation	Description
RTK	Real Time Kinematic GPS observation method
SiD	Safety in Design
SISD	Safe Intersection Sight Distance
SSD	Stopping Sight Distance
SLIP	State Land Information Portal
SLK	Straight Line Kilometre
SPT	Standard penetration test
SSM	State Survey Marks
STATS	Specialist Testing and Technical Services
SWALSC	South West Aboriginal Land and Sea Council
t	Metric tonne
tc	Time of concentration
TEC	Threatened Ecological Communities
TP	Test pit
USEPA	United States Environmental Protection Authority
WA	Western Australia
WALGA	Western Australian Local Government Association
WAOL	Western Australian Organism List
WAPC	Western Australian Planning Commission
WARES	Main Roads Road Evaluation System
WC Act	Wildlife Conservation (Act)
WCLT	Wide Centreline Treatment
WoNS	Weeds of National Significance

1. Introduction

1.1 Project Background

In 2014 Main Roads Western Australia (Main Roads) established the Muchea to Wubin Integrated Project Team (M2W Team), comprising Main Roads and industry partners Arup and Jacobs (combining to form Arup Jacobs Joint Venture, ASJV) to conduct a comprehensive planning review of the full Muchea to Wubin link along the Great Northern Highway (GNH). This planning review is a critical component of the Great Northern Highway: Muchea to Wubin Upgrade Stage 2, which has been funded with \$384.8 million from the Federal and State Governments.

Among the improvements to be considered as part of the planning review were additional passing lanes, flattening crests and easing curves, safer roadsides, more rest stops and additional facilities for heavy vehicles.

The review examined the previous upgrade strategy developed in the 1990s and, having carefully considered current requirements for the movement of people and freight, delivered a revised upgrade strategy.

The M2W team has identified and prioritised construction packages to be delivered over the four-year period from 2015/16 to 2018/19. The construction programme includes the currently funded sections Muchea North / Chittering (13km), Bindoon South (2km), New Norcia (7kms), Lyons East Road to Pithara (46km, including Miling) and Dalwallinu to Wubin realignment (16km) and identifies additional priority packages to be constructed as funding becomes available.

On 28 July 2016, a referral under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) was submitted to the Department of Environment and Energy (DoEE) for the Walebing to Wubin Approval package (EPBC2016/7761). This referral encompasses the Walebing, Miling Bypass, Pithara and Dalwallinu to Wubin contract areas.

On 19 October 2016, DoEE notified Main Roads that the referral was determined to be a controlled action, with the controlling provision being “listed threatened species and communities”, namely Carnaby’s Black Cockatoo and the Eucalypt Woodlands of the Western Australian Wheatbelt ecological community. On 21 December 2016 the Minister of the Environment’s delegate decided that the proposed action would be assessed by preliminary documentation. This document has been prepared in response to the request for additional information required for the preliminary documentation.

1.2 Structure of this Document

For ease of reference, **Table 1-1** provides a guide to the location of the information requested within the document. The proposed action is separated in to four construction packages (Walebing; Miling Bypass; Pithara; and Dalwallinu to Wubin), which are referenced throughout this document.

Table 1-1 : Requested Information Provided

Information Request #	Information Request Text	Preliminary Document Location
Mitigation and Management Measures		
1	The referral documentation notes that the presence of the Eucalypt Woodlands of the Western Australian Wheatbelt TEC has been estimated based on surveys that were undertaken prior to the community’s listing and which therefore did not specifically assess the likely presence of this TEC within the project area. Given this please:	

Information Request #	Information Request Text	Preliminary Document Location
1.a	Discuss the likely abundance, distribution and condition of the TEC within the project area. This should include further targeted surveys for the TEC within the project area.	Section 4.1
1.b	Quantify the total area of the TEC that will be cleared for the proposed action.	Section 4.1.6
1.c	Discuss potential direct and indirect impacts to the TEC as a result of construction activities, including impacts from compaction and excavation activities to the root system of the trees that comprise part of this TEC.	Section 4.1.6
2	Please provide further discussion on any proposed mitigation and management measures to be implemented prior to, during and post clearing to manage potential direct and indirect impacts of the proposed action on black cockatoos and/or their habitat and the Eucalypt Woodlands of the Western Australian Wheatbelt TEC. Please include a discussion of the efficacy of these proposed mitigation and management measures. This discussion should have regard to any conservation advice for these species or ecological communities.	Section 4.1.7 and Section 4.2.7
3.	Demonstrate how the proposed action is not inconsistent with any relevant Recovery Plans or Threat Abatement Plans for the species discussed above.	Section 4.1.8 and Section 4.2.8
Offsets		
4.	In the event that impacts cannot be avoided or mitigated, please provide further information on offsets to compensate for any significant residual impacts on black cockatoos and the Eucalypt Woodlands of the Western Australian Wheatbelt TEC, including the: <ul style="list-style-type: none"> a) type of offsets proposed b) extent to which the proposed offset actions correlate to, and adequately compensate for, the significant residual impacts of the proposed action on the protected matter c) suitability of the location of any proposed offset site for the protected matter d) conservation gain to be achieved by the offset i.e. positive management strategies that improve the site or averting the future loss, degradation or damage of the protected matter e) time it will take to achieve the proposed conservation gain f) level of certainty that the proposed offset will be successful g) current land tenure of any proposed offset and the method of securing and managing the offset for the life of the impact. 	Section 5 and Appendix B
5.	Demonstrate how the proposed action is consistent with the <i>Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy, October 2012.</i>	Section 5.2

Information Request #	Information Request Text	Preliminary Document Location
Economic and Social matters		
6.	Please provide further detail on the social and economic costs and/or benefits of undertaking the proposed action, including the: <ul style="list-style-type: none"> a) basis for any estimations of costs and/or benefits b) potential employment opportunities expected to be generated at each phase of the proposed action c) details of any public and stakeholder consultation activities, including the outcomes. 	Section 6

2. Ecological Surveys

In order to assess the impact of the proposed action, Phoenix Environmental Service (Phoenix) undertook the following surveys:

- October 2014 to February 2015:
 - ▶ initial spring season flora and vegetation field survey of the existing road reserve; and
 - ▶ initial fauna habitat assessment and significant Black Cockatoo tree assessment.
- February to June 2015:
 - ▶ follow up flora and vegetation assessments of the areas surveyed in spring and preliminary flora and vegetation assessments for areas not previously surveyed (outside of the existing road reserve).
- September to December 2015:
 - ▶ flora and vegetation areas surveyed in the first half of 2015 but not surveyed in Spring 2014; and
 - ▶ site assessment of Black Cockatoo habitat and inspection of potential breeding trees for signs of use.

The results and outcomes of these surveys are detailed in Phoenix (2016a; 2015) *Flora and fauna assessment for the Calingiri to Wubin study areas* and *Flora and fauna assessment for Lyons East Road to Gatti Road study area* (**Appendix A**).

The following additional surveys were undertaken between September, October and November 2016 to address gaps in the surveyed area and to provide additional information on species and communities of particular interest:

- Level 2 flora and vegetation survey;
- intensive transect searches in suitable habitat for threatened orchids listed under the EPBC Act;
- detailed field assessment and mapping the distribution of the Eucalypt Woodlands of the Western Australian Wheatbelt Threatened Ecological Community (TEC);
- Level 1 and, where necessary, targeted conservation significant fauna survey; and
- targeted Black Cockatoo survey, including potential breeding tree assessment.

The results and outcomes of these surveys are detailed in Phoenix (2016b; 2016c) *Flora and fauna assessment for the Calingiri to Wubin study areas – Report Addendum* and *Flora and fauna and fauna assessment for the Lyons East Road to Gatti Road study area – Report Addendum* (**Appendix A**).

Figure 1 shows the coverage of all surveys undertaken for the proposed action. This includes the surveys undertaken for both flora and fauna in 2014, 2015 and 2016. The extent of the flora and fauna surveys are identical and as such have not been shown separately.

3. Design Options and Engineering Controls to Avoid or Minimise Impacts

The final route selection for each construction package was determined through numerous design iterations which were refined through design options analysis. During the design options analysis mitigation measures were implemented to manage the potential direct and indirect impacts of the proposed actions to the Eucalypt Woodlands of the Western Australian Wheatbelt TEC and Carnaby's Black Cockatoos and/or their habitat. A discussion of the efficacy of these mitigation measures is provided below.

As discussed in the EPBC2016/7761 referral supporting information document (ASJV, 2016), the ultimate decision was made to construct the proposed action primarily offline from the existing alignment where significant rebuilding of the road was required. Where works were limited to seal widening and overtaking lanes, this has been incorporated into the existing alignment. This mitigation decision reduced impact to Carnaby's Black Cockatoo habitat, Carnaby's Black Cockatoo nesting trees and the Eucalypt Woodlands of the Western Australian Wheatbelt TEC as it centres on construction within paddock and cleared areas. The proposed offline alignment reduces clearing of Carnaby's Black Cockatoo habitat by 33% and the amount of clearing of the TEC by 32.5%. Additionally, there is a 59% reduction in the number of potential breeding trees to be removed. As shown in **Table 3-1** no known nesting trees or trees with suitable hollows will be impacted as a result of the proposed action.

Table 3-1 : Comparison of Impacts - Proposed Action Against Alternative

Impact	Proposed Action	Online Alternative	Change
<i>Clearing of Eucalypt Woodlands of the WA Wheatbelt TEC (ha)</i>	15.0	20.0	-25%
Carnaby's Black Cockatoo			
<i>Habitat Clearing (ha)</i>	30	45	- 33%
<i>All Potential Breeding Trees (>500 mm DBH)</i>	130	317	- 59%
<i>Known Nesting Trees</i>	0	4	- 100%
<i>Trees with Suitable Hollows (other than known nesting trees)</i>	0	4	- 100%

Environmental surveys have resulted in design changes to avoid clearing vegetation, including the TEC and Carnaby's Black Cockatoo habitat. This has included measures such as deviations through paddocks around discrete areas of vegetation within Pithara, and the relocation of road intersections and driveways into paddocks to avoid clearing remnant vegetation.

Design decisions were made with consideration of potential impacts to Carnaby's Black Cockatoo trees and minimise or avoiding these impacts. Within the Miling Bypass section, driveway realignment could have impacted three Carnaby's Black Cockatoo trees with suitable hollows however design decisions prioritized the retention of the trees over the most direct driveway placement.

In areas where offline design was not feasible, such as the Water Corporation reserve in Pithara, stringent conditions have been imposed on the design and construction method. This includes:

- a requirement that installation of fencing within the Water Corporation Reserve south of Pithara townsite must be largely installed by foot, to minimise clearing of vegetation along the proposed fence line, with a maximum of five access tracks to be cleared between the GNH and the fence line allowed for in order to transport materials (such as posts, strainer assemblies and concrete) to fence post locations. This will reduce the total area of clearing required within the TEC. The proposed fence runs through approximately 1.7 km of native vegetation with 400 m through the TEC. Access tracks in the Water

Corporation Reserve commence at the GNH and will extend to the road reserve fence line (between 300 and 500 m) with a turnaround provided at the fence end. Up to 0.5 ha of vegetation will be cleared for all five tracks, including turnarounds, It is expected that 0.25 ha of clearing will be within the TEC. The Water Corporation Reserve encompasses approximately 250 ha on the western side of the existing GNH with approximately 90% of this covered by native vegetation. Clearing of vegetation within the reserve for these tracks will not result in fragmentation of the vegetation as no track passes through the entire patch, or joins with an existing track which already bisects the reserve. The vegetation surrounding the access tracks remains intact, allowing for fauna movement around these areas; and

- any additional areas of the TEC within the reserve have been identified as No-Go areas which cannot be impacted during construction.

To further reduce impact to native vegetation and Carnaby's Black Cockatoo habitat additional engineering controls have been applied:

- where possible, the design includes safety barriers in lieu of a design standard compliant safety clear zone therefore avoiding the need to remove significant fauna habitat trees potentially used by Carnaby's Black Cockatoo for breeding and foraging. As a result, where safety barriers are introduced, there is an opportunity to steepen the batters behind the barrier to further reduce impacts to Carnaby's Black Cockatoo habitat;
- construction activities will be managed under a Construction Environmental Management Plan (CEMP);
- the landscape design has identified and incorporated opportunities to strengthen and enhance Carnaby's Black Cockatoo habitat and TEC occurrence/quality. For example, species mixes reflect the species composition of Eucalypt woodlands and includes foraging species for Carnaby's Black Cockatoo;
- Areas of TEC and Carnaby's Black Cockatoo trees (known nesting trees and those with suitable hollows) within the construction boundary that can be avoided are identified as 'No-Go Areas'; and
- The construction contract includes requirements that clearing is kept to a minimum and all clearing is marked out and approved by the Main Roads Superintendent prior to clearing being undertaken. The Superintendent assesses the requested clearing area against the contract requirements; design; regulatory approval conditions; CEMP requirements; and location of environmental and heritage constraints (for example TECs and fauna habitat trees).

4. Listed Threatened Species and Ecological Communities

4.1 Eucalypt Woodlands of the Western Australian Wheatbelt

4.1.1 Environmental Objective

The following environmental objectives for the project were identified in the referral:

- increase the extent of the ecological community present in the Western Australian conservation estate through offsetting; and
- improve the condition of the ecological community adjacent to the area of disturbance.

4.1.2 Surveys Conducted

Phoenix conducted further targeted surveys to determine the extent of Eucalypt Woodlands of the Western Australian Wheatbelt TEC between 5 September and 24 November 2016. The surveys were conducted in accordance with relevant State and Commonwealth guidelines including:

- Technical Guidance - Flora and Vegetation Surveys for Environmental Impact Assessment (Environmental Protection Authority (EPA), 2016a);
- Environmental Factor Guideline - Flora and Vegetation (EPA, 2016b); and
- *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) Approved Conservation Advice - Eucalypt Woodlands of the Western Australian Wheatbelt.

Preliminary (desktop based) mapping of the extent of the Eucalypt Woodlands of the Western Australian Wheatbelt TEC was undertaken following the Spring 2015 surveys. This assessment was checked and ground-truthed in the field using a key and customised data collection template derived from conservation advice for TEC. Additional areas that had not previously been surveyed were assessed in the field. The full survey report is provided in **Appendix A**.

4.1.3 Ecological Community Description

The Eucalypt Woodlands of the Western Australian Wheatbelt ecological community is defined as eucalypt woodlands dominated by a complex mosaic of eucalypt species with a single tree or mallet form over an understorey that is highly variable in structure and composition (Threatened Species Scientific Committee (TSSC), 2015). The community occupies a transitional zone between the wetter forests associated with the Darling Range and the southwest coast, and the low woodlands and shrublands of the semi-arid to arid interior.

4.1.4 Occurrence and Condition of the TEC within the Proposal Area

Surveys undertaken by Phoenix (2015; 2016a,b,c) have recorded a total of 87.37 ha of the TEC within the area of the proposed action (**Table 4-1; Figure 2**). Some patches of vegetation were determined not to represent the TEC, even though they occur adjacent to a patch of the same woodland community that was determined to be TEC. This occurred for vegetation that was degraded in condition, where the density of mature trees was insufficient to meet the diagnostic criteria, and between the patches was an area devoid of trees for 50 m or more (Phoenix, 2016b).

The condition of the TEC ranged from degraded to pristine. This aligns with the condition of native vegetation generally throughout the area of the proposed action, which also ranges from degraded to pristine.

Table 4-1 : Occurrence of Eucalypt Woodlands of the WA Wheatbelt TEC Mapped by Phoenix

Construction Package	Area of TEC (ha)	Beard Vegetation Associations
Walebing	64.30	7, 142, 352, 936, 946, 1040
Miling Bypass	0.00	N/A
Pithara	16.04	141, 352
Dalwallinu to Wubin	7.03	142, 352, 8
Total	87.37	

4.1.5 Regional Occurrence

Current regional distribution mapping for this ecological community provided by the Department of Parks and Wildlife (Park and Wildlife) indicates there to be 451,598.83 ha of the Eucalypt Woodlands of the WA Wheatbelt in the Avon Wheatbelt Bioregion and 22,906.42 ha and 26,771.74 ha of the ecological community in the Shire of Dalwallinu and the Shire of Moora, respectively (**Figure 3**).

4.1.6 Likely Impacts

The locations of occurrences of the Eucalypt Woodlands of the Western Australian Wheatbelt have been taken into consideration during the design phase and occurrences avoided where practicable. Not all occurrences can be avoided. For example, realignment of the highway in some areas is not feasible given the location of towns and other infrastructure, or the cost of realignment is prohibitive.

Table 4-2 details the clearing required by construction package, percentage of the area mapped as TEC by Phoenix (2015; 2016a,b,c) that will be cleared and the original clearing requirements estimated in the referral. **While the total amount of clearing within the TEC remains the same, there have been adjustments to the amount of clearing required within each construction package.** This is due to both design refinements and the Spring 2016 ground-truthing of the desktop TEC assessment, which determined some areas tentatively identified as the TEC did not meet the diagnostic criteria and were consequently removed from the mapping (see Section 3.2.6 of Phoenix (2016) in **Appendix A**).

Table 4-3 provides a breakdown of the clearing required in terms of the quality of the vegetation. The majority of clearing will be undertaken in vegetation which is in Degraded or Good condition with less than one hectare required in vegetation that is of Very Good condition. No clearing is required in vegetation that is Excellent or Pristine.

In terms of regional impacts, the clearing required represents 0.003% of the total TEC occurrences mapped by Parks and Wildlife, 0.056% of the occurrences within the Shire of Moora and 0.065% of occurrences within the Shire of Dalwallinu.

Some areas of cut are required in areas of the TEC in order to meet the safety objectives and design criteria of the proposed action. These cuttings have the potential to disrupt lateral root systems that are characteristic of many of the eucalypts which form part of the TEC. However, previous works undertaken in the early to mid-2000s, which also created cuttings through areas of the TEC, do not appear to have had any observable impact and various eucalypt species can be seen growing close to the top of the cutting.

In areas where cuttings are required, a qualified arborist will be engaged to undertake pruning of tree roots greater than 50 millimetres in diameter. The arborist will be able to assess the tree/s in question and identify an appropriate point at which to prune the tree root to minimise the potential impact to the tree/s.

Road construction activities are likely to result in compaction of the soil. Underneath the newly constructed road this compaction will be permanent. Beyond the earthworks of the road any compaction due to construction activities will be temporary.

Table 4-2 : Clearing Requirements - Eucalypt Woodlands of the Western Australian Wheatbelt TEC

Construction Package	Area Mapped by Phoenix (2016) (ha)	Clearing Requirement (ha)	Clearing as a percentage of Phoenix (2016) mapped area	Original Clearing estimate from referral (ha)	Change in clearing required (ha)
Walebing	64.30	11.50	17.88%	10.00	1.50
Miling Bypass	0.00	N/A	N/A	0.00	0.00
Pithara	16.04	1.00	6.23%	3.00	-2.00
Dalwallinu to Wubin	7.03	2.50	35.56%	2.00	0.50
Total	87.37	15.00	15.45%	15.00	0.00

Table 4-3 : TEC Clearing Requirements by Vegetation Quality

Construction Package	Vegetation Condition					
	Completely Degraded	Degraded	Good	Very Good	Excellent	Pristine
Walebing	1.50	8.00	1.85	0.15	-	-
Miling Bypass						
Pithara	-	-	0.65	0.35	-	-
Dalwallinu to Wubin	-	1.10	1.00	0.40	-	-
Total	1.50	9.10	3.50	0.90	-	-

4.1.7 Management and Mitigation Measures

During the design phase of the proposed action, the mitigation hierarchy (avoid, minimise, rehabilitate, offset) was applied. Where practicable, the alignment was modified to avoid areas of native vegetation, including occurrences of the TEC. Where avoidance was not possible, the following management measures have been put in place to minimise impacts:

- Clearing within areas identified as the Western Australian Wheatbelt TEC will be minimised to that required for a safe construction environment and to achieve National Highway standards and objectives. Areas beyond the required impact area will be marked as “no-go” zones on construction drawings and on site. This will reduce the risk of accidental clearing or disturbance outside of the area required for construction;
- The area to be cleared will be accurately pegged/marked on the ground. The area to be cleared requires approval by the Superintendent prior to the clearing occurring. This provides an opportunity to conduct a final check that environmental and heritage sensitivities have been considered and that the area to be cleared is suitable for the purpose of the clearing (for example, is not larger than required);
- Additional areas required for construction such as laydown areas, stockpile areas and vehicle turn around will be located in areas that are not identified as the Eucalypt Woodlands of the Western Australian Wheatbelt TEC. Preference shall be for these areas to be in cleared areas or areas of non-native vegetation in order to avoid unnecessary clearing. This will reduce the risk that ancillary clearing will reduce patch sizes below the thresholds defined in the conservation advice;

- Weed and hygiene control measures will be in place during construction. These will include verifying all plant and machinery as clean prior to arrival at site and segregating stripped topsoil according to its weed and disease status. While many of the species which make up the TEC are resistant to dieback disease, appropriate hygiene measures will reduce the risk of introducing or spreading weeds which have the potential to further degrade areas of the TEC;
- Road reserve fence installation through the Water Corporation reserve south of Pithara townsite will be largely installed by foot with a maximum of five access tracks between the GNH and the fence line allowed for in order to transport materials (such as posts, strainer assemblies and concrete) to fence post locations. This will reduce the total area of clearing required within the TEC;
- To avoid additional compaction in areas of the TEC, particularly the Water Corporation reserve south of Pithara townsite, traffic management alternatives to side roads, such as reduction of the road to a single lane with movement controlled by either temporary electronic signals or by qualified traffic management personnel, will be considered. This will both reduce the area of clearing required within the TEC and avoid secondary impacts from compaction of the soil leading to reduced infiltration rate and potential decline in vegetation health; and
- a qualified arborist will be engaged to undertake pruning of tree roots greater than 50 millimetres in diameter.

Areas that are cleared as part of construction but are not required to be kept clear (that is, they are not part of the road formation, drainage, and so on) will be rehabilitated in accordance with the Landscape and Rehabilitation Plan. Landscaping includes revegetation with seed mixes which replicate the TEC. For example, in the Pithara construction packages, the landscaping design and contract specification calls for rehabilitation with the following species mixes:

- An overstorey mix which includes *Eucalyptus kochii*, *E. erythronema*, *E. tenera*, *E. leptopoda* and *E. armillata*;
- A second overstorey mix which includes *E. loxophleba* and *E. salmonophloia*; and
- An understorey mix which includes *Allocasuarina acutivalvis*; *Melaleuca adnata*; *M. hamata*; *Enchylaena lanata / tomentosa* complex; *Maireana brevifolia* and *Rhagodia preissii*.

It should be noted that, for safety reasons, no tree species will be planted within the clear zone. The clear zone is nominally 10 m from the road edge marking. In situations where the road design calls for installation of safety barriers or other design alternatives, the width required for the clear zone may be reduced.

4.1.8 Consistency with Recovery Plans or Threat Abatement Plans

At the time of writing, there was no Recovery Plan prepared for this ecological community and the conservation advice does not identify the need for one. The Conservation Advice for the Eucalypt Woodlands of the WA Wheatbelt ecological community was prepared by the Threatened Species Scientific Committee for the Minister for the Environment and was accepted and adopted by the Minister as the approved conservation advice in 2015.

No Threat Abatement plan has been developed for the TEC. The Conservation Advice does, however, provide guidance on actions for threat abatement of this ecological community. **Table 4-4** details how these actions have been considered by the project.

Table 4-4 : TEC Conservation Advice Threat Abatement Actions (TSSC, 2015)

Recommended Action	Consideration by Proposed Action
Avoid or restrict	
<p>Further clearance and fragmentation of the ecological community, especially of:</p> <ul style="list-style-type: none"> • High quality eucalypt woodland sites (as per the condition thresholds). Do not allow such patches to be further reduced below the size thresholds specified. • Components identified as particularly threatened, such as threatened and priority ecological communities recognized in WA; and • Woodland sites known to be habitat for threatened species or species that are uncommon in the relevant IBRA subregion or catchment. 	<p>A small area of high quality eucalypt woodland sites will be cleared. No more than 0.9 ha of Eucalypt Woodland identified as in very good condition will be cleared. No Excellent or Pristine condition TEC vegetation will be cleared. Clearing is not anticipated to reduce the size of any one patch below the condition thresholds.</p> <p>No patches identified as particularly threatened (such as areas previously identified as a TEC or Priority Ecological Community) or that contain threatened flora species have been identified within the area to be cleared.</p> <p>Clearing has been reduced as far as practicable without limiting the ability for the proposed action to be constructed safely or compromising the long term safety of road users.</p>
<p>With regard to any proposals involving offsets for such a complex and diverse ecological community as the WA Wheatbelt Woodlands, the aims should be to:</p> <ul style="list-style-type: none"> • increase the area, condition and ecological function of the woodlands, e.g. by improving connectivity, diversity and other habitat values; • match sites as far as this is possible, for instance the same or similar type of woodland community/sub-community as per Harvey and Keighery (2012) or similar Beard vegetation association; • extend protection to otherwise unprotected sites. This may include sites that presently fall outside the condition criteria but can reasonably be restored to a better, more intact condition; and • manage and protect offset areas in perpetuity in areas dedicated for conservation purposes. 	<p>The acquisition of land shall increase the area of the woodlands protected within the conservation estate. Acquired land shall be transferred to Parks and Wildlife for management, providing in perpetuity protection and management for conservation purposes.</p> <p>Land acquisitions will preferentially be undertaken in the Shires of Moora, Dalwallinu and Wongan-Balidu in order to locate the offset site as close as possible to the impact site with vegetation therefore be more likely to match at the sites. Parks and Wildlife have identified a property near Wongan Hills which may be appropriate for offsets, pending further ecological investigation.</p> <p>Further details of the offset proposal are provided in Section 5 and Appendix B.</p>
<p>Introducing grazing to intact and high quality sites of the ecological community, at least those that occur west of the agricultural clearing line. Consider opportunities to reduce existing grazing pressure, e.g. through fencing.</p>	<p>Grazing will not be introduced as a result of the proposed action. The road reserve will be fenced, thereby excluding stock from TEC occurrences within the road reserve.</p>

Recommended Action	Consideration by Proposed Action
<p>Extensive disturbances to native vegetation, hydrology or soil structures in and around the ecological community, especially in landscapes prone to erosion, salinity and waterlogging. For instance, apply buffer zones as per Section 3.4, control run-off and avoid significant hydrological changes and eutrophication by minimizing impacts from developments and activities in and around the ecological community.</p>	<p>Drainage has been designed in accordance with Austroads' guidelines and will be installed, where required, adjacent to the bitumen road in order to control surface water run-off. The proposed action will not significantly alter the current hydrological environment.</p> <p>Construction areas beyond the road formation will be landscaped and rehabilitated in accordance with the Landscape and Rehabilitation Plan and the landscape design. This includes treatment of compacted areas and establishment of appropriate vegetation, which will assist in reducing the risk of erosion and land degradation.</p>
<p>Removal of large trees that have hollows, regardless of whether trees are living or dead.</p>	<p>Removal of large trees with hollows has been minimized, where reasonably practicable. No known nesting trees for Carnaby's Black Cockatoo will be cleared.</p>
Support wherever possible	
<p>Revegetate degraded patches of eucalypt woodland with appropriate native tree, shrub and ground layer species. Regularly monitor the plantings to determine the success of revegetation and adapt management techniques, as necessary.</p>	<p>All disturbed areas will be rehabilitated in accordance with the Landscape and Rehabilitation Plan and the landscape design. This includes appropriate topsoil management to retain the soils seed bank and revegetation of cleared areas. Where appropriate, landscaping and revegetation treatments may also be extended to degraded occurrences of the TEC.</p> <p>Landscaping and revegetation is monitored to determine if revegetation has been successful.</p>
<p>Quick response to prevent new weed, disease or feral animal incursions identified in the Wheatbelt, especially if they are likely to seriously impact upon woodlands. Use appropriate hygiene and management protocols to prevent or contain any invasive species or diseases, and aim to eradicate them.</p>	<p>Weed treatment activities will occur prior to clearing of vegetation and stripping of topsoil. Any declared weeds found occurring within the construction area will be treated appropriately in accordance with the Western Australian Department of Agriculture and Food weed treatment guidelines/advice.</p> <p>All plant and machinery are required to be certified as clean and free of soil and vegetative matter prior to arriving at site. Weed and disease hygiene measures are implemented in high risk areas.</p> <p>Key Wheatbelt woodland eucalypts are considered resistant to dieback disease (TSSC, 2015) and therefore this TEC is not considered at risk to dieback.</p>

Recommended Action	Consideration by Proposed Action
Support and communicate with agencies/groups and landholders about avoiding impacts and undertaking conservation activities	
State agencies, local governments and other organizations responsible for approving developments and maintaining water, power, telecommunications and other amenities that may include patches of the ecological community.	The M2W team has and will continue to liaise with relevant authorities such as DoEE, Department of Environment Regulation and Parks and Wildlife as well as other relevant stakeholders in relation to impact avoidance and conservation activities.

4.2 Carnaby's Black Cockatoo

4.2.1 Environmental Outcome

The environmental objective for the project identified in the referral is no nett loss of foraging and potential breeding habitat for Carnaby's Black Cockatoo.

4.2.2 Surveys Conducted

Initial fauna habitat and black cockatoo tree assessments were undertaken concurrently with the flora and vegetation surveys (refer to **Section 2** for details). Subsequent black cockatoo habitat assessments were undertaken with Tony Kirkby, a recognised subject matter expert on black cockatoos, to inspect the recorded potential breeding trees for signs of use. The following assessment was conducted for black cockatoo species in the study area:

- survey of potential breeding trees, roosting sites and feeding sites for Carnaby's Black Cockatoo;
- records of opportunistic sightings of Carnaby's Black Cockatoos; and
- mapping of breeding and foraging habitat for Carnaby's Black Cockatoo.

Full survey reports are provided in **Appendix A**. Surveys were conducted in accordance with the relevant state and federal guidelines:

- Environmental Factor Guideline - Terrestrial Fauna (EPA, 2016);
- Technical Guidance - Terrestrial fauna surveys (EPA 2004a);
- Technical guide: Terrestrial vertebrate fauna surveys for environmental impact assessment (EPA & DEC 2010); and
- EPBC Act referral guidelines for three threatened black cockatoo species: Carnaby's cockatoo, Baudin's cockatoo and Forest red-tailed black cockatoo (Department of Sustainability Environment Water Populations and Communities (DSEWPaC, now DoEE) 2012).

4.2.3 Habitat Description

Habitat for Carnaby's Black Cockatoo is separated into breeding habitat, foraging habitat and night roosting habitat. Breeding habitat is generally located in woodlands or forest but can also be present as isolated trees. Nesting occurs in appropriate hollows in salmon gums, wandoo, tuart, jarrah, flooded gum, york gum, powderbark, karri and marri. Roosting habitat is generally associated with riparian areas with a range of species being used, including flat-topped yate, salmon gum, wandoo, marri, karri, blackbutt, tuart, introduced eucalypts and pines. Foraging occurs in proteaceous shrublands and woodlands, kwongan heathland and eucalypt woodlands and forest that contain foraging species (DSEWPaC 2012).

4.2.4 Occurrence within the Proposal Area

Surveys undertaken by Phoenix (2016) have recorded a total of 203.08 ha of low value foraging habitat for Carnaby’s Black Cockatoo across the area of the proposed action (**Figure 4**). No Quality or Valued foraging habitat was recorded or mapped by Phoenix (2015; 2017). Some of this foraging habitat occurs adjacent to known nesting trees, which is considered to be habitat critical for the species. Research has shown that the availability of foraging habitat within 6 km of nesting trees has a significant relationship to breeding success (Parks and Wildlife 2013). In addition to foraging habitat, 17 trees showing evidence of use by the species, 13 trees with hollows suitable for use and 1,194 potential breeding trees (diameter at breast height greater than 500 mm) have been recorded within the proposal area. **Table 4-5** shows the breakdown of foraging habitat and breeding trees (potential and known) by construction package.

Table 4-5 : Carnaby’s Black Cockatoo Habitat

Construction Package	Known Nesting Trees	Trees with Suitable Hollows	Potential Breeding Trees	Foraging habitat (ha)
Walebing	12	8	934	33.23
Miling Bypass	1	4	73	4.49
Pithara	1	0	73	40.27
Dalwallinu to Wubin	3	1	114	125.09
Total	17	13	1,194	203.08

4.2.5 Regional Occurrence

Carnaby’s Black Cockatoo is endemic to the south-west of Western Australia, with a widespread distribution from Albany and Esperance in the south to Merredin and Dowerin in the east and Morawa and Kalbarri in the north. Inspection of recent aerial photography, combined with broad scale vegetation mapping for the wider area suggests that 32,590 ha of suitable habitat for the species occurs within 15 km of the proposed action with 11,916 ha within 15 km of the Walebing construction package, 7,854 ha within 15 km of Miling Bypass, 6,015 ha within 15 km of Pithara and 12,748 ha within 15 km of the Dalwallinu to Wubin construction package.

The “Carnaby’s Cockatoo Recovery Plan” (Parks and Wildlife, 2013) outlines the Important Bird Areas (IBA) designated specifically for Carnaby’s Black Cockatoo and include the following:

- Walebing - Supports up to 40 breeding pairs which nest in woodland remnants and isolated paddock trees and feed in native shrublands. This IBA is adjacent to the existing GNH, on the southern side;
- Moora - Supports up to 60 breeding pairs. This IBA is approximately 19 km north west of the Walebing construction package;
- Gillingarra - Supports up to 20 breeding pairs which nest in Marri trees and feed in native shrublands. This IBA is approximately 22 km south west of the Walebing construction package;
- Calingiri - Supports up to 20 breeding pairs which nest in woodland remnants and isolated paddock trees and feed in native shrublands. This IBA is approximately 28 km south of the Walebing construction package; and
- Bindoon-Julimar - Supports at least 110 pairs in nesting and associated feeding habitat; this is the largest population of breeding birds in south-west Australia. This IBA is approximately 48 km south of the Walebing construction package.

4.2.6 Likely Impacts

The locations of known nesting trees and trees with hollows suitable for Carnaby’s Black Cockatoo have been taken into consideration during the design phase of the project. As a result, no clearing of, or disturbance to

known nesting trees or trees with suitable hollows is anticipated. A total of 130 potential breeding trees and 30 ha of foraging habitat will be cleared for the proposed action (**Table 4-6**). In a regional context, this represents 0.09% of the potential foraging habitat present with 15 km of the proposed action.

Table 4-6 : Clearing Requirements - Carnaby's Black Cockatoo Habitat

Construction Package	Potential Breeding Trees	Foraging habitat (ha)
Walebing	84	8
Miling Bypass	12	2
Pithara	14	6
Dalwallinu to Wubin	20	14
Total	130	30

4.2.7 Management and Mitigation Measures

During the design phase of the proposed action, the mitigation hierarchy (avoid, minimise, rehabilitate, offset) was applied. Where practicable, the alignment was modified to avoid areas of native vegetation and known nesting trees or trees with hollows suitable for Carnaby's Black Cockatoo. Where foraging habitat could not be avoided, the following management measures have been put in place to minimise impacts:

- Trees within the Approval Boundary known to contain hollows suitable for use by Carnaby's Black Cockatoo that are not within the proposed disturbance footprint will not be cleared. These trees will be identified as "no-go" zones in the Principal's Environmental Management Plan (PEMP) and Construction Drawings. This will reduce the risk that these trees are accidentally cleared or otherwise damage during construction activities.
- Where potential breeding trees occur adjacent to the alignment and within the required clear zone, consideration will be given to including safety barriers within the design (or other design alternatives) in order to avoid clearing these trees;
- In areas of high abundance of known nesting trees or trees with suitable hollows, or where extensive foraging habitat occurs, wildlife hazard signage will be considered and installed if appropriate. This will alert road users to the potential presence of Carnaby's Black Cockatoo and may assist in reducing the risk of vehicle-bird collisions;
- The area to be cleared will be accurately pegged/marked on the ground. The area to be cleared is approved by the Superintendent prior to the clearing occurring. This provides an opportunity to conduct a final check that environmental and heritage sensitivities have been considered and that the area to be cleared is suitable for the purpose of the clearing (for example, is not larger than required);
- Known nesting trees and trees with suitable hollows within 20 m of the construction footprint will be clearly marked for retention;
- Additional areas required for construction such as laydown areas, stockpile areas and vehicle turn around will be located in cleared areas or areas of non-native vegetation. This will avoid unnecessary clearing of the Carnaby's Black Cockatoo habitat, including foraging species and potential (or known) breeding trees;
- During construction, vehicle speed on site will be limited to reduce dust lift off and the risk of vehicle-fauna collisions;
- It is considered unlikely that construction activities will result in injury or death to Carnaby's Black Cockatoo as there will be no clearing of Hollows with Evidence of Use or Suitable Hollows. Speed limits for all light and heavy vehicles will be reduced on site to minimise fauna strikes. The contractor will be required to roll out mandatory environmental inductions and toolbox sessions to all personnel to raise

awareness on Black Cockatoo species and encourage reporting of Black Cockatoo sightings. Any birds injured or killed as a result of construction or rehabilitation/revegetation activities will be reported to Parks and Wildlife and injured animals transferred to wildlife carers for rehabilitation and release back into the wild;

- A list of local wildlife rescue organisations and carers will be maintained on site. This will allow efficient identification of an appropriate destination to which to transfer sick or injured wildlife, thereby reducing the holding time and potential stress on the animal; and
- Weed and hygiene control measures will be in place during construction. These will include verifying all plant and machinery as clean prior to arrival at site and segregating stripped topsoil according to its weed and disease status. While many of the Eucalypt species which make up Carnaby's Black Cockatoo habitat are resistant to dieback disease, many of the foraging species are not. Appropriate hygiene measures will reduce the risk of introducing or spreading weeds and disease which have the potential to further degrade areas of habitat for Carnaby's Black Cockatoo.

Areas that are cleared as part of construction but are not required to be kept clear (that is, they are not part of the road formation, drainage, and so on) will be rehabilitated in accordance with the Landscape and Rehabilitation Plan and landscape design. Landscaping includes revegetation with seed mixes which include eucalypt species which are known to form hollows suitable for use by Carnaby's Black Cockatoo, though seedlings are likely to require at least 100 years before such hollows will form (Parks and Wildlife 2013).

It should be noted that, for safety reasons, no tree species will be planted within the clear zone. The clear zone is nominally 10 m from the road edge marking. In situations where the design calls for installation of safety barriers the width required for the clear zone may be reduced.

4.2.8 Consistency with Recovery Plans or Threat Abatement Plans

The "Recovery Plan for Carnaby's Cockatoo" (Parks and Wildlife, 2013) and the recovery action items outlined in Section 14 of the plan are primarily targeted for regulators and conservation group. However, action items 1, 4 and 5 from the Recovery Plan are relevant to this proposal. **Table 4-7** discusses how these recovery actions have been considered for the proposed action.

Table 4-7 : Carnaby's Black Cockatoo Recovery Plan Considerations

Recovery action	Consideration
Action 1. Protect and Manage Important Habitat	<p>Breeding sites are considered to be critical habitat for the species. No known nesting trees or trees with suitable hollows are to be cleared for the proposed action. Known nesting trees and those with suitable hollows will be identified as No Go areas with barriers established during construction to prevent unauthorized access and accidental damage.</p> <p>The landscape design for the project includes revegetating cleared areas with flora species identified as known foraging and/or breeding habitat species. This will reduce the final amount of permanent loss of habitat. In addition, redundant carriageway within the road reserve will be revegetated in line with the landscape design. As landscape designs for each construction package are progressed, consideration will also be given to improving the condition of existing degraded patches of habitat adjacent to the alignment. This will be balanced against the potential for increased risk of bird-vehicle collisions.</p> <p>The offset strategy for the proposed action will result in additional Carnaby's Black Cockatoo habitat being added to the Conservation Estate. The preferred offset strategy</p>

Recovery action	Consideration
	includes both breeding and foraging habitat for the species.
Action 2: Undertake Regular Monitoring	The proposed action is not inconsistent with this recovery plan action.
Action 3: Conduct Research to Inform Management	The proposed action is not inconsistent with this recovery plan action.
Action 4. Manage other impacts	The installation of wildlife crossing signs in locations where there is a high abundance of known nesting trees or extensive areas of foraging habitat (such as in the Walebing construction package) has been considered in order to reduce the incidence of vehicle-bird collisions. Any injured birds found during construction activities (within the construction area) will be taken to the nearest local wildlife carer as appropriate.
Action 5: Engage with the Broader Community	There is potential to engage with local community groups, schools, landcare groups and the like as part of the proposed offsets for the project. These opportunities shall be further considered as the offsets strategy is progressed.
Action 6: Undertake Information and Communication Activities	The proposed action is not inconsistent with this recovery plan action.

While no specific threat abatement plans have been identified for Carnaby’s Black Cockatoo, the “Threat Abatement Plan for Disease in Natural Ecosystems Caused by *Phytophthora cinnamomi*” is relevant for this species. Although several of the key Eucalypts used by Carnaby’s Black Cockatoo for breeding are considered resistant to dieback disease (TSSC, 2015), many foraging species are susceptible.

In relation to the proposed action only the Walebing construction package is within the area where dieback is known to occur (areas receiving more than 400 mm annual rainfall). The majority of the Walebing construction package has been mapped as ‘Excluded’ as it is predominantly cleared agricultural land with sparse remnant native vegetation that is in Degraded or Completely Degraded condition (Terratree, 2016). The one Uninterpretable (Protectable) area is located at the intersection of Midlands Road and Great Northern Highway. The remaining two Uninterpretable areas are wetland areas and watercourses that do not meet the protocol for being Protectable because of their size or dimensions. No dieback occurrence was observed or diagnosed within the Walebing construction package.

Construction management measures include weed and disease hygiene with clean on entry/exit requirements for Uninterpretable areas provided the area in question meets the requirements set out in Parks and Wildlife’s protocol for identifying protectable areas.

The Threat Abatement Plan outlines management measures, objectives and actions which relate specifically to Carnaby’s cockatoo breeding and foraging habitat. The mapping of dieback occurrence/risk and the controls put in place to manage the risk of spread of the disease, ongoing awareness training and establishment of no-go zones addresses the objectives of the Threat Abatement Plan.

5. Environmental Offsets

5.1 Offset Proposal

Main Roads proposes to offset the predicted impacts to Carnaby's Black Cockatoo and the Eucalypt Woodlands of the Western Australian Wheatbelt TEC as follows:

- provision of 130 ha of land at Lot 1, 1395 Banovich Road, Hill River to offset impacts to Carnaby's Black Cockatoo foraging and potential breeding habitat. This property has been acquired by Main Roads and a portion of the land allocated to offsetting impacts from the Mitchell Freeway Extension (EPBC 2013/7091); and
- financial contribution of \$78,489.00 to the State offset fund managed by the DER to offset impacts to the Eucalypt Woodlands of the Western Australian Wheatbelt TEC.

These offsets have been calculated using the EPBC Offset Guide. A conservative approach has been adopted in calculating the offset requirements by using the total amount of clearing required, rather than the residual impact following landscaping and revegetation activities. Full details on the offsets proposed are provided in **Appendix B**, including inputs to the EPBC Offset Guide and the justification for these.

In a meeting between Main Roads WA, the M2W team and DER on 21 March 2017, the possibility of a financial contribution to the DER offset fund for the purposes of offsetting impacts to the Eucalypt Woodlands of the Western Australian Wheatbelt TEC was discussed. It was confirmed by DER that the offset fund can be used for this purpose. In order to calculate the financial contribution to the State offset fund, valuation information was obtained from the Valuer-General (on a \$/ha basis) for unimproved (vegetated) land within the Shire of Moora. As the Valuer-General's market valuation (\$/ha) of vegetated land differs according to the size of the land parcel, the valuation of the closest 'standard parcels' of land (i.e. 10, 50, 100, 200 or 500 ha) was used to determine the market valuation of the offset area.

5.2 Consistency with EPBC Environmental Offsets Policy

In determining the offset strategies described above, consideration has been given to the requirements of the EPBC Environmental Offsets Policy. **Table 5-1** provides discussion on how the policy has been considered.

Table 5-1 : Consistency with EPBC Environmental Offsets Policy

EPBC Offsets Policy Requirement	Consideration in Offset Proposal
Suitable offsets must deliver an overall conservation outcome that improves or maintains the viability of the protected matter	The offset strategies proposed will increase the representation of the relevant protected matters within the State and potentially in the conservation estate. This protection will, at a minimum, assist in maintaining the viability of the protected matter.
Suitable offsets must be built around direct offsets but may include other compensatory measures	The offset strategies proposed are built around direct offsets.
Tenure for direct offsets	Acquired land will be transferred to the State or incorporation into the conservation estate and managed by Parks and Wildlife, providing in perpetuity protection and management
Impacting on existing EPBC Act offsets	There are no impacts on existing EPBC Act offsets
Suitable offsets must be in proportion to the level of statutory protection that applies to the protected matter	The Offset Guide has been used to calculate the area required for direct offset. The guide takes into consideration the level of statutory protection for the protected matter.

EPBC Offsets Policy Requirement	Consideration in Offset Proposal
Suitable offsets must be of a size and scale proportionate to the residual impacts on the protected matter	Offsets have been calculated based on the total extent of clearing required for the protected matter. Landscaping and rehabilitation will reduced the final (residual) impact; however, as landscape designs have not been finalized for all construction packages, a conservative approach has been adopted. Using this approach, it is considered that the proposed offset will be proportionate to the final residual impact.
Suitable offsets must effectively account for and manage the risks of the offset not succeeding	<p>Carnaby's Black Cockatoo: There is a high level of certainty that the offset will be successful given the offset site is located within the breeding range for Carnaby's Black Cockatoo, has been nominated by Main Roads based on recent fauna survey information (GHD, 2016) and contains known nesting locations. The site will be managed by Parks and Wildlife and transferred into the conservation estate.</p> <p>Eucalypt Woodland TEC There is a high level of certainty that the offset will be successful given the offset site will be nominated by DER, managed by Parks and Wildlife and transferred into the conservation estate.</p>
Suitable offsets must be additional to what is already required, determined by law or planning regulations, or agreed to under other schemes or programs	The proposed offset strategies are additional to any other requirements.
Links with state and territory approval processes	Offsets will also be required under Part V of the <i>Environmental Protection Act 1986</i> (WA) as part of the permit to clear native vegetation.
Suitable offsets must be efficient, effective, timely, transparent, scientifically robust and reasonable	<p>Carnaby's Black Cockatoo The conservation gain will be achieved within a year as the site has already been acquired by Main Roads WA, is vegetated and provides foraging and breeding habitat for Carnaby's Black Cockatoo.</p> <p>Eucalypt Woodland TEC The conservation gain will be achieved once the land has been acquired.</p>
Suitable offsets must have transparent governance arrangements including being able to be readily measured, monitored, audited and enforced	As the offset site(s) will be under the management responsibility of Parks and Wildlife, it will be subject to the same governance, policy and management arrangements as are applied to all parks and Wildlife managed lands.

6. Economic and Social Matters

The total capital cost to construct the proposed action has been estimated at \$122 million. This is broken down as follows:

- Walebing – \$20 million;
- Miling Bypass – \$34 million;
- Pithara – \$29 million; and
- Dalwallinu to Wubin – \$39 million.

6.1 Potential Employment Opportunities

The following direct and indirect employment opportunities are expected to be generated as a result of the proposed action:

- Walebing – 140 people;
- Miling Bypass – 238 people;
- Pithara – 203 people; and
- Dalwallinu – 273 people.

There has been a deliberate focus on identifying local small businesses capable of undertaking early works for the project (fencing and services relocations). This has been facilitated through the community engagement and stakeholder consultation activities outlined in Section 6.3. Once identified, these local businesses are invited to tender for early works contracts.

Nudge (formerly the Main Roads ROADS Foundation) has been engaged to work with the local indigenous community to build up a network of resources and information to facilitate employment opportunities related to the proposed action.

Construction contractors engaged as part of the proposed action will be required to comply with the project's Aboriginal Participation targets and develop an Aboriginal Participation Plan outlining strategies to achieve the targets for indigenous employment and business engagement.

6.2 Cost/Benefit Estimation

The Cost Benefit Analysis (CBA) was performed on the overall GNH Upgrade (Stage 2) project, of which the proposed action is a key component. Main Roads' Road Evaluation System (WARES) and Crash Analysis Reporting System (CARS) were used to conduct the CBA. WARES and CARS are complimentary tools used to estimate the economic benefits and costs of non-urban road projects in WA.

The following benefits were estimated:

- **Travel time benefits** – a reduction in the travel time per vehicle due to improved service levels within the GNH corridor. Both WARES and CARS were used in order to estimate these benefits using time value parameters from Austroads Project Evaluation Data (2012).
- **Vehicle operating cost (VOC) savings** – a reduction in fuel and 'wear and tear' costs due to improved service levels on the GNH corridor. Both WARES and CARS were used in order to estimate these benefits using time value parameters from Austroads Project Evaluation Data (2012).
- **Safety benefits** – a reduction in the number of crashes due to an improved GNH corridor alignment. WARES was used to estimate this benefit. WARES utilises crash cost parameters from Austroads Project Evaluation Data (2012).

- **Road maintenance cost savings** – a reduction in the cost of maintaining the GNH corridor due to an enhanced road geometry that reduces the ‘wear and tear costs’ from vehicles travelling through the corridor. WARES was used to estimate this benefit using Main Roads’ cost parameters.

Assumptions behind the CBA include:

- Construction of the overall GNH Upgrade (Stage 2) project beginning at the start of the 2016/2017 financial year, with completion occurring in the financial year ending in 2018/2019;
- Project operation period of 30 years commencing in the financial year 2019/20;
- P50 and P90 capital costs of \$337.9m and \$384.8m, respectively, were used;
- Discount rate of 7% per annum, with sensitivity tests of 4 and 10%;
- Traffic volumes from Main Roads traffic surveys; and
- Annual average traffic growth rate for all traffic of 2.9% (consistent with the Corridor Development Strategy).

6.3 Stakeholder Consultation

A number of stakeholders have been consulted and information sessions have been held as part of the proposed action, these are summarised in **Table 6-1**. General communications included targeted mailout of the project newsletter (electronic and physical), newspaper advertisements, notices in local collection points such as Shire offices, post offices and libraries and radio interviews.

Table 6-1 : Stakeholder Consultation Summary

Location	Date	Type	Stakeholders	Outcomes
Miling	Oct-14 Nov-14 Mar-15	Town Hall	Local community	<p>The township of Miling provided a variety of feedback regarding a potential bypass of Miling and was interested in other works the M2W team is proposing outside of town. The issues important to this region are:</p> <ul style="list-style-type: none"> • conflicts between trucks and cars and noise pollution as a result of trucks; • proper access into and out of CBH and the seed cleaning facility; • improved sight distances; and • general road improvements including possible realignments to avoid sharp turns and uneven surfaces. <p>Miling has found the prospect of a bypass highly contentious and has split much of the townspeople between those who support the bypass and those who don't. Further division has also occurred over which side of the town the bypass should go on.</p>
Dalwallinu	Various Mar-15 Various	Meeting Town Hall Council Meeting	Shire CEO Local community Shire Council	<p>Dalwallinu residents did not engage with the project team and very few people attended the community session held 31 March 2015. For those that did attend, feedback has been very positive and residents appear to be very supportive of the proposed upgrade.</p>

Location	Date	Type	Stakeholders	Outcomes
Wubin	Oct-14 Nov-14 Apr-15	Town Hall	Local community	<p>The residents of Wubin were mostly concerned with the road realignment/bypass of their town. A bypass has not been previously presented to the town as an option, so generated much discussion.</p> <p>Three main issues were raised by Wubin residents:</p> <ul style="list-style-type: none"> • they are worried that the town will cease to exist if road trains no longer need to stop in town; • they were concerned about the two roadhouses going out of business; • they would like the project team to ensure that if Wubin is to be bypassed that proper access is provided and the road upgraded to a suitable standard to allow 53.5m road trains to enter the town.
All areas	various	1 on 1 meetings	Landowners	<p>One to one meetings occurred with landowners to discuss the road realignment. Landowners were concerned about land acquisition, loss of business and impact upon existing infrastructure such as bus stops.</p> <p>Some residents raised concerns about consultation and engagement methods after a perceived lack of consultation on Batty Bog works (not part of this proposed action).</p>
Moora	Various Various	Meeting Council Meeting	Shire CEO Shire Council	<p>The council was concerned about the future viability of Miling town should it be bypassed by the highway. Council requested the project team look at constructing a truck bay in town to help mitigate impacts of the bypass.</p>

The M2W team has also attending the following workshops and meetings:

- Northlink Freight and Road Users Group;
- Austroads Urban Freight workshop;
- Regional Development Australia Board; and
- Avon-Midland Country Zone Meeting WA Local Government Association (WALGA).

6.4 Aboriginal Liaison

There are two Native Title claimant groups relevant to the proposed action, Yued (Walebing to Dalwallinu) and Widi Mob (Dalwallinu to Wubin). Yued are the primary Aboriginal group as the majority of the proposed alignment work will be undertaken in the Yued Indigenous Land Use Agreement area.

The project team commenced Indigenous heritage surveys in early 2015. Formal consultation has been held with Yued stakeholders regarding the proposed alignment at the Walebing Reserve, corner of Midland's Road

and GNH. Ongoing consultation with both the Widi Mob and Yued is planned going forward, including exploring opportunities for community development and interpretive material.

7. References

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Figures

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Figure 1 : Ecological Survey Extents
[GNH-CN00-EN01-GIS-0035]

Figure 2 : Eucalypt Woodlands of the Western Australian Wheatbelt Occurrence Mapped by Phoenix
[GNH-CN00-EN01-GIS-0036]

Figure 3 : Regional Extent of Eucalypt Woodlands of the Western Australian Wheatbelt
[GNH-CN00-EN01-GIS-0038]

Figure 4 : Carnaby's Black Cockatoo Habitat Mapped by Phoenix

[GNH-CN00-EN01-GIS-0037]

Appendix A. Ecological Survey Reports (Phoenix 2015; 2016a; 2016b; 2016c)

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Appendix B. Offset Proposal

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