Great Northern Highway
Muchea to Wubin Upgrade - Stage 2

MAIN ROADS WESTERN AUSTRALIA

Walebing to Wubin | EPBC Act Referral - Supporting Information

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Issue summary

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1	14-04-2016	Draft	Cross Discipline Review / Technical Review
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3	26-07-2016	Final	Issued for Approval

Contents

Glossary

Abbreviation	Description
AASHTO	American Association of State Highway and Transportation Officials
AHA	*Aboriginal Heritage Act 1972*
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	*Biosecurity and Agriculture Management Act 2007*
BAR	Basic Right turn treatment
BGL	Below ground level
BH	Borehole
BoM	Bureau of Meteorology
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
DAA	Department of Aboriginal Affairs

Abbreviation	Description
DAFWA	Department of Agriculture and Food WA
DBH	Diameter Breast Height
DBYD	Dial Before You Dig
DCP	Dynamic Cone Penetrometer
DEM	Digital Elevation Model
DER	Department of Environment and Regulation
DGS	Digital Ground Survey
DoE	Department of the Environment
DoW	Department of Water
Parks and Wildlife	Department of Parks and Wildlife
DSEWPaC	Department of Sustainability Environment Water Planning and Community
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EPA	Environmental Protection Authority
EP Act	*Environmental Protection Act 1986*
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
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

Abbreviation	Description
Ma	Mega-annum (period of 1 million years)
Main Roads	Main Roads Western Australia
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
PAG	Project Advisory Group
PDNH	Perth to Darwin National Highway
PEMP	Principal's Environmental Management Plan
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)

Abbreviation	Description
RRM	Road Reference Marks
RRPM	Retro-reflective Pavement Markers
RTE	Road and Traffic Engineering Branch of Main Roads WA
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
WAOL	Western Australian Organism List
WAPC	Western Australian Planning Commission
WC Act	Wildlife Conservation (Act)
WCLT	Wide Centreline Treatment
WoNS	Weeds of National Significance

1. Introduction

1.1 Great Northern Highway: Muchea to Wubin Upgrade Stage 2

Main Roads Western Australia (Main Roads) has established the Muchea to Wubin Integrated Project Team (M2W Team), comprising Main Roads and industry partners Jacobs and Arup to conduct a comprehensive planning review of the full Muchea to Wubin link. 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. In addition, a further $35 million was made available for improvements to 11 km of highway through the Bindi Bindi curves.

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. Among the improvements to be considered are more passing lanes, flattening crests and easing curves, safer roadsides, more rest stops and additional facilities for heavy vehicles.

1.2 The Proposed Action: Walebing to Wubin

The proposed action involves upgrading and/or realignment of discrete sections of the existing Great Northern Highway (GNH) between approximate straight line kilometre (SLK) 147 and SLK 256.8, herein referred to as Walebing to Wubin (**Figure 1-1**). The sections included in this referral are:

- Walebing (SLK 147.7 to SLK 165.6)
- Miling Bypass (SLK 177.6 to SLK 186.9)
- Pithara (SLK 207.4 to SLK 223.4)
- Dalwallinu to Wubin (SLK 231.77 to SLK 256.5)

A planning review of the current GNH and feedback from community consultation has identified a number of deficiencies along the Highway between these two SLKs. These deficiencies include:

- Narrow and substandard road width. The original GNH was constructed with an 8 m wide seal on a 10 m formation. Current Main Roads standards require at least a 9 m seal on an 11 m formation, with a 10 m seal on 12 m formation adopted for the proposed action;
- Areas with non-compliant horizontal and vertical geometry. To allow vehicle speeds of 110 km/h (100 km/h for heavy vehicles), these geometry issues require rectification;
- A number of intersections with poor sight distance or inadequate turning provisions; and
- Insufficient clear zone.

A detailed description of the works to be undertaken is provided in Section 2. Coordinates for the Approval Boundary are provided in **Appendix A**.

1.3 Scope and Purpose of this Document

This document has been prepared to support the referral of the proposed action under the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act). It provides additional information regarding the proposed action and the interaction with Matters of National Environmental Significance (MNES) to assist the Commonwealth Department of the Environment (DoE) in determining if formal assessment of the proposed action is required. Its purpose is to present an environmental impact assessment of the proposed action on MNES. The scope of the proposed action is limited to construction of upgrades and improvements to the GNH as detailed in the following section between approximate SLK 147 and SLK 256.8 (Walebing to Wubin).

It should be noted that certain components of the proposed action are regulated under the *Aboriginal Heritage Act 1972* (WA) (AHA). The purpose of this Act is the preservation of places and objects customarily used by the original inhabitants of Australia and provides for consent to disturb aboriginal sites

1.4 Proponent

The proponent for the proposal is:

Main Roads Western Australia

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PO Box 6202

East Perth WA 6892

The key contacts for this proposal are:

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2. Description of the Proposed Action

2.1 Overview

Main Roads proposes to upgrade and improve the GNH between SLK 147 and SLK 256.8 (Walebing to Wubin). The works will be carried out in a number of discrete locations to address the deficiencies identified along specific stretches of highway. In general, works will be undertaken to improve the horizontal and vertical geometry of the road, increase the seal and formation widths, and improve sight distances and clear zones. Details on specific works to be undertaken in each section are provided below. The information provided is based on concept designs and may be subject to change as the design progresses to 100 per cent.

An Approval Boundary for the proposed action has been identified (**Figure 1-1**). The Approval Boundary encompasses an area of 845 hectares (ha), which is larger than required for the construction footprint to provide a degree of flexibility and allow for minor changes in alignment during detailed design.

It is anticipated that the total development footprint required for the proposed action will comprise 275 ha within the Approval Boundary, of which 68.5 ha is remnant native vegetation, 49.5 ha has previously been cleared and revegetated with a mix of non-native or not locally indigenous vegetation, and 157 ha is pasture/paddock, cleared land or road. **Table 2-1** provides a breakdown of the estimated disturbance by section.

Table 2-1 : Preliminary Disturbance Estimate by Section

Section	Approval Boundary (ha)	Total Disturbance Estimate (ha)	Native Vegetation Clearing Estimate (ha)
Walebing	225	50	15
Miling Bypass	136	65	18
Pithara	124	75	12
Dalwallinu to Wubin	360	85	23.5
Totals	**845**	**275**	**68.5**

Clearing for the proposed action will be undertaken using bulldozers with vegetation stockpiled or used in accordance with the Principal's Environmental Management Plan (PEMP) for the proposed action. Topsoil will be stripped and stockpiled separately to vegetation. Where required, topsoil and vegetation stockpiles will be segregated according to their weed and disease status.

Equipment likely to be used to construct the road and associated infrastructure includes:

- Bulldozers, front end loaders, excavators, dump trucks and graders;
- Compactors, rollers, pavers and kerb machines;
- Batching/mixing plants for asphalt and concrete;
- Low loaders to transport plant and machinery to the work area; and
- Light vehicles.

Construction material borrow pits, construction water sources and construction camps have been excluded from the scope of this referral. Refer to Section 2.8 for details on why these components have been excluded from the referral.

2.2 Land Tenure

The current tenure of the land which relates to the proposed action is a mixture of the existing GNH road reserve, local road reserves managed by the relevant Shire, railway reserve, Unallocated Crown Land, and various leasehold, freehold and Crown land parcels as detailed in **Table 2-2**.

Table 2-2 : Current Land Tenure

Reserves	Crown Land (CT Number)		Freehold Land (CT Number)		Leasehold Land
R 10969	112200302	99400005	126400051	268300998	L GE L593800
R 15247	117900035	100400119	162900633	268700613	L GE M096301
R 17626	117900419	100400913	199600476	272100978	
R 21195	118900411	103500868	216500593	282000188	
R 24671	119800437	104700760	220400410	283100969	
R 28521	125900019	115000611	253500757	288300329	
R 29324	131900336	118900412	268300973	0044500031A	
R 37017	138900838	121500605	268300975	0044500032A	
R 37517	143000925	140600559	268300976	LR0301500563	
R 41061	148800088	142500882	268300980	LR0302000973	
R 41646	148800089	146500864	268300991	LR0315600301	
R 46504	152800547	146500865	268300993	LR0315600305	
	181500593	149900614	268300997	LR0316200110	
	183700286	153800580	LR0301500561	LR0316200280	
	183700287	156300401	LR0301500562	LR0316300169	
	205500595	161100209			
	208900549	173200501			
	216500592	176000879			
	218800431	178500399			
	256100584	201400913			
	0009100048A	210500152			
	0017500161A	219200536			
		275800221			

2.3 Road Design

The proposed action has been designed to support the overall project objectives to allow vehicles to travel safely between Wubin and Muchea at 110km/h (100 km/h for heavy vehicles). The road design parameters adopted to achieve this are provided in **Table 2-3**. At the time of writing, concept level designs for the road were available for all sections with Pithara and Miling Bypass progressed to 15% design. It is these stages of design that forms the basis of this referral.

In order to achieve the required horizontal geometry, cut and fill will be required. Fill embankments will be constructed of materials that consist of granular soils such as sand and gravel, but may also include aggregate, rock, or crushed paving material.

Drainage design for the proposed action is based on design flood estimation carried out in accordance with Australian Rainfall & Runoff, A Guide to Flood Estimation 2001. Culverts under GNH have been designed up to a 50 year Annual Recurrence Interval (ARI) level of serviceability, as specified by Main Roads to manage road safety and limit the probability of flood damage to the road and/or properties and any associated costs.

The road reserve boundary has been developed on the basis of achieving a 60 m reserve along the entire corridor. This has been generally adopted between Walebing and Wubin, although in some locations it has been widened to include any earthworks that extend beyond the initial 60 m reserve and to provide for straight boundary fence lines.

Table 2-3 : Adopted Road Design Standards

Element	Adopted Criteria
Design Speed	110 km/h
Posted Speed	110 km/h
Seal Width	10 m
Lane Width	3.5 m
Sealed Shoulder Width	1 m
Unsealed Shoulder Width	1.0 m
Median Width (wide centreline)	1.0 m (painted)
Carriageway Width	12 m
Pavement Cross Fall	3%
Maximum Superelevation	4% (5% for Walebing)
Maximum gradient	5% absolute (maximum), 3% desirable
Vertical Clearances	10 m
Crest Vertical K Value (min)	97.3
Sag Vertical K Value (min)	51

2.4 Walebing

The planning review identified the following deficiencies along the Walebing section of the GNH (SLK 147.7 to SLK 165.6):

- substandard formation of 9m seal on 10m carriageway from SLK 147.7 to 150.71;
- substandard horizontal and vertical geometry;
- poor sight distances at the old Geraldton Road intersection;
- insufficient clear zones;
- no overtaking lanes; and
- inadequate roadside stopping facilities.

The planned works in this section are split across two sites; Site (i) 147.7 – 151.5 SLK and Site (ii) 151.5 – 165.6 SLK. The works will involve the upgrade of a number of intersections, construction of overtaking lanes, and widening in some locations, as follows:

- upgrade sub-standard geometry of GNH and associated minor roads between SLK 147.7 and SLK 151.5 (Walebing Curve);
- realignment of Midlands Road;
- extension of Old Geraldton Road;
- new turning pockets into Walebing Roadhouse;
- widening an existing 9 m seal to a 10 m seal;
- intersection upgrades;
- construction of new overtaking lanes;
- construction of new parking areas for Walebing Roadhouse;
- accommodation works including driveway construction and fencing; and
- services identification, planning and relocation works.

There are significant Aboriginal and European heritage areas on either side of the GNH through the portion referred to as the Walebing Curve which have resulted in considerable constraints for road design.

2.5 Miling Bypass

The planning review identified the following deficiencies along the Miling Bypass section of the GNH (SLK177.6 to 186.9):

- Areas with non-compliant horizontal and vertical geometry;
- No overtaking lanes;
- Narrow seal width with no edge line marking in some areas;
- Inadequate roadside stopping facilities;
- Conflict points between heavy vehicles and communities in the town of Miling; and
- Insufficient clear zone.

The planned works in this section will involve the upgrade of a number of intersections, construction of overtaking lanes, and widening in some locations, as follows:

- Construction of approximately 8 km of new carriageway extending from SLK177.5 to 186.7;
- Construction of new access roads to Miling townsite and the CBH Group grain terminal;
- Construction of a new T-intersection for Miling East Road and Miling West Road;
- Upgrade and installation of new culverts on the proposed and existing GNH;
- Elimination of the existing floodway on the GNH;
- Reinstatement of existing driveways to provide access onto the proposed alignment;
- Provision of solar powered flag lighting at the two Miling Town Access Road T-intersections along the new highway alignment; and
- Services identification, planning and relocation works.

The majority of the new carriageway passes through open farmland with very little associated native vegetation. Additional areas required for construction such as laydown areas, stockpile areas, water storage and vehicle turn around will be located in cleared paddocks where practicable.

2.6 Pithara

The planning review identified the following deficiencies along the Pithara section of the GNH (SLK 207.4 to SLK 223.4):

- Substandard cross section of 6.8 m seal on 9.2 m formation;
- Areas with non-compliant horizontal and vertical geometry;
- Inadequate road reserve widths;
- No overtaking lanes;
- Land restrictions associated with rail reserve;
- Conflict points between heavy vehicles and communities in the town of Pithara; and
- Insufficient clear zone.

The planned works in this section will involve the upgrade of a number of intersections, construction of overtaking lanes, and widening in some locations, as follows:

- Construction and upgrade of approximately 16.2 km of carriageway;
- Upgrade and installation of new culverts on the proposed and existing GNH;
- Construction of two overtaking lanes, one northbound and one south bound;
- A formalised parking lane to provide separation between local traffic and freight traffic for local traffic within Pithara near the post office and indented bus bays for TransWA buses stopping in Pithara;
- Redesigned or upgrade of the intersections at Sheoak Road, Moller Road, Crampton Street, Northam Pithara Road, Sutcliffe Road, Pithara West and Pithara East Road;
- Removal of Roach Street, Bonney Street and Lewis Road intersections;
- Accommodation works including driveway construction, stock underpasses and fencing; and
- Services identification, planning and relocation works.

The majority of the new carriageway passes through open farmland with very little associated native vegetation. The GNH has been moved further to the west of Reserve 10969 (SLK 213 to SLK 214) and remains on the existing alignment within the Water Corporation reserve immediately south of Pithara (Reserve 2706) in order to avoid or minimise potential impacts.

2.7 Dalwallinu to Wubin

The planning review identified the following deficiencies along the Dalwallinu to Wubin section (SLK 231.77 to SLK 256.5):

- Substandard seal and carriageway width;
- Insufficient clear zones;
- Deficient pavements;
- Substandard horizontal and vertical geometry;
- No overtaking lanes;
- Inadequate road side stopping facilities;
- Poor sight distances to intersections; and
- Safety concerns due to the GNH passing through the centre of Wubin; the town-site of Wubin is not deemed suitable for 53.5 m road trains.

The planned works in this section will involve the upgrade of a number of intersections, construction of a bypass, overtaking lanes, and widening in some locations, as follows:

- Construction of a new bypass at Wubin;
- Construction of new access roads to the Wubin town-site (to accommodate 53.5 m long vehicles);
- Construction of a new T-intersection for Wubin East Road;
- Upgrade intersections at Dalwallinu West Road, Dalwallinu Kalannie Road and Mullewa-Wubin Road;
- Removal of the intersection at Caravan Access Road;
- Offline horizontal curve improvements (233 – 234.63 SLK);
- Seal widening from existing 9/11 carriageway (234.63 – 235.54 SLK and SLK 238.7 – 240.3 SLK);
- One sided pavement widening (240.3 – 245.1 SLK and SLK, 247.78 – 250 SLK); and
- Southbound overtaking lane and offline horizontal curve improvements (245.1 – 247.78 SLK).

The works required are largely in cleared areas and as such little vegetation clearing will be required. Works required adjacent to the Nugadong Nature Reserve (SLK 241 to SLK 242) will occur on the eastern side of the existing GNH (the opposite side to the reserve) and as such, no impacts to the Nugadong Nature Reserve are anticipated.

2.8 Excluded items

Construction materials are likely to be sourced from local borrow pits. The exact locations of these are yet to be determined and as such these have been excluded from the scope of this referral. Preliminary sites that have been identified are located in existing extraction areas and additional clearing of native vegetation is unlikely to be required. As such, use of these areas is considered unlikely to result in significant impacts to MNES.

Construction water will be sourced from existing water sources, such as bores, dams or tanks, which may be located offsite. Exact sources will be identified during pre-construction activities. No significant impact to MNES is anticipated as a result of the use of these water sources.

Construction workers may be housed at purpose built construction camps along the alignment. The exact location(s) and potential layout of the camp(s) has not yet been determined. Construction contracts will stipulate that camps will be built in existing cleared locations, and as such, it is unlikely that there will be significant impacts from the construction, use and decommissioning of the construction camp(s).

While locations of these components are yet to be finalised, they may be outside of the Approval Boundary for the proposed action. Once locations are finalised, the assessment of potential impact to MNES will be revisited. If significant impacts to MNES are considered likely, a separate referral under the EPBC Act will be submitted.

3. Previous Referrals and Approvals

Three sections of the larger GNH project have been previously submitted as follows:

- New Norcia Bypass (EPBC 2015/7523) – Deemed as Not a Controlled Action by DoE;
- Miling Straight (EPBC 2015/7584) – Deemed as Not a Controlled Action by DoE; and
- Muchea North (Old Gingin Road to Chittering Roadhouse) (EPBC 2016/7656) – Deemed a Controlled Action with assessment by Preliminary Documentation.

These sections were submitted separately to this referral for the following reasons:

- Schedule – The three sections referred separately are on aggressive construction schedules and as such it would not have been possible to obtain environmental approvals within the required timeframe if they were included in this referral.
- Baseline data availability – Ecological surveys for the sections that form part of this referral were completed in Spring of 2015. Including the three previously referred sections within this referral would have resulted in schedule delays due to the timing of the surveys and subsequent availability of data.
- Alignment design – Concept designs for the sections included in this referral were not available until early 2016.

Table 3-1 details the expected impacts to MNES from the previously referred sections. The Muchea North section is currently undergoing a number of design changes and a request to vary the referred action is expected to be submitted to DoE by mid-July 2016. These design changes are expected to result in additional impact to Black Cockatoo habitat in the order of the removal of an additional two known breeding trees and a small increase in clearing of Black Cockatoo habitat.

Table 3-1 : Expected Impacts of Previously Referred Sections

Section	Relevant MNES	Description of Impact	Extent of Impact
New Norcia Bypass	Carnaby's Black Cockatoo	Clearing of habitat	3.4 ha
		Clearing of potential breeding trees	55 trees
Miling Straight	Carnaby's Black Cockatoo	Clearing of habitat	15 ha
		Clearing of potential breeding trees	20 trees
Muchea North	Carnaby's Black Cockatoo	Clearing of habitat	38.5 ha
		Clearing of potential breeding trees	509 trees
		Clearing of known breeding trees	5 trees

4. Description of the Environment

4.1 Regional Setting

The Approval Boundary for the proposed action lies in the Avon Wheatbelt Bioregion as defined by the Interim Biogeographic Regionalisation of Australia (IBRA) (Thackway, R. and Cresswell, I.D. (Editors), 1995). The Walebing section and the Miling Bypass lie within the Katanning subregion of the Avon Wheatbelt Bioregion. The Pithara and Dalwallinu to Wubin sections lie within the Merredin subregion of the Avon Wheatbelt Bioregion.

The Merredin subregion is an ancient peneplain with low relief undulating landscape with no connected drainage; salt lake chains occur as remnants of ancient drainage systems (Beecham, 2001a) while the Katanning subregion comprises the erosional surface of gently undulating rises to low hills with abrupt breakaways and continuous stream channels (Beecham, 2001b). The Northern Jarrah Forest subregion incorporates the area east of the Darling Scarp, overlying Archaean granite and metamorphic rocks capped by lateritic duricrust (Williams and Mitchell, 2001).

The climate of the Avon Wheatbelt Bioregion is warm Mediterranean. In general, the area experiences warm dry summers and cool wet winters. Two Bureau of Meteorology weather stations are located in proximity to the Approval Boundary for the proposed action at Dalwallinu (site number 008297) and Walebing (site number 008151). The average maximum temperature is recorded in January at both stations with 33.9 degrees Celsius recorded at Walebing and 35.3 degrees Celsius at Dalwallinu. The average minimum temperature is 5.4 degrees Celsius at Walebing and 5.8 degrees Celsius at Dalwallinu, both recorded in July. Average annual rainfall is 475.4 mm at Walebing, with the majority falling between May and September, and 290.7 at Dalwallinu, also with the majority falling between May and September, though significant falls are common in January and March.

The predominant land use across the area of the proposed action in mixed agriculture, consisting of grain crops such as wheat, barley, oats and canola, and sheep and cattle farming.

4.2 Physical Environment

Three land systems mapped by the Department of Agriculture and Food WA (DAFWA) occur within the proposed Approval Boundary as follows:

- Ballidu System (Pithara and Dalwallinu to Wubin) – gently undulating sand plain with narrow flat valleys, from weathered granite, yellow to brown sands to earths with some gravel on rises and red to brown earths to duplexes in valleys.
- Burabidge Hill System (Walebing) – undulating rises to low hills with rock outcrop. granite, migmatite, gneiss. Brown and red loamy and sandy earths, yellow/brown shallow loamy duplex and some stony soil. York Gum-jam woodland.
- Glentrome System (Walebing) – stripped, weathered plateau with undulating low hills and rises; loamy earths, loams, loamy gravel and some clay and rock; weathered granite and migmatite.

The Dalwallinu CSBP depot is located at Lot 563 Clinch Road, Dalwallinu and is classified as a potentially contaminated site (investigation required) in accordance with the *Contaminated Sites Act 2003*. Potential contamination at the site includes:

- storage and spillage of fertilisers onsite;
- uncontrolled dumping of solid waste onsite, at the Shire of Dalwallinu landfill (including building rubble, possible asbestos containing materials (ACM) and animal waste) in multiple locations, by non-CSBP personnel;

- fuel storage onsite and on the neighbouring Caltex storage depot;
- possible application of pesticides beneath building slabs;
- potential use of ACM in buildings during construction;
- site drainage, including a septic tank and leach drain, stormwater soaks and wastewater ponds; and
- the potential presence of a historical Dalwallinu town landfill, circa 1964.

The potential for Acid Sulfate Soils (ASS) to occur has been assessed as low to extremely low for the majority of the proposed action, however a small portion of the Miling Bypass traverses an area of high risk (ASRIS, 2011).

A portion of the Pithara section lies within the Avon River System, proclaimed under the *Rights in Water and Irrigation Act 1914.* The remainder of the proposed action is outside of any proclaimed surface or groundwater areas (Department of Water, 2009a, 2009b).

4.3 Biological Environment

4.3.1 Flora and Vegetation

4.3.1.1 Desktop Review

Based on vegetation mapping undertaken by Beard (1981) and Shepherd et al. (2002), the regional vegetation consists of the following vegetation associations:

- Vegetation Association 7 – Medium woodland; York Gum & Wandoo
- Vegetation Association 142 – Medium woodland; York Gum & Salmon Gum
- Vegetation Association 352 – Medium woodland; York Gum
- Vegetation Association 631 – Succulent steppe with woodland and thicket; York Gum over *Melaleuca thyoides* & samphire
- Vegetation Association 1024 – Shrublands; mallee & casuarina thicket

The desktop and literature review identified a total of 126 conservation significant flora species potentially present in the vicinity of the Approval Boundary for the proposed action, of which 23 are listed as Threatened under the EPBC Act and 35 species are listed under the *Wildlife Conservation Act 1950* (WC Act) (including all of the EPBC Act listed species) (Phoenix Environmental Services, 2016). A further 91 species are listed as Priority flora by Department of Parks and Wildlife (Parks and Wildlife) (17 Priority 1, 12 Priority 2, 48 Priority 3 and 14 Priority 4).

4.3.1.2 Field Surveys

Phoenix Environmental Services Pty Ltd (Phoenix) completed an initial spring season flora and vegetation field survey in October 2014 covering an approximately 40 m wide survey area (the existing road reserve). Between February and June 2015, follow up assessments of the areas surveyed in spring were undertaken along with preliminary flora and vegetation assessments for areas not previously surveyed. Between September and December 2015, areas surveyed in the first half of 2015 but not surveyed in Spring 2014 were revisited (Phoenix Environmental Services, 2016) with the exception of Miling Bypass (Phoenix, 2015). Details on the method of the surveys undertaken by Phoenix are provided in Phoenix (2015; 2016) survey reports, provided in **Appendix B**.

The combined extent of all three surveys in relation to the proposed Approval Boundary for the action is shown on **Figure 4-2**. The surveys cover 95% of the Approval Boundary. Gaps in the survey area are associated with significant changes to alignment design at Miling Bypass following on from the 2015 survey. These survey gaps have since been addressed via an additional survey, the results of which are currently pending and will be

provided as soon as they are available. Given the vegetation units in question, it is unlikely that there will be significant additional impacts to MNES beyond those that can be assessed with the information currently available.

4.3.1.3 Conservation Significant Flora

The field surveys undertaken by Phoenix (2016) did not record the presence of any flora species listed under the EPBC Act or WC Act within the Approval Boundary for the proposed action. Known locations of threatened flora (for example *Eremophila pinnatifida*) were visited during the surveys. However, despite extensive searches in the area, the species was unable to be located and it is assumed it no longer exists in these locations. A total of eight flora species listed on the Parks and Wildlife Priority Flora list were recorded in the Approval Boundary for the proposed action, as detailed in **Table 4-1** and shown on **Figure 4-1**.

Table 4-1 : Conservation Significant Flora Recorded during 2014 and 2015 Surveys (Phoenix, 2015; 2016)

Scientific Name (Common Name)	Conservation Category	Section	Number of records (plants)
Acacia isoneura subsp. *nimia*	P3	Pithara	1 (1)
		Dalwallinu to Wubin	29 (40)
Acacia scalena	P3	Dalwallinu to Wubin	219 (346)
Chamelaucium sp. Wongan Hills	P3	Miling Bypass	17 (53)
Daviesia debilior subsp. *sinuans*	P3	Dalwallinu to Wubin	1 (1)
Frankenia glomerata (Cluster Head Frankenia)	P3	Miling Bypass	7 (7)
Grevillea asparagoides	P3	Miling Bypass	6 (95)
		Dalwallinu to Wubin	45 (423)
Verticordia venusta	P3	Dalwallinu to Wubin	1 (2)
Banksia benthamiana	P4	Dalwallinu to Wubin	1 (3)

*Notes: P = Priority. Definitions for level of Priority flora are available from the **Parks and Wildlife website***

4.3.1.4 Introduced Flora

Phoenix recorded a total of 45 weed species during the Phoenix (2016) surveys, of which five species (**Asparagus asparagoides* (Bridal Creeper), **Echium plantagineum* (Patterson's Curse), **Emex australis* (Spiny Emex), **Lycium ferocissimum* (African Boxthorn) and * *Opuntia monacantha* (Barabary Fig)) were identified as Declared Plants under the WA *Biosecurity and Agriculture Management Act 2007* (BAM Act) (Phoenix, 2015; 2016). **Asparagus asparagoides, *Lycium ferocissimum* (African Boxthorn) and **Opuntia monacantha* are also Weeds of National Significance (WoNS) (**Figure 4-1**). For a full listing of weed species which may occur within the proposed Approval Boundary refer Phoenix's Flora and Fauna Reports (**Appendix B**).

4.3.1.5 Vegetation Associations

Vegetation mapping in the Approval Boundary undertaken by Phoenix (2016) defined 19 vegetation associations. Vegetation associations are detailed in **Table 4-2** and shown on **Figure 4-2**. Broadly, the vegetation associations recorded represent medium woodlands. Areas described as road, cleared (townships, driveways), cleared and planted (non-native species) and pasture accounted for the majority (75%) of the area surveyed.

Of the 19 mapped vegetation associations, 15 are considered “underrepresented” as the current extent of these is less than 30% of the pre-European extent (**Table 4-3**). Thirteen of the vegetation associations defined in the study area may be considered locally significant as they represent habitat for Threatened, Protected or Priority Flora, were recorded to be in excellent or pristine condition and therefore are considered to represent patches of comparatively high native species diversity surrounded by highly impacted vegetation, and/or occupy less than one percent of the area mapped by Phoenix (2015; 2016)

4.3.1.6 Vegetation Condition

The condition of vegetation mapped by Phoenix (2016) ranged from completely degraded to pristine, with excellent and pristine vegetation condition comprising only a small proportion of the area surveyed (**Figure 4-3**). A large proportion (75%) of the area surveyed passes through cleared areas classed as completely degraded (paddocks, roads and other infrastructure) and cleared and revegetated woodlands of non-indigenous species, which provide little value to fauna in terms of habitat or as ecological corridors. The areas of the vegetation recorded to be in excellent or pristine condition may be considered locally significant as they represent patches of comparatively high native species diversity in otherwise degraded vegetation. Pristine vegetation only occurred in the Dalwallinu to Wubin section (Phoenix, 2015; 2016). Of the native vegetation mapped by Phoenix (2015; 2016) approximately 94 ha has been recorded as degraded, 63 ha as good quality, 66 ha as very good quality, 10 ha as excellent quality and 1.5 ha as pristine quality.

Table 4-2 : Vegetation Types Mapped by Phoenix (2015; 2016)

Code	Vegetation Description (as per Shepherd et al. 2002)	Area Mapped (ha)				
		Walebing	Miling Bypass	Pithara	Dalwallinu to Wubin	Totals
7	Medium woodland; York gum (*Eucalyptus loxophleba*) & wandoo	0.69	-	-	-	**0.69**
8	Medium woodland; salmon gum & gimlet	-	-	-	1.85	**1.85**
35	Shrublands; jam scrub with scattered York gum	1.03	-	1.13	-	**2.16**
141	Medium woodland; York gum, salmon gum & gimlet	-	-	1.36	-	**1.36**
142	Medium woodland; York gum & salmon gum	5.11	0.81	-	0.49	**6.41**
352	Medium woodland; York gum	28.36	12.55	14.55	3.25	**58.71**
354	Shrublands; jam and *Acacia rostellifera* (+ hakea) scrub with scattered York gum	-	-	0.29	-	**0.29**
436	Shrublands; mixed *Acacia* thickets in thickets of *acacia-casuarina-melaleuca* alliance	-	-	-	1.67	**1.67**
551	Shrublands; *Allocasuarina campestris* thicket	-	-	-	14.13	**14.13**
631	Succulent steppe with woodland and thicket; York Gum over *Melaleuca thyoides* and samphire	-	1.12	-	-	**1.12**
676	Succulent steppe; samphire	5.09	23.77	-	-	**28.86**
936	Medium woodland; salmon gum	0.26	-	-	-	**0.26**
946	Medium woodland; wandoo	9.48	-	-	-	**9.48**
950	Medium woodland; *Casuarina obesa*	0.88	-	-	-	**0.88**
1024	Shrublands; mallee & casuarina thicket	0.92	1.96	17.30	52.99	**73.17**
1040	Medium woodland; York gum & *Casuarina obesa*	1.54	-	-	-	**1.54**

Code	Vegetation Description (as per Shepherd et al. 2002)	Area Mapped (ha)				
		Walebing	Miling Bypass	Pithara	Dalwallinu to Wubin	Totals
1048	Mosaic: Shrublands; *Melaleuca* patchy scrub / Succulent steppe; samphire	-	3.68	-	-	**3.68**
1155	Medium woodland; *Eucalyptus rudis* and *Melaleuca rhaphiophylla*	-	-	-	0.22	**0.22**
1413	Shrublands, *Acacia, Casuarina* and *Melaleuca* thicket	-	-	-	28.14	**28.14**
Totals		**53.36**	**43.89**	**34.63**	**102.74**	**234.62**

Table 4-3 : Regional Pre-European and Existing Extents for Vegetation Types Recorded in the Proposed Approval Boundary.

Vegetation Type	Vegetation Type Description (Shepherd et al. 2002)	Scale1	Pre-European Extent (ha)	Current Extent (ha)	% Pre-European Extent Remaining	Vegetation Status
7	Medium woodland; York gum (*Eucalyptus loxophleba*) & wandoo	AVW02	144,017.05	15,421.77	**10.71**	Vulnerable
8	Medium woodland; salmon gum & gimlet	AVW01	353,871.79	50,085.55	**14.15**	Vulnerable
35	Shrublands; jam scrub with scattered York gum	State	184,501.78	30,088.01	**16.31**	Vulnerable
141	Medium woodland; York gum, salmon gum & gimlet	AVW01	250,614.98	77,323.46	30.85	Depleted
142	Medium woodland; York gum & salmon gum	AVW02	224,265.61	16,137.58	**7.20**	Endangered
352	Medium woodland; York gum	AVW02	337,875.88	36,848.71	**10.91**	Vulnerable
354	Shrublands; jam and Acacia rostellifera (+ hakea) scrub with scattered York gum	AVW01	91,254.36	10,407.46	**11.40**	Vulnerable
436	Shrublands; mixed Acacia thickets in thickets of acacia-casuarina-melaleuca alliance	State	1,059.10	1,059.10	100.00	Least Concern

Vegetation Type	Vegetation Type Description (Shepherd et al. 2002)	Scale1	Pre-European Extent (ha)	Current Extent (ha)	% Pre-European Extent Remaining	Vegetation Status
551	Shrublands; *Allocasuarina campestris* thicket	AVW01	244,379.59	49,198.68	**20.13**	Vulnerable
631	Succulent steppe with woodland and thicket; York Gum over *Melaleuca thyoides* and samphire	AVW02	11,821.43	1,702.93	**14.41**	Vulnerable
676	Succulent steppe; samphire	AVW02	196.08	38.22	**19.49**	Vulnerable
936	Medium woodland; salmon gum	AVW02	426.84	53.48	**12.53**	Vulnerable
946	Medium woodland; wandoo	AVW02	37,482.63	6,847.46	**18.47**	Vulnerable
950	Medium woodland; *Casuarina obesa*	AVW01	138.07	26.90	**19.48**	Vulnerable
1024	Shrublands; mallee & casuarina thicket	Shire of Dalwallinu	142,789.06	12,568.24	**8.80**	Endangered
1040	Medium woodland; York gum & *Casuarina obesa*	AVW02	96.17	7.53	**7.83**	Endangered
1048	Mosaic: Shrublands; Melaleuca patchy scrub / Succulent steppe; samphire	AVW02	2,690.50	729.09	**27.10**	Vulnerable
1155	Medium woodland; *Eucalyptus rudis* and *Melaleuca rhaphiophylla*	State/AVW01	7,812.24	3,105.28	39.75	Depleted
1413	Shrublands, Acacia, Casuarina and Melaleuca thicket	AVW01	546,675.54	174,214.35	31.87	Depleted

Notes: Red text denotes below 30% threshold; Based on Parks and Wildlife (Government of Western Australia, 2014); Scale refers to the boundary with the lowest remaining extent for the vegetation unit (State, Bioregion/subregion or Local Government Area); AVW01 = Merredin Subregion; AVW02 = Katanning Subregion

4.3.1.7 Threatened and Priority Ecological Communities

In November 2015 the Eucalypt Woodlands of the Western Australian Wheatbelt ecological community was listed as Critically Endangered under the EPBC Act. This listing and subsequent DoE approved conservation advice occurred after the 2015 spring survey campaign. Quadrats within woodland vegetation types have been assesses against the diagnostic criteria detailed in the approved conservation advice (TSCC, 2015) to determine areas potential representative of this TEC (**Appendix B)**. Detailed discussion of the method used and the results of this assessment are provided in the Phoenix (2016) report in **Appendix B**. The area of this TEC potentially occurring in each section, based on this assessment, is provided in **Table 4-4** and shown on **Figure 4-4**. It should be noted that the same assessment was undertaken for Miling Bypass (surveyed as part of Phoenix (2015)) though none of the quadrats were identified as potentially representative of the TEC.

This assessment is conservative and likely overestimates the occurrence of this TEC within the Approval Boundary, in particular where individual patches are too small to meet the TEC criteria. Additional surveys will be undertaken in Spring 2016 to confirm the distribution of this TEC within the Approval Boundary.

Table 4-4: Area of Woodland Vegetation Potentially Representative of the Eucalypt Woodlands of the Western Australian Wheatbelt TEC

Section	Vegetation Condition					Total (ha)
	Degraded (ha)	Good (ha)	Very Good (ha)	Excellent (ha)	Pristine (ha)	
Walebing	43.0	12.4	0.4	0.0	0.0	**55.8**
Miling Bypass	0.0	0.0	0.0	0.0	0.0	**0.0**
Pithara	3.0	3.7	8.0	0.0	0.0	**14.7**
Dalwallinu to Wubin	3.7	3.0	1.1	0.4	0.2	**8.4**
Total	**49.7**	**19.1**	**9.5**	**0.4**	**0.2**	**78.9**

4.3.2 Fauna

4.3.2.1 Desktop Review

The desktop review identified nine conservation significant fauna species (excluding migratory species) that may occur in the vicinity of the Approval Boundary proposed action[1] (**Table 4-5**). A likelihood of occurrence assessment for these species and has been included in **Table 4-5**.

Table 4-5 : Conservation Significant Fauna Species potentially occurring in the proposed action area.

Scientific Name (Common Name)	Species Status	Section(s)	Likelihood of occurrence
Birds			
Calyptorhynchus latirostris (Carnaby's Black Cockatoo)	EN (EPBC Act) EN (WC Act)	• Walebing	**Recorded** – sighting recorded in close proximity to study area, breeding evidence in hollows present
		• Pithara	**Likely** – within known range - habitat trees and food plants recorded in study area and confirmed use of habitat trees along the GNH to the west of the study area
		• Dalwallinu to Wubin	**Possible** – may occur in woodland habitat; on margin of modelled distribution, although possible records from the area exist (T. Kirkby pers. comm., March 2015)
Leipoa ocellata (Malleefowl)	VU (EPBC Act) VU (WC Act)	• Walebing • Pithara	**Unlikely** – habitat unsuitable (too degraded and fragmented). Not recorded (direct observation , tracks, nests or scats) during surveys
		• Dalwallinu to Wubin	**Possible** – may occur in woodland and shrubland habitats; however, habitat largely degraded and fragmented. Not recorded (direct observation , dis-used or active nesting mounds, tracks, or scats) during surveys
Falco peregrinus (Peregrine Falcon)	Schedule 7 (WC Act)	• Walebing • Pithara • Dalwallinu to Wubin	**Likely** – may forage in all habitats and nest in woodland habitats where suitable large eucalypts present
Ninox connivens connivens	Priority 2	• Walebing • Pithara	**Possible** – may occur in woodland habitat

[1] EPBC Act Marine species returned from the database searches have been excluded from the results as they are not relevant to the proposed action area, considering its geographical location, and are therefore not discussed further within this report.

Scientific Name (Common Name)	Species Status	Section(s)	Likelihood of occurrence
(Barking Owl)		• Dalwallinu to Wubin	**Possible** – may occur in woodland habitat
Thinornis rubricollis (Hooded Plover)	Priority 4	• Walebing	**Possible** – may occur in samphire/salt lake habitat
		• Pithara	**Unlikely** – habitat not present (salt lakes)
Reptiles			
Egernia stokesii badia (Western Spiny-tailed Skink)	EN (EPBC Act) VU (WC Act)	• Walebing • Pithara	**Unlikely** – habitat not suitable (too degraded and fragmented)
		• Dalwallinu to Wubin	**Possible** – may occur in woodland habitat however, habitat largely degraded and fragmented
Aspidites ramsayi (Woma Python)	Priority 1	• Walebing • Pithara • Dalwallinu to Wubin	**Unlikely** – suitable habitat not present
Invertebrates			
Idiosoma nigrum (Shield-back Trapdoor Spider)	VU (EPBC Act) VU (WC Act)	• Walebing • Pithara	**Possible** – may occur in woodland habitat
		• Dalwallinu to Wubin	**Possible** – previously recorded from Buntine Nature Reserve (approximately 12 km north of Wubin)

EN = Endangered; VU = Vulnerable

4.3.2.2 Field Surveys

In accordance with the DoE Referral Guidelines for Three Threatened Black Cockatoo Species (Department of Sustainability, Environment, Water, Population and Communities, 2012), a targeted Black Cockatoo assessment was conducted by Phoenix in the form of a significant tree survey. An initial fauna habitat assessment and significant Black Cockatoo tree assessment was undertaken between October 2014 and February 2015 with a more comprehensive Level 1 fauna survey and complete black cockatoo tree assessment was completed in September to December 2015. Subsequent site assessment of Black Cockatoo habitat was undertaken in January and February 2016 with Tony Kirkby (a recognised black cockatoo expert), to inspect potential breeding trees for signs of use. For details on the method for these surveys refer to Section 3 of Phoenix's Flora and Fauna Report (**Appendix B**).

4.3.2.3 Threatened Fauna

One Endangered fauna species (Carnaby's Black Cockatoo) was directly recorded during the surveys undertaken by Phoenix (2016). The Approval Boundary for the proposed action area is within the known breeding range for Carnaby's Black Cockatoo and suitable breeding and foraging habitat has been identified within the proposed Approval Boundary.

The Shield-back Trapdoor Spider, the Forest Red-tailed Black Cockatoo, Western Spiny-tailed Skink (Dalwallinu to Wubin) and Malleefowl (Dalwallinu to Wubin) were identified as 'possibly' occurring within the Approval Boundary for the proposed action. The Western Spiny-tailed Skink and Malleefowl may occur in woodland and shrubland habitats between Dalwallinu and Wubin, however this habitat is largely degraded and fragmented. Additionally, no evidence of Malleefowl (including nests, which persist in the environment after use) were recorded during surveys of the area, thereby indicating that the species is not resident in the vicinity of the Approval Boundary (Phoenix Environmental Services, 2016).

Carnaby's Black Cockatoo

A total of 510 potential breeding trees for Black Cockatoos were recorded during the Phoenix (2016) surveys. Assessment of these trees by Tony Kirkby confirmed 19 to have hollows suitable for use by Carnaby's Black Cockatoo with 12 of these showing signs of use by the species (**Table 4-6** and **Figure 4-5**). Approximately 154.5 ha of suitable Carnaby's Black Cockatoo habitat was mapped by Phoenix (2016). None of this was identified as Quality habitat.

Table 4-6 : Summary of Potential Breeding Trees by Section

	Walebing	Miling Bypass	Pithara	Dalwallinu to Wubin	Totals
Total number of potential breeding trees recorded	813	78	72	76	1,039
Number of trees with hollows suitable for use by Carnaby's Black Cockatoo	0	4	0	0	4
Number of trees with hollows showing evidence of use by Carnaby's Black Cockatoo	8	1	0	3	12
Foraging Habitat (ha)	51.2	4.5	31	76.6	163.3

4.3.2.4 Migratory Species

Six migratory species[2] were identified in the EPBC Protected Matters search as potentially occurring within the Approval Boundary for the proposed action (**Table 4-7**). One of these species (Rainbow Bee-eater) was recorded during the Phoenix (2016) surveys.

Table 4-7 : Listed Migratory Species Potentially Occurring in the Proposed Approval Boundary.

Scientific Name (Common Name)	Section	Likelihood of occurrence
Apus pacificus (Fork-tailed Swift)	• Walebing • Pithara • Dalwallinu Bypass Improvements	**Likely** – may frequent the area on occasion above most habitats to forage, unlikely to land or nest within the study area
	• Dalwallinu to Wubin	**Possible** – may occur in woodland and shrubland habitats; however, habitat largely degraded and fragmented
Ardea modesta (Eastern Great Egret)	• Walebing	**Possible** – may occur in streams and low lying areas
	• Pithara	**Unlikely** – habitat not present
	• Dalwallinu to Wubin	**Likely** – may frequent the area on occasion above most habitats to forage, unlikely to land or nest within the study area
Ardea ibis (Cattle Egret)	• Walebing • Pithara	**Possible** – may occur in low lying areas following suitable rainfall
	• Dalwallinu to Wubin	**Possible** – may occur in low lying areas following suitable rainfall
Gelochelidon nilotica (Gull-billed Tern)	• Pithara	**Unlikely** – habitat not present (wetlands)
Tringa hypoleucos (Common Sandpiper)	• Walebing	**Possible** – may occur in samphire/salt lake habitat following suitable rainfall
Merops ornatus (Rainbow Bee-eater)	• Walebing	**Possible** – may occur in woodland habitat
	• Pithara	**Recorded** – several individuals observed in remnant native vegetation adjacent to the study area
	• Dalwallinu to Wubin	**Possible** – may occur in woodland habitat

[2] EPBC Act Migratory Marine species returned from the database searches have been excluded from the results as the area of the proposed action scale and proximity to the ocean indicate a very low likelihood of any in-direct impacts to habitat for marine species. They are therefore not discussed further within this report.

5. Matters of National Environmental Significance Impact Assessment

5.1 Proposed Action

5.1.1 Threatened Species and Ecological Communities

The only listed threatened species likely to occur in the proposed Approval Boundary for the proposed action is the Endangered Carnaby's Black Cockatoo. No threatened flora species are known to occur within or in the immediate vicinity of the Approval Boundary for the proposed action.

Analysis of quadrat data from the spring 2015 survey campaign has identified areas of vegetation potentially representative of the Critically Endangered Eucalypt Woodlands of the Western Australian Wheatbelt ecological community in the Walebing, Pithara and Dalwallinu to Wubin sections.

5.1.1.1 Eucalypt Woodlands of the Western Australian Wheatbelt

Table 5-1 details the likely clearing required within vegetation identified as potentially representative of the Eucalypt Woodlands of the Western Australian Wheatbelt TEC. These figures do not include any buffer area for this TEC. Given the precautionary approach undertaken to identify areas potentially representing this TEC, the numbers provided in **Table 5-1** are likely to be an over estimate of the clearing required. According to the approved conservation advice (Threatened Species Scientific Committee, 2015), the current extent of this TEC is estimated at approximately 940,000 ha. Mapping recently undertaken by Parks and Wildlife estimates the current extent of the TEC in the region of the proposed action at approximately 143,981 ha (area defined by north west corner 429700 mE, 6674576 mN; south east corner 468145 mE 6566823 mN). This area includes a 200 m buffer of all occurrences. The clearing required for this project is therefore estimated at 0.002% of the current total estimated extent and 0.01% of the regional extent. It should be noted that none of the occurrences mapped by Parks and Wildlife have been surveyed to confirm that they are in fact representative of the Eucalypt Woodlands of the Western Australian Wheatbelt TEC.

Construction of the road is unlikely to require extensive excavation within the root systems of the trees that are the dominant species of this TEC. Some excavation will be required for culvert installation, however culverts are unlikely to the located in areas representative of the TEC. Some excavation may be required for services relocations, namely Telstra cable and water pipeline relocations. These excavations are not expected to have long tern adverse impacts on this TEC, as shown by existing buried services within areas of very good to excellent woodland vegetation.

Table 5-1: Preliminary Clearing Requirements - Eucalypt Woodlands of the Western Australian Wheatbelt

Section	Total Potential Area as per Phoenix (2016) (ha)	Vegetation Condition			Total (ha)
		Degraded (ha)	Good (ha)	Very Good (ha)	
Walebing	55.8	9.0	0.9	0.1	10.0
Miling Bypass	0.0	0.0	0.0	0.0	0.0
Pithara	14.7	0.5	1.5	1.0	3.0
Dalwallinu to Wubin	8.4	1.5	0.5	0.0	2.0
Total	**78.9**	**11.0**	**2.9**	**1.1**	**15.0**

Table 5-2 provides an assessment of the impact of the proposed action on this TEC against the criteria set out in the Significance Impact Guidelines 1.1. The results of the assessment indicate the proposed action will require clearing of the TEC, however it is unlikely that the required clearing will result in a significant impact to the TEC as a whole.

Table 5-2 : Assessment Against Significant Impact Guideline 1.1 – Criteria for Critically Endangered and Endangered Ecological Communities

Criteria	Assessment
Reduce the extent of an ecological community.	**Significant Impact Possible but Unlikely** Clearing for the project will remove a maximum of 15 ha of vegetation that has been identified as potentially representative of the Eucalypt Woodlands of the Western Australian Wheatbelt, By realigning the road in a number of locations, clearing of this TEC has been reduced by an estimated 5.0 ha compared to if all works had been undertaken online. The current extent of this TEC is estimated at approximately 940,000 ha and 143,981 ha in the local region. The clearing required for this project is 0.002% of the total estimated extent and 0.01% of the local region extent. As this TEC was listed after the spring survey campaign had been completed and determination of the TEC is based on quadrat data only, it is likely that the extent of the TEC is over estimated and the actual amount of clearing required, as well as the extent within the survey boundary, is over estimated.
Fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines	**Significant Impact Unlikely** As the works required will be undertaken adjacent to the existing GNH, the level of fragmentation is unlikely to be increased above that already present.
Adversely affect habitat critical to the survival of an ecological community.	**Significant Impact Unlikely** While some clearing of the TEC is required, these areas are largely degraded and unlikely to represent critical habitat. Project revegetation and landscaping activities may also result in a net improvement to the surrounding ecological community occurrence.
Modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns.	**Significant Impact Unlikely** Given the nature and extent of the works required and the linear nature of the project, it is unlikely that abiotic factors will be negatively impacted to the extent that they affect the ecological community.
Cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting.	**Significant Impact Unlikely** The works required are unlikely to result in changes to the species composition of the ecological community. Weed and disease hygiene measures will be in place during construction while revegetation and landscaping activities may result in a net improvement to the surrounding ecological community occurrence.

Criteria	Assessment
Cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to: • assisting invasive species, that are harmful to the listed ecological community, to become established, or • causing regular mobilisation of fertilizers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community.	**Significant Impact Unlikely** The works required are unlikely to cause a substantial reduction in the quality or integrity of an occurrence of an ecological community. Weed and disease hygiene measures will be in place during construction and the risk of transport of invasive species by normal (operational) road traffic is considered extremely low. The nature of the works and end use (i.e. major highway) are unlikely to cause regular mobilisation of chemicals which could inhibit plant growth. Drainage will be managed through design such that drainage flows are directed to natural watercourses and/or areas that disperse/infiltrate water in a short period of time and will not result in ongoing waterlogging of the soil. Project revegetation and landscaping activities may also result in a net improvement to the surrounding ecological community occurrence.
Interfere with the recovery of an ecological community.	**Significant Impact Unlikely** While some clearing of the TEC is required, these areas are largely degraded. Project revegetation and landscaping activities may result in a net improvement to the surrounding ecological community occurrence. It is further expected that offsetting will be required at the State level to address residual impacts related to clearing of remnant native vegetation in an extensively cleared landscape. This offset requirement will assist in securing areas of the TEC within the conservation estate.

5.1.1.2 Carnaby's Black Cockatoo

Carnaby's Black Cockatoo (EPBC Act - Endangered) was directly recorded in the Approval Boundary on numerous occasions. A total of 1,039 potential breeding trees (trees with a diameter at breast height (DBH) greater than 500 mm) for Carnaby's Black Cockatoo were recorded by Phoenix (2016). The proposed action is likely to result in the removal of up 130 potential breeding trees, mainly within the Walebing section (84 trees).

No known nesting trees (those that show evidence of use by Carnaby's Black Cockatoo) or trees with hollows suitable for use by the species will be cleared. All potential breeding trees within the Approval Boundary with hollows suitable for or used by Carnaby's Black Cockatoo will be marked as no-go zones in construction drawings.

Phoenix (2016) identified approximately 163 ha of Carnaby's Black Cockatoo breeding and foraging habitat. Approximately 30 ha of suitable habitat for Carnaby's Black Cockatoo will be cleared within the Approval Boundary for the proposed action. None of this has been identified as quality foraging habitat. **Table 5-3** provides a breakdown of the expected clearing by section and vegetation condition (based on Keighery 1994).

Table 5-3 : Condition of Carnaby's Black Cockatoo Habitat Proposed to be Cleared

Condition Rating	Clearing Estimate (ha)				
	Walebing	Miling Bypass	Pithara	Dalwallinu to Wubin	Totals
Excellent	0.0	0.5	0.0	0.5	1.0
Very Good	0.0	1.0	3.0	3.0	7.0
Good	1.0	0.0	2.5	5.0	8.5
Degraded	7.0	0.5	0.5	5.5	13.5
Totals	**8.0**	**2.0**	**6.0**	**14.0**	**30.0**

Inspection of recent aerial photography for the wider area suggests that 32,590 ha of suitable habitat occurs within 15 km of the Approval Boundary for the proposed action, with 6,015 ha within 15 km of the Pithara section and 12.748 ha within 15 km of the Dalwallinu to Wubin section (**Table 5-4**). Based on this assessment, the area of habitat within the Approval Boundary impacted by the proposed action is 0.09% of the potentially suitable vegetation present within 15 km of the proposed action (**Table 5-4**).

The Walebing section passes through the edge of the Walebing International Bird Area (IBA). This area supports up to 40 breeding pairs of Carnaby's Black Cockatoo. No significant impacts to this IBA are anticipated as no hollow bearing trees suitable for or showing evidence of use by Carnaby's Black Cockatoo will be removed as a result of the proposed action from within the IBA boundary, or along the Walebing section.

Table 5-4 : Extent of Regional Habitat for Carnaby's Black Cockatoo

Section	Regional Habitat (ha)[1]	% of Regional Habitat to be Cleared
Walebing	11,916	0.07
Miling Bypass	7,854	0.03
Pithara	6,015	0.10
Dalwallinu to Wubin	12,748	0.11
Combined[2]	32,590	0.09

Notes: [1] within 15 km of the Approval Boundary. [2]Due to the distance between some sections being less than 30 km, regional habitat buffers overlap and as such the combined area is not simply a sum of the four regional habitat extents.

Table 5-5 provides an assessment of the impact of the proposed action on Carnaby's Black Cockatoo against the criteria set out in the EPBC Act Referral Guidelines for Three Threatened Black Cockatoo Species while **Table 5-6** provides the same assessment against the criteria set out in the Significance Impact Guidelines 1.1. The results of the assessment indicate the proposed action is unlikely to have a significant impact on the species.

Table 5-5 : Assessment Against Referral Guidelines for Black Cockatoos

Criteria	Assessment
High Risk of Significant Impact	
Clearing of any known nesting tree.	**Significant Impact Unlikely** No known nesting trees will be cleared.
Clearing or degradation of any part of a vegetation community known to contain breeding habitat	**Significant Impact Possible but Unlikely** Breeding habitat has been recorded in all sections. However, given the extent of similar suitable habitat within 15 km of the Approval Boundary for the proposed action, the area of potential breeding habitat occupied by the species will be reduced by a very small amount (less than 0.5%) from that available within 15 km of the Approval Boundary for the proposed action.
Clearing of more than 1 ha of quality foraging habitat.	**Significant Impact Unlikely** No quality foraging habitat is required to be cleared.
Clearing or degradation (including pruning the top canopy) of a known night roosting site.	**Significant Impact Unlikely** No known night roosts occur within the Approval Boundary for the proposed action.
Creating a gap of greater than 4 km between patches of black cockatoo habitat (breeding, foraging or roosting).	**Significant Impact Unlikely** Clearing will not create a gap of greater than 4 km.
Uncertainty of Impact	
Degradation (such as through altered hydrology or fire regimes) of more than 1 ha of foraging habitat.	**Significant Impact Unlikely** The action is unlikely to result in degradation of additional habitat to that impacted directly by the proposed action.
Clearing or disturbance in areas surrounding black cockatoo breeding, foraging or night roosting habitat that has the potential to degrade habitat through introduction of invasive species, edge effects, hydrological changes, increased human visitation or fire.	**Significant Impact Unlikely** Given that the Approval Boundary for the proposed action is in close proximity to an existing major road (GNH), the proposed action is unlikely to increase the level of degradation in relation to Black Cockatoo habitat. Weed and hygiene control measures will be in place during construction and drainage will be designed to reduce the risk of scouring or erosion.
Actions that do not directly affect the listed species but that have the potential for indirect impacts such as increasing competitors for nest hollows.	**Significant Impact Unlikely** As no permanent water sources will be created and there will be a negligible change to the overall landscape character, the proposed action is considered unlikely to result in the introduction of or increase in competitors for nest hollows. In addition, vehicle and machinery hygiene measures will reduce the risk of introducing or spreading invasive species or disease that may impact on Black Cockatoos.

Criteria	Assessment
Actions with the potential to introduce known plant diseases such as *Phytophthora* spp. to an area where the pathogen was not previously known.	**Significant Impact Unlikely** *Phytophthora* dieback is known to occur in the Approval Boundary for the proposed action. Surveys are being undertaken to map areas of protectable and infested vegetation. Weed and hygiene control measures will be in place during construction including all plant and machinery to be certified clean prior to arrival at site and segregation of topsoil according to weed/disease status. Construction of the proposed action is unlikely to increase the threat of *Phytophthora* dieback being introduced, to or spread within, the Approval Boundary for the proposed action.

Table 5-6 : Assessment Against Significant Impact Guideline 1.1 – Criteria for Endangered Species

Criteria	Assessment
Will the action lead to a long-term decrease in the size of a population?	**Unlikely** Numerous Carnaby's Black Cockatoos were directly recorded in the Approval Boundary for the proposed action area during the field surveys and suitable breeding habitat (known and potential breeding trees) for this species has been identified. Known breeding areas are located outside of the proposed Approval Boundary for the proposed action, including several IBAs located within 30 km of the Approval Boundary for the proposed action (one of which partially intersects the proposed Approval Boundary). These areas are known to contain large numbers of Carnaby's Black Cockatoo and nesting habitat. Approximately 32,590 ha of native vegetation suitable for Carnaby's Black Cockatoo is present within 15 km of the Approval Boundary for the proposed action, including IBAs containing breeding areas. As such, the species is unlikely to rely on the habitat proposed to be cleared for the proposed action.
Will the action reduce the area of occupancy of the species?	**Unlikely** The area of potential habitat occupied by the species will be reduced by 0.08% from that available within 15 km of the Approval Boundary for the proposed action. Due to the availability of potential habitat in the regional area (such as nearby IBAs and conservation reserves) it is considered unlikely that the proposed action will significantly reduce the occupancy of the species within the regional area.
Will the action fragment an existing population into two or more populations?	**Unlikely** Clearing for the proposed action will not result in the fragmentation of an existing Carnaby's Black Cockatoo population. The required clearing will not significantly increase the current footprint of the GNH and works are located in close proximity to the existing GNH. The upgraded road is unlikely to impose a physical barrier to the movement of Carnaby's Black Cockatoo between habitat areas and areas of remnant vegetation greater than 4 km apart. Any additional gaps in remnant vegetation created are unlikely to be sufficient to impact the movement of bird fauna.

Criteria	Assessment
Will the action adversely affect habitat critical to the survival of a species?	**Unlikely** The vegetation to be cleared is not quality foraging habitat for Carnaby's Black Cockatoo and no known nesting trees will be removed as a result of the proposed action.
Will the action disrupt the breeding cycle of a population?	**Unlikely** No known nesting trees will be removed as a result of the proposed action. Prior to clearing occurring near trees with hollows suitable for or used by Carnaby's Black Cockatoo, hollows will be inspected to determine if there are any resident cockatoos. Should resident cockatoos be found, the Superintendent will determine the appropriate course of action to minimise impacts.
Will the action modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?	**Unlikely** Clearing of 30 ha of potential habitat for Carnaby's Black Cockatoo is unlikely to result in species decline, particularly given no known breeding trees will be cleared. The majority of habitat in the study area is narrow with variable habitat quality, ranging from completely degraded areas offering little habitat value to good quality habitat (Phoenix Environmental Services, 2016). Given the amount of suitable habitat in the surrounding area it is unlikely that the loss of habitat as a result of the proposed action will result in a significant decline in Carnaby's Black Cockatoo.
Will the action result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat?	**Unlikely** Hygiene control measures will be in place during construction including all plant and machinery to be certified clean prior to arrival at site and segregation of topsoil according to weed/disease status. Construction of the proposed action is unlikely to increase the threat of invasive species being spread within or introduced to the proposed Approval Boundary for the action.
Will the action introduce disease that may cause the species to decline?	**Unlikely** *Phytophthora* dieback is known to occur in the proposed Approval Boundary for the proposed action. Surveys are being undertaken to map areas of protectable and infested vegetation. Weed and hygiene control measures will be in place during construction including all plant and machinery to be certified clean prior to arrival at site and segregation of topsoil according to weed/disease status. Construction of the proposed action is unlikely to increase the threat of *Phytophthora* dieback being introduced to the proposed Approval Boundary for the action.
Will the action interfere with the recovery of the species?	**Unlikely** The proposed clearing of 30 ha of potential habitat for Carnaby's Black Cockatoo is not likely to impact on the recovery of the species due to the presence of a large amount of similar habitat within 15 km. Suitable hollow-bearing trees will be checked for resident cockatoos prior to clearing. If cockatoos are found, the Superintendent will determine the appropriate course of action to minimise impact.

5.1.2 Listed Migratory Species

There is the potential for terrestrial migratory bird species such as the Fork-tailed Swift (*Apus pacificus)*, Eastern Great Egret (*Ardea modesta*), Cattle Egret (*Ardea ibis*), Common Sandpipe (*Tringa hypoleucos*) and the Rainbow Bee-eater (*Merops ornatus*) to transit or forage in the area. Several Rainbow Bee-eaters were observed in remnant native vegetation adjacent to the Pithara section (Phoenix Environmental Services, 2016)

The Fork-tailed Swift is almost exclusively aerial and found to occur in the majority of Australia over inland plains however; this species does not breed in Australia (Department of the Environment, 2016a). The species may potentially fly and forage over the Approval Boundary for the proposed action. However, it is unlikely that this species will exclusively utilise habitat within the proposed Approval Boundary and any impacts will be negligible.

The Rainbow Bee-eater is a common and widespread bird and is found across the majority of Australia (Department of the Environment, 2016b). The species may utilise habitat within the Approval Boundary for the proposed action, however, any impacts are expected to be minor due to the limited amount of disturbance to preferred habitat required and presence of additional habitat within the local area. Additionally, this species is known to make use of disturbed sites such as road cuttings, cleared areas and gravel/sand pits for both breeding and foraging.

The Eastern Great Egret and Cattle Egret are both known to use a variety of habitats including swamps and marshes, margins of rivers and lakes, damp or flooded grasslands, pastures or agricultural lands, salt pans and salt lakes, salt marshes, estuarine mudflats, and temperate grasslands (Department of the Environment, 2016c, 2016d).

The Common Sandpiper uses a range of coastal and some inland wetlands and has been recorded in estuaries and deltas, lakes, pools, billabongs, reservoirs, dams and clay pans. Generally the species forages in shallow water and on bare soft mud at the edges of wetlands (Department of the Environment, 2016e). It may occur in the samphire/salt lake habitat along the Walebing section following suitable rainfall.

Table 5-7 provides an assessment of the impact of the proposed action on Migratory species against the criteria set out in the Significance Impact Guidelines 1.1. The results of the assessment indicate that the proposed action will not have a significant impact on any of the species.

Table 5-7 : Assessment Against Significant Impact Criteria for Migratory Species

Criteria	Assessment
Will the action substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species?	**Unlikely** None of the listed migratory species were directly recorded in the Approval Boundary for the proposed action during the field surveys. These species would most likely occur as vagrants or transients through the Approval Boundary for the proposed action and as such, significant impacts are not expected. Habitat within the proposed action area is not considered important habitat for migratory species and there are no IBAs within the region specific to these species.
Will the action result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species?	**Unlikely** It is considered unlikely that the Approval Boundary for the proposed action represents important habitat for migratory species as all species are widely distributed. Weed and hygiene control measures will be in place during construction including all plant and machinery to be certified clean prior to arrival at site and segregation of topsoil according to weed/disease status. Construction of the proposed action is unlikely to increase the threat of weeds being spread within or introduced to the proposed Approval Boundary for the action.
Will the action seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species?	**Unlikely** The migratory species identified as possibly occurring within the Approval Boundary for the proposed action are all widely distributed across Australia. Given the small amount of clearing required, the linear nature of the proposed action, and the presence of additional habitat in the vicinity, the proposed action is unlikely to disrupt the lifecycle of these species.

5.2 Impact Mitigation for the Proposed Action

The initial stages of design took into consideration the location of Carnaby's Black Cockatoo potential breeding trees and avoided these where practicable. It is not practicable to avoid all potential breeding trees due to other project constraints such as links to existing and proposed roads, road geometry, and locations of heritage sites, existing houses and other structures. The location of all potential Carnaby's Black Cockatoo breeding trees is shown on **Figure 4-5**. The following management actions will be implemented during the proposed action:

- Surveys will be undertaken in Spring 2016 to delineate the occurrence within the Approval Boundary of the Eucalypt Woodlands of the Western Australian Wheatbelt TEC.
- Clearing of the Eucalypt Woodlands within areas identified as the Western Australian Wheatbelt TEC will be minimised to that required for a safe construction environment. Areas beyond this will be marked as "no-go" zones on construction drawings and on site.
- Trees within the Approvals 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.
- The area to be cleared will be accurately pegged/marked on the ground, unless a pegless machine control technology is proposed and approved for use by Main Roads.

- Where practicable, 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.
- 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.
- During construction, vehicle speed on site will be limited to reduce dust lift off and the risk of vehicle-fauna collisions. Water carts will also be used during construction to reduce dust lift off.
- It is considered unlikely that construction activities will result in injury or death to Carnaby's Black Cockatoo. Any birds injured or killed as a result of construction or rehabilitation/revegetation activities will be reported to the site superintendent (or delegate) who shall determine the necessary steps to be taken, such as reporting deaths to the appropriate regulatory authorities or arranging for transfer of injured animals to wildlife carers.
- A list of local wildlife rescue organisations and carers will be maintained on site.
- Topsoil will be stripped and stockpiled separately to vegetation. Where required, topsoil and vegetation stockpiles will be segregated according to their weed status, as per the Topsoil Management Plan for the proposed action.

5.3 Potential Impacts from Alternatives Considered

In comparison with the proposed action, if upgrades and improvement works were undertaken along the existing alignment (based on a 50 m wide disturbance footprint), up to 20 ha of the Eucalypt Woodlands of the Western Australian Wheatbelt, 45 ha of habitat for Carnaby's Black Cockatoo and 317 potential breeding trees would be cleared, including four known nesting trees and four trees containing hollows suitable for use by Carnaby's Black Cockatoo. By constructing the proposed offline alignments as described in Section 2, the amount of clearing of the TEC is reduced by 35% and clearing of Carnaby's Black Cockatoo habitat is reduced by 33%. Additionally, there is a 59% reduction in the number of potential breeding trees to be removed, 100% reduction in the number of known nesting trees to be removed, and a 100% reduction in the number of trees with hollows suitable for use by Carnaby's Black Cockatoo (**Table 5-8**).

Table 5-8 : Comparison of potential impact – Proposed Action and Online Alternative

Impact	Proposed Action	Online Alternative	Change[1]
Cleaing of Ecualypt Woodlands of the WA Wheatbelt TEC (ha)	15.0	20.0	-25%
Carnaby's Black Cockatoo			
Habitat Clearing (ha)	30	45	- 33%
All Potential Breeding Trees (>500 mm DBH)	130	317	- 59%
Known Nesting Trees	0	4	- 100%
Trees with Suitable Hollows (other than known nesting trees)	0	4	- 100%

Notes: [1] Negative value represents a reduction in impact for the proposed action in comparison with the alternative

6. Conclusions

Based on the assessment presented within this Supporting Information document and the referral form, the proposed action is considered unlikely to result in significant impacts to MNES, namely Listed Threatened Species and Ecological Communities.

The proposed action will impact upon suitable foraging habitat for Carnaby's Black Cockatoo and the Critically Endangered Eucalypt Woodlands of the Western Australian Wheatbelt ecological community. An assessment of the proposed action against the criteria outlined in the EPBC Act Referral Guideline for Three Species of Black Cockatoo and the Significance Impact Guidelines 1.1 was undertaken. This assessment found it is unlikely that the proposed action will result in a significant impact to Carnaby's Black Cockatoo or the Eucalypt Woodlands of the Western Australian Wheatbelt as:

- for the Eucalypt Woodlands of the Western Australian Wheatbelt TEC:
  - the amount of clearing required in vegetation potentially representative of the TEC is 0.002% of the current extent of this TEC and 0.01% of the local regional extent as mapped by Parks and Wildlife;
  - the works to be undertaken and required clearing will not result in increased fragmentation or degradation of the TEC, cause a substantial change in the species composition of an occurrence or modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for the TECs survival; and
  - the management measures proposed in Section 5.2 will further reduce the risk of impacts.
- for Carnaby's Black Cockatoo:
  - no known nesting trees for Carnaby's Black Cockatoo will be cleared;
  - vegetation to be cleared is not quality foraging habitat for Carnaby's Black Cockatoo;
  - approximately 32,590 ha of potentially suitable habitat occurs within 15 km of the Approval Boundary for the proposed action;
  - the clearing required (30 ha of suitable habitat) equates to less than 0.1% of the potentially suitable habitat present within 15 km of the proposed action; and
  - the management measures proposed in Section 5.2 will further reduce the risk of impacts.

There is the potential for terrestrial migratory bird species to transit or forage in the area. Assessment against the criteria set out in the Significance Impact Guidelines 1.1 indicates that the proposed action will not have a significant impact on these species.

All activities associated with the proposed action will be managed in accordance with the Construction Environmental Management Plan, which will include the management measures outlined in Section 5.2.

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Figures

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Figure 1-1 : Location of the Proposed Action

(Refer to GNH-CN00-EN01-GDF-0001-A.pdf)

Figure 4-1 : Conservation Significant Flora and Weeds

(refer to GNH-CN00-EN01-GDF-0005-A.pdf)

Figure 4-2 : Mapped Vegetation Types

(refer to GNH-CN00-EN01-GDF-0004-A.pdf)

Figure 4-3 : Vegetation Condition

(refer to GNH-CN00-EN01-GDF-0002-A.pdf)

Figure 4-4 : Eucalypt Woodlands of the Western Australian Wheatbelt Potential Occurrences

(refer to GNH-CN00-EN01-GDF-0015-A.pdf)

Figure 4-5 : Carnaby's Black Cockatoo Habitat

(refer to GNH-CN00-EN01-GDF-0003-A.pdf)

Appendix A. Approval Boundary Coordinates

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Location Point	Longitude	Latitude	Location Point	Longitude	Latitude	Location Point	Longitude	Latitude	Location Point	Longitude	Latitude
Walebing			Miling Bypass			Pithara			Dalwallinu to Wubin		
WAL001	-30.628	116.358	MB001	-30.484	116.372	PITH001	-30.365	116.670	DW001	-30.103	116.634
WAL002	-30.629	116.353	MB002	-30.488	116.371	PITH002	-30.365	116.670	DW002	-30.104	116.633
WAL003	-30.630	116.349	MB003	-30.488	116.372	PITH003	-30.365	116.670	DW003	-30.104	116.633
WAL004	-30.630	116.347	MB004	-30.489	116.373	PITH004	-30.385	116.670	DW004	-30.104	116.633
WAL005	-30.631	116.345	MB005	-30.489	116.374	PITH005	-30.386	116.670	DW005	-30.104	116.632
WAL006	-30.632	116.343	MB006	-30.489	116.375	PITH006	-30.387	116.670	DW006	-30.104	116.632
WAL007	-30.635	116.340	MB007	-30.489	116.375	PITH007	-30.387	116.670	DW007	-30.104	116.632
WAL008	-30.635	116.340	MB008	-30.489	116.376	PITH008	-30.387	116.670	DW008	-30.105	116.631
WAL009	-30.636	116.340	MB009	-30.490	116.376	PITH009	-30.387	116.669	DW009	-30.105	116.631
WAL010	-30.636	116.340	MB010	-30.490	116.375	PITH010	-30.391	116.668	DW010	-30.106	116.631
WAL011	-30.642	116.334	MB011	-30.490	116.373	PITH011	-30.391	116.667	DW011	-30.106	116.632
WAL012	-30.643	116.333	MB012	-30.490	116.370	PITH012	-30.392	116.668	DW012	-30.107	116.631
WAL013	-30.644	116.331	MB013	-30.491	116.370	PITH013	-30.392	116.668	DW013	-30.106	116.630
WAL014	-30.649	116.321	MB014	-30.492	116.370	PITH014	-30.393	116.668	DW014	-30.106	116.630
WAL015	-30.650	116.320	MB015	-30.495	116.368	PITH015	-30.393	116.668	DW015	-30.105	116.628
WAL016	-30.650	116.318	MB016	-30.496	116.366	PITH016	-30.393	116.667	DW016	-30.104	116.629
WAL017	-30.650	116.316	MB017	-30.498	116.363	PITH017	-30.396	116.668	DW017	-30.105	116.630
WAL018	-30.650	116.316	MB018	-30.499	116.359	PITH018	-30.398	116.668	DW018	-30.105	116.630
WAL019	-30.650	116.304	MB019	-30.501	116.358	PITH019	-30.399	116.668	DW019	-30.104	116.630
WAL020	-30.651	116.297	MB020	-30.501	116.357	PITH020	-30.400	116.668	DW020	-30.104	116.631

Location Point	Longitude	Latitude	Location Point	Longitude	Latitude	Location Point	Longitude	Latitude	Location Point	Longitude	Latitude
Walebing			Miling Bypass			Pithara			Dalwallinu to Wubin		
WAL021	-30.652	116.292	MB021	-30.501	116.357	PITH021	-30.400	116.668	DW021	-30.104	116.631
WAL022	-30.653	116.290	MB022	-30.508	116.353	PITH022	-30.403	116.667	DW022	-30.104	116.632
WAL023	-30.653	116.289	MB023	-30.509	116.353	PITH023	-30.405	116.667	DW023	-30.104	116.632
WAL024	-30.654	116.288	MB024	-30.509	116.353	PITH024	-30.407	116.664	DW024	-30.103	116.632
WAL025	-30.657	116.283	MB025	-30.509	116.353	PITH025	-30.407	116.664	DW025	-30.104	116.632
WAL026	-30.661	116.277	MB026	-30.519	116.347	PITH026	-30.407	116.664	DW026	-30.103	116.633
WAL027	-30.662	116.275	MB027	-30.519	116.347	PITH027	-30.408	116.664	DW027	-30.103	116.633
WAL028	-30.662	116.275	MB028	-30.520	116.347	PITH028	-30.408	116.664	DW028	-30.103	116.634
WAL029	-30.663	116.275	MB029	-30.520	116.347	PITH029	-30.410	116.662	DW029	-30.103	116.634
WAL030	-30.665	116.270	MB030	-30.530	116.341	PITH030	-30.410	116.663	DW030	-30.103	116.634
WAL031	-30.679	116.239	MB031	-30.531	116.340	PITH031	-30.410	116.662	DW031	-30.086	116.655
WAL032	-30.681	116.235	MB032	-30.535	116.340	PITH032	-30.410	116.662	DW032	-30.087	116.654
WAL033	-30.682	116.234	MB033	-30.542	116.340	PITH033	-30.412	116.660	DW033	-30.093	116.647
WAL034	-30.683	116.232	MB034	-30.542	116.339	PITH034	-30.414	116.659	DW034	-30.093	116.646
WAL035	-30.684	116.228	MB035	-30.538	116.338	PITH035	-30.415	116.660	DW035	-30.095	116.644
WAL036	-30.686	116.224	MB036	-30.538	116.337	PITH036	-30.416	116.659	DW036	-30.096	116.644
WAL037	-30.686	116.222	MB037	-30.534	116.331	PITH037	-30.415	116.659	DW037	-30.098	116.643
WAL038	-30.686	116.217	MB038	-30.534	116.329	PITH038	-30.415	116.659	DW038	-30.099	116.643
WAL039	-30.686	116.217	MB039	-30.534	116.328	PITH039	-30.415	116.658	DW039	-30.106	116.643
WAL040	-30.686	116.214	MB040	-30.533	116.328	PITH040	-30.415	116.657	DW040	-30.106	116.645

Location Point	Longitude	Latitude	Location Point	Longitude	Latitude	Location Point	Longitude	Latitude	Location Point	Longitude	Latitude
Walebing			Miling Bypass			Pithara			Dalwallinu to Wubin		
WAL041	-30.686	116.213	MB041	-30.533	116.328	PITH041	-30.420	116.653	DW041	-30.108	116.645
WAL042	-30.686	116.212	MB042	-30.533	116.328	PITH042	-30.420	116.653	DW042	-30.108	116.643
WAL043	-30.687	116.212	MB043	-30.533	116.328	PITH043	-30.420	116.652	DW043	-30.115	116.643
WAL044	-30.687	116.211	MB044	-30.532	116.328	PITH044	-30.420	116.652	DW044	-30.116	116.643
WAL045	-30.693	116.212	MB045	-30.533	116.330	PITH045	-30.424	116.649	DW045	-30.117	116.643
WAL046	-30.694	116.213	MB046	-30.533	116.331	PITH046	-30.424	116.649	DW046	-30.118	116.644
WAL047	-30.698	116.213	MB047	-30.533	116.332	PITH047	-30.425	116.648	DW047	-30.118	116.644
WAL048	-30.700	116.213	MB048	-30.537	116.338	PITH048	-30.425	116.648	DW048	-30.120	116.645
WAL049	-30.701	116.213	MB049	-30.537	116.338	PITH049	-30.430	116.643	DW049	-30.123	116.648
WAL050	-30.703	116.213	MB050	-30.534	116.338	PITH050	-30.432	116.642	DW050	-30.124	116.649
WAL051	-30.705	116.214	MB051	-30.534	116.337	PITH051	-30.432	116.642	DW051	-30.125	116.650
WAL052	-30.709	116.217	MB052	-30.533	116.337	PITH052	-30.435	116.640	DW052	-30.126	116.650
WAL053	-30.709	116.216	MB053	-30.533	116.338	PITH053	-30.438	116.639	DW053	-30.128	116.651
WAL054	-30.705	116.213	MB054	-30.533	116.339	PITH054	-30.441	116.638	DW054	-30.129	116.651
WAL055	-30.703	116.212	MB055	-30.533	116.339	PITH055	-30.443	116.638	DW055	-30.152	116.653
WAL056	-30.702	116.212	MB056	-30.530	116.340	PITH056	-30.445	116.638	DW056	-30.152	116.654
WAL057	-30.701	116.212	MB057	-30.530	116.340	PITH057	-30.446	116.637	DW057	-30.153	116.654
WAL058	-30.700	116.211	MB058	-30.529	116.341	PITH058	-30.467	116.613	DW058	-30.153	116.653
WAL059	-30.698	116.211	MB059	-30.526	116.342	PITH059	-30.467	116.613	DW059	-30.155	116.654
WAL060	-30.697	116.211	MB060	-30.525	116.343	PITH060	-30.467	116.605	DW060	-30.161	116.653

Location Point	Longitude	Latitude	Location Point	Longitude	Latitude	Location Point	Longitude	Latitude	Location Point	Longitude	Latitude
Walebing			Miling Bypass			Pithara			Dalwallinu to Wubin		
WAL061	-30.697	116.212	MB061	-30.515	116.348	PITH061	-30.467	116.605	DW061	-30.198	116.661
WAL062	-30.695	116.212	MB062	-30.515	116.348	PITH062	-30.467	116.605	DW062	-30.199	116.661
WAL063	-30.695	116.211	MB063	-30.513	116.349	PITH063	-30.467	116.605	DW063	-30.199	116.661
WAL064	-30.695	116.211	MB064	-30.513	116.349	PITH064	-30.467	116.601	DW064	-30.199	116.662
WAL065	-30.695	116.212	MB065	-30.510	116.351	PITH065	-30.467	116.601	DW065	-30.200	116.661
WAL066	-30.694	116.211	MB066	-30.510	116.351	PITH066	-30.467	116.601	DW066	-30.201	116.662
WAL067	-30.694	116.205	MB067	-30.509	116.352	PITH067	-30.467	116.601	DW067	-30.208	116.669
WAL068	-30.694	116.205	MB068	-30.509	116.352	PITH068	-30.466	116.598	DW068	-30.209	116.672
WAL069	-30.694	116.204	MB069	-30.509	116.352	PITH069	-30.467	116.601	DW069	-30.210	116.672
WAL070	-30.694	116.204	MB070	-30.508	116.352	PITH070	-30.466	116.601	DW070	-30.210	116.672
WAL071	-30.694	116.202	MB071	-30.509	116.352	PITH071	-30.466	116.603	DW071	-30.210	116.671
WAL072	-30.694	116.202	MB072	-30.504	116.355	PITH072	-30.466	116.608	DW072	-30.226	116.671
WAL073	-30.694	116.202	MB073	-30.500	116.357	PITH073	-30.466	116.610	DW073	-30.226	116.670
WAL074	-30.693	116.202	MB074	-30.499	116.358	PITH074	-30.466	116.612	DW074	-30.250	116.670
WAL075	-30.693	116.205	MB075	-30.496	116.360	PITH075	-30.465	116.614	DW075	-30.250	116.671
WAL076	-30.691	116.208	MB076	-30.495	116.360	PITH076	-30.464	116.616	DW076	-30.250	116.671
WAL077	-30.690	116.208	MB077	-30.494	116.360	PITH077	-30.452	116.630	DW077	-30.250	116.670
WAL078	-30.689	116.209	MB078	-30.494	116.361	PITH078	-30.451	116.630	DW078	-30.258	116.670
WAL079	-30.688	116.209	MB079	-30.494	116.361	PITH079	-30.451	116.630	DW079	-30.264	116.671
WAL080	-30.687	116.210	MB080	-30.495	116.361	PITH080	-30.451	116.630	DW080	-30.268	116.671

Location Point	Longitude	Latitude	Location Point	Longitude	Latitude	Location Point	Longitude	Latitude	Location Point	Longitude	Latitude
Walebing			Miling Bypass			Pithara			Dalwallinu to Wubin		
WAL081	-30.684	116.209	MB081	-30.496	116.362	PITH081	-30.449	116.632	DW081	-30.271	116.670
WAL082	-30.684	116.209	MB082	-30.494	116.365	PITH082	-30.447	116.634	DW082	-30.273	116.670
WAL083	-30.684	116.209	MB083	-30.492	116.368	PITH083	-30.446	116.635	DW083	-30.273	116.668
WAL084	-30.684	116.209	MB084	-30.490	116.369	PITH084	-30.444	116.635	DW084	-30.273	116.668
WAL085	-30.684	116.209	MB085	-30.487	116.370	PITH085	-30.441	116.635	DW085	-30.274	116.667
WAL086	-30.682	116.219	MB086	-30.486	116.370	PITH086	-30.438	116.636	DW086	-30.274	116.665
WAL087	-30.682	116.220	MB087	-30.486	116.367	PITH087	-30.435	116.637	DW087	-30.275	116.664
WAL088	-30.683	116.222	MB088	-30.487	116.365	PITH088	-30.430	116.642	DW088	-30.276	116.664
WAL089	-30.683	116.223	MB089	-30.488	116.365	PITH089	-30.430	116.642	DW089	-30.279	116.664
WAL090	-30.684	116.225	MB090	-30.488	116.365	PITH090	-30.430	116.641	DW090	-30.279	116.664
WAL091	-30.684	116.226	MB091	-30.488	116.364	PITH091	-30.430	116.640	DW091	-30.280	116.664
WAL092	-30.684	116.227	MB092	-30.488	116.364	PITH092	-30.430	116.640	DW092	-30.280	116.664
WAL093	-30.684	116.228	MB093	-30.488	116.364	PITH093	-30.430	116.640	DW093	-30.280	116.664
WAL094	-30.683	116.230	MB094	-30.488	116.364	PITH094	-30.430	116.640	DW094	-30.280	116.664
WAL095	-30.681	116.234	MB095	-30.488	116.364	PITH095	-30.430	116.642	DW095	-30.281	116.664
WAL096	-30.681	116.234	MB096	-30.489	116.364	PITH096	-30.430	116.642	DW096	-30.281	116.664
WAL097	-30.680	116.235	MB097	-30.489	116.364	PITH097	-30.409	116.661	DW097	-30.281	116.664
WAL098	-30.664	116.271	MB098	-30.489	116.364	PITH098	-30.408	116.663	DW098	-30.283	116.663
WAL099	-30.664	116.271	MB099	-30.489	116.364	PITH099	-30.407	116.664	DW099	-30.284	116.663
WAL100	-30.663	116.272	MB100	-30.490	116.364	PITH100	-30.405	116.663	DW100	-30.285	116.663

Location Point	Longitude	Latitude	Location Point	Longitude	Latitude	Location Point	Longitude	Latitude	Location Point	Longitude	Latitude
Walebing			Miling Bypass			Pithara			Dalwallinu to Wubin		
WAL101	-30.662	116.275	MB101	-30.490	116.363	PITH101	-30.405	116.664	DW101	-30.285	116.663
WAL102	-30.661	116.276	MB102	-30.489	116.363	PITH102	-30.405	116.664	DW102	-30.285	116.663
WAL103	-30.661	116.276	MB103	-30.489	116.363	PITH103	-30.406	116.665	DW103	-30.285	116.663
WAL104	-30.661	116.276	MB104	-30.488	116.364	PITH104	-30.404	116.666	DW104	-30.285	116.663
WAL105	-30.653	116.287	MB105	-30.488	116.364	PITH105	-30.403	116.667	DW105	-30.285	116.663
WAL106	-30.653	116.288	MB106	-30.488	116.364	PITH106	-30.401	116.667	DW106	-30.287	116.664
WAL107	-30.652	116.289	MB107	-30.488	116.364	PITH107	-30.401	116.667	DW107	-30.287	116.664
WAL108	-30.652	116.291	MB108	-30.487	116.364	PITH108	-30.401	116.667	DW108	-30.287	116.664
WAL109	-30.651	116.292	MB109	-30.488	116.363	PITH109	-30.401	116.667	DW109	-30.287	116.664
WAL110	-30.650	116.298	MB110	-30.488	116.362	PITH110	-30.399	116.667	DW110	-30.288	116.664
WAL111	-30.651	116.298	MB111	-30.488	116.361	PITH111	-30.395	116.667	DW111	-30.293	116.669
WAL112	-30.650	116.305	MB112	-30.488	116.362	PITH112	-30.393	116.667	DW112	-30.294	116.669
WAL113	-30.649	116.316	MB113	-30.488	116.361	PITH113	-30.393	116.667	DW113	-30.295	116.669
WAL114	-30.649	116.318	MB114	-30.488	116.361	PITH114	-30.393	116.667	DW114	-30.303	116.669
WAL115	-30.649	116.319	MB115	-30.488	116.361	PITH115	-30.393	116.667	DW115	-30.305	116.670
WAL116	-30.642	116.331	MB116	-30.488	116.361	PITH116	-30.391	116.667	DW116	-30.305	116.670
WAL117	-30.642	116.332	MB117	-30.488	116.362	PITH117	-30.391	116.666	DW117	-30.307	116.670
WAL118	-30.637	116.337	MB118	-30.487	116.362	PITH118	-30.391	116.666	DW118	-30.346	116.670
WAL119	-30.637	116.337	MB119	-30.487	116.363	PITH119	-30.391	116.667	DW119	-30.346	116.672
WAL120	-30.632	116.342	MB120	-30.486	116.365	PITH120	-30.390	116.668	DW120	-30.347	116.672

Location Point	Longitude	Latitude	Location Point	Longitude	Latitude	Location Point	Longitude	Latitude	Location Point	Longitude	Latitude
Walebing			Miling Bypass			Pithara			Dalwallinu to Wubin		
WAL121	-30.631	116.343	MB121	-30.486	116.365	PITH121	-30.390	116.667	DW121	-30.347	116.670
WAL122	-30.630	116.345	MB122	-30.484	116.366	PITH122	-30.390	116.667	DW122	-30.361	116.670
WAL123	-30.630	116.346	MB123	-30.484	116.366	PITH123	-30.390	116.668	DW123	-30.361	116.670
WAL124	-30.629	116.348	MB124	-30.484	116.367	PITH124	-30.388	116.668	DW124	-30.361	116.670
WAL125	-30.628	116.355	MB125	-30.477	116.370	PITH125	-30.388	116.668	DW125	-30.347	116.670
WAL126	-30.627	116.359	MB126	-30.476	116.372	PITH126	-30.388	116.668	DW126	-30.347	116.669
WAL127	-30.628	116.359	MB127	-30.476	116.372	PITH127	-30.388	116.668	DW127	-30.347	116.669
WAL128	-30.628	116.358	MB128	-30.476	116.372	PITH128	-30.387	116.669	DW128	-30.347	116.668
			MB129	-30.478	116.371	PITH129	-30.387	116.669	DW129	-30.346	116.668
			MB130	-30.480	116.369	PITH130	-30.387	116.669	DW130	-30.346	116.669
			MB131	-30.484	116.367	PITH131	-30.387	116.669	DW131	-30.346	116.669
			MB132	-30.484	116.367	PITH132	-30.386	116.669	DW132	-30.346	116.669
			MB133	-30.484	116.367	PITH133	-30.386	116.669	DW133	-30.346	116.669
			MB134	-30.485	116.367	PITH134	-30.385	116.669	DW134	-30.346	116.670
			MB135	-30.485	116.366	PITH135	-30.385	116.669	DW135	-30.336	116.670
			MB136	-30.485	116.366	PITH136	-30.385	116.669	DW136	-30.336	116.667
			MB137	-30.485	116.367	PITH137	-30.385	116.669	DW137	-30.334	116.667
			MB138	-30.485	116.367	PITH138	-30.372	116.669	DW138	-30.334	116.670
			MB139	-30.485	116.368	PITH139	-30.372	116.669	DW139	-30.323	116.670
			MB140	-30.485	116.370	PITH140	-30.372	116.669	DW140	-30.323	116.667

Location Point	Longitude	Latitude	Location Point	Longitude	Latitude	Location Point	Longitude	Latitude	Location Point	Longitude	Latitude
Walebing			Miling Bypass			Pithara			Dalwallinu to Wubin		
			MB141	-30.485	116.370	PITH141	-30.372	116.669	DW141	-30.323	116.667
			MB142	-30.485	116.371	PITH142	-30.371	116.669	DW142	-30.323	116.669
			MB143	-30.480	116.372	PITH143	-30.371	116.669	DW143	-30.318	116.669
			MB144	-30.478	116.372	PITH144	-30.371	116.669	DW144	-30.317	116.670
			MB145	-30.477	116.373	PITH145	-30.371	116.669	DW145	-30.306	116.670
			MB146	-30.476	116.373	PITH146	-30.361	116.669	DW146	-30.305	116.669
			MB147	-30.476	116.373	PITH147	-30.361	116.670	DW147	-30.303	116.669
			MB148	-30.476	116.373	PITH148	-30.365	116.670	DW148	-30.296	116.669
			MB149	-30.474	116.376	PITH149	-30.365	116.670	DW149	-30.294	116.669
			MB150	-30.476	116.374	PITH150	-30.436	116.639	DW150	-30.293	116.668
			MB151	-30.484	116.372	PITH151	-30.435	116.640	DW151	-30.287	116.663
			MB152	-30.489	116.363	PITH152	-30.432	116.641	DW152	-30.287	116.662
			MB153	-30.489	116.363	PITH153	-30.432	116.641	DW153	-30.286	116.662
			MB154	-30.489	116.363	PITH154	-30.436	116.637	DW154	-30.286	116.662
			MB155	-30.489	116.363	PITH155	-30.438	116.636	DW155	-30.286	116.663
						PITH156	-30.438	116.637	DW156	-30.285	116.662
						PITH157	-30.440	116.637	DW157	-30.285	116.662
						PITH158	-30.441	116.636	DW158	-30.285	116.662
						PITH159	-30.444	116.636	DW159	-30.285	116.662
						PITH160	-30.446	116.635	DW160	-30.285	116.662

Location Point	Longitude	Latitude	Location Point	Longitude	Latitude	Location Point	Longitude	Latitude	Location Point	Longitude	Latitude
Walebing			Miling Bypass			Pithara			Dalwallinu to Wubin		
						PITH161	-30.448	116.634	DW161	-30.285	116.662
						PITH162	-30.449	116.634	DW162	-30.283	116.662
						PITH163	-30.449	116.634	DW163	-30.283	116.662
						PITH164	-30.447	116.636	DW164	-30.283	116.662
						PITH165	-30.445	116.637	DW165	-30.283	116.662
						PITH166	-30.445	116.638	DW166	-30.282	116.662
						PITH167	-30.444	116.638	DW167	-30.282	116.663
						PITH168	-30.442	116.638	DW168	-30.282	116.663
						PITH169	-30.439	116.638	DW169	-30.282	116.663
						PITH170	-30.438	116.638	DW170	-30.281	116.663
						PITH171	-30.438	116.638	DW171	-30.280	116.664
						PITH172	-30.436	116.639	DW172	-30.280	116.663
						PITH173	-30.436	116.639	DW173	-30.280	116.663
						PITH174	-30.436	116.639	DW174	-30.280	116.664
									DW175	-30.276	116.664
									DW176	-30.274	116.664
									DW177	-30.274	116.664
									DW178	-30.274	116.663
									DW179	-30.274	116.664
									DW180	-30.274	116.664

Location Point	Longitude	Latitude	Location Point	Longitude	Latitude	Location Point	Longitude	Latitude	Location Point	Longitude	Latitude
Walebing			Miling Bypass			Pithara			Dalwallinu to Wubin		
									DW181	-30.273	116.666
									DW182	-30.272	116.667
									DW183	-30.271	116.668
									DW184	-30.270	116.669
									DW185	-30.268	116.669
									DW186	-30.268	116.670
									DW187	-30.254	116.670
									DW188	-30.254	116.669
									DW189	-30.253	116.669
									DW190	-30.253	116.670
									DW191	-30.236	116.670
									DW192	-30.236	116.670
									DW193	-30.236	116.670
									DW194	-30.236	116.669
									DW195	-30.236	116.669
									DW196	-30.235	116.670
									DW197	-30.235	116.670
									DW198	-30.219	116.670
									DW199	-30.218	116.669
									DW200	-30.214	116.669

Location Point	Longitude	Latitude	Location Point	Longitude	Latitude	Location Point	Longitude	Latitude	Location Point	Longitude	Latitude
Walebing			Miling Bypass			Pithara			Dalwallinu to Wubin		
									DW201	-30.213	116.669
									DW202	-30.212	116.669
									DW203	-30.211	116.669
									DW204	-30.210	116.668
									DW205	-30.210	116.668
									DW206	-30.207	116.666
									DW207	-30.207	116.665
									DW208	-30.207	116.665
									DW209	-30.207	116.664
									DW210	-30.207	116.664
									DW211	-30.207	116.664
									DW212	-30.206	116.665
									DW213	-30.206	116.665
									DW214	-30.200	116.660
									DW215	-30.200	116.659
									DW216	-30.200	116.659
									DW217	-30.200	116.660
									DW218	-30.157	116.652
									DW219	-30.156	116.652
									DW220	-30.155	116.652

Location Point	Longitude	Latitude	Location Point	Longitude	Latitude	Location Point	Longitude	Latitude	Location Point	Longitude	Latitude
Walebing			Miling Bypass			Pithara			Dalwallinu to Wubin		
									DW221	-30.154	116.652
									DW222	-30.153	116.652
									DW223	-30.154	116.649
									DW224	-30.153	116.649
									DW225	-30.153	116.650
									DW226	-30.152	116.652
									DW227	-30.128	116.650
									DW228	-30.127	116.650
									DW229	-30.126	116.649
									DW230	-30.123	116.647
									DW231	-30.123	116.647
									DW232	-30.111	116.635
									DW233	-30.110	116.635
									DW234	-30.113	116.637
									DW235	-30.113	116.642
									DW236	-30.095	116.642
									DW237	-30.095	116.643
									DW238	-30.094	116.643
									DW239	-30.092	116.642
									DW240	-30.092	116.641

Location Point	Longitude	Latitude	Location Point	Longitude	Latitude	Location Point	Longitude	Latitude	Location Point	Longitude	Latitude
Walebing			Miling Bypass			Pithara			Dalwallinu to Wubin		
									DW241	-30.094	116.641
									DW242	-30.094	116.640
									DW243	-30.092	116.641
									DW244	-30.090	116.644
									DW245	-30.089	116.648
									DW246	-30.088	116.651
									DW247	-30.085	116.654
									DW248	-30.081	116.658
									DW249	-30.078	116.662
									DW250	-30.079	116.662
									DW251	-30.081	116.658
									DW252	-30.086	116.655

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Appendix B. Flora and Fauna Assessments

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