

Biodiversity Assessment

LIVERPOOL RANGE WIND FARM - TRANSMISSION LINE STUDY AREA



DECEMBER 2013

Document Verification



Project Title: Liverpool Range Wind Farm - Transmission Line Study Area

Project Number: 5415

Project File Name: Liverpool Wind Farm BA – Transmission Line Study Area

Revision	Date	Prepared by (name)	Reviewed by (name)	Approved by (name)
Draft v1	14/11/12	Deb Frazer Mark Free Jackie Miles	Jenny Walsh Brooke Marshall	Brooke Marshall
Final v1	27/11/12	Deb Frazer	Brooke Marshall	Brooke Marshall
Draft v2	11/11/13	Mark Free Kelly Simpson Jacqui Coughlan Brenton von Takach Dukai	Jacqui Coughlan	Brooke Marshall
Final v2	10/12/13	Brenton von Takach Dukai	Jacqui Coughlan	Brooke Marshall

ngHENvironmental prints all documents on environmentally sustainable paper including paper made from bagasse (a by-product of sugar production) or recycled paper.

ngHENvironmental is a registered trading name of ngHENvironmental Pty Ltd; ACN: 124 444 622.
ABN: 31 124 444 622

18/21 mary st surry hills nsw 2010 australia t (02) 8202 8333

www.nghenvironmental.com.au e ngH@ngHENvironmental.com.au

room 15, 341 havannah st (po box 434)
bathurst nsw 2795 australia
0488 820 748

suite 1, 216 carp st (po box 470)
bega nsw 2550 australia
t (02) 6492 8333

suite 1, 39 fitzmaurice st (po box 5464)
wagga wagga nsw 2650 australia
t (02) 6971 9696

unit 17/27 yellourn st (po box 62)
fyshwick act 2609 australia
t (02) 6280 5053

(po box 1037)
dunsborough wa 6281 australia
t (08) 9759 1985

ACRONYMS AND ABBREVIATIONS

AoS	Assessment of Significance
CMA	Catchment Management Authority
C'wth	Commonwealth Government of Australia
DoE (formerly DSEWPaC)	Department of Environment (formerly Department of Sustainability, Environment, Water, Population and Communities)
Durridgere SCA	Durridgere State Conservation Area
EEC	Endangered Ecological Community – as defined by either the NSW <i>Threatened Species Conservation Act 1995</i> or Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i> .
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i> (C'wth)
ha	hectares
km	kilometres
IBRA	Interim Biogeographic Regionalisation Australia
m	metres
Mgt	Management, e.g. Bird and Bat Mgt Plan
MNES	Matters of National environmental significance under the EPBC Act
NPW Act	<i>National Parks And Wildlife Act 1974</i> (NSW)
NSW	New South Wales
OEH	(NSW) Office of Environment and Heritage, formerly Department of Environment, Climate Change and Water
POM	Plan of Management
SoC	Statement of Commitment - commitments made by the proponents that would be implemented as part of the project, if approved.
SIS	Species Impact Statement
sp/spp	Species/multiple species
TLSA	Transmission Line Study Area
TSC Act	<i>Threatened Species Conservation Act 1995</i> (NSW)

TERMINOLOGY USED IN THIS REPORT

~	Approximately.
Project Area	The entire proposal area: defined by extent of landholder boundaries for the Wind Farm Study Area and extent of all infrastructure for the Transmission Line Study Area.
Survey Area	This includes the development area, and is a buffer of 100 m either side of the centreline of the proposed transmission line. This is the area that has been assessed.
Development Area	Development footprint plus a buffer area (30 m to either side of centreline of proposed transmission line) to allow for flexibility in the siting of infrastructure.
Development Footprint	The actual area that would be occupied by project infrastructure (i.e. not including the buffer).
Indicative layout	The infrastructure layout assessed in this report. While some minor adjustments are expected during the detailed design process, prior to construction, the indicative layout is considered typical of what is proposed and has been used to calculate impact areas to assist the impact assessment.
The Proposal	The proposed wind farm and transmission line, including approximately 288 turbines and their associated infrastructure, and up to 39 km of transmission line and the associated easement and infrastructure.
Wind Farm Study Area (WFSA)	Wind farm survey area, which includes the northern section of the transmission line.
Transmission Line Study Area (TLSA)	Transmission line survey area, which includes the central and southern sections of the transmission line, south of the Wind Farm Study Area.
Threatened entity	Refers to all units listed as threatened under the EPBC Act and/ or TSC Act including species, populations and ecological communities.

CONTENTS

1	INTRODUCTION.....	1
1.1	THE PROPOSAL.....	1
1.2	OBJECTIVE OF THIS ASSESSMENT	2
1.3	APPROACH	2
1.3.1	Report Structure	2
1.3.2	Guidelines and Approach for Assessment	3
2	REGIONAL CONTEXT	6
2.1	CMAS AND IBRA SUBREGIONS	6
2.1.1	Hunter/Central Rivers CMA	6
2.1.2	Central West CMA	7
2.1.3	Namoi CMA.....	7
2.2	LANDUSE AND ISSUES COMMON TO THESE CMAS	7
2.3	LOCAL COUNCILS AND BIODIVERSITY	8
2.4	PROTECTED AREAS.....	8
2.4.1	Goulburn River National Park and Munghorn Gap Nature Reserve	8
2.4.2	Coolah Tops National Park.....	9
2.4.3	Durrigere State Conservation Area.....	10
2.4.4	Turill State Conservation Area	10
2.5	LANDSCAPE CONNECTIVITY	10
3	STATUTORY CONSIDERATIONS.....	12
3.1	NSW ENVIRONMENTAL PLANNING AND ASSESSMENT ACT 1979	12
3.2	NSW THREATENED SPECIES CONSERVATION ACT 1995	12
3.3	NSW NATIONAL PARKS AND WILDLIFE (NPW) ACT 1974	12
3.4	NSW FISHERIES MANAGEMENT (FM) ACT 1994	13
3.5	STATE ENVIRONMENTAL PLANNING POLICY NO. 44 – KOALA HABITAT PROTECTION.....	13
3.6	ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION (EPBC) ACT 1999 (CWTH)	14
4	METHODS	15
4.1	DESKTOP ASSESSMENT	15
4.1.1	Background Research	15
4.1.2	Database Searches.....	15
4.2	FIELD SURVEY METHODS	17
4.2.1	Survey Timing	17

4.2.2	Flora	17
4.2.3	Fauna	21
4.3	SURVEY EFFORT	24
4.4	WEATHER CONDITIONS DURING SURVEY PERIOD	24
4.4.1	Limitations	29
4.5	GIS MAPPING & ANALYSIS	30
4.6	LANDSCAPE CONNECTIVITY ANALYSIS	31
4.7	VEGETATION TYPE CLASSIFICATION & NOMENCLATURE	31
4.8	CONSTRAINTS ANALYSIS	31
5	RESULTS - FLORA	33
5.1	VEGETATION COMMUNITIES	33
5.2	ENDANGERED ECOLOGICAL COMMUNITIES	37
5.3	CONSERVATION-SIGNIFICANT FLORA SPECIES	38
5.4	VEGETATION CONDITION	40
5.5	NOXIOUS WEEDS	40
6	RESULTS - FAUNA	42
6.1	HABITAT TYPES AND CONDITION	42
6.1.1	Open Pasture with Scattered Trees	42
6.1.2	Woodland	42
6.1.3	Forest	43
6.1.4	Aquatic / Riparian Areas	43
6.1.5	Habitat Features	43
6.2	CONSERVATION-SIGNIFICANT FAUNA SPECIES	45
6.2.1	Database Searches	45
6.2.2	Koala – SEPP 44	48
6.3	FAUNA SPECIES RECORDED	48
6.3.1	Threatened Species	48
6.3.2	Microchiropteran Bat Results	49
6.3.3	Threatened Bat Species	50
6.3.4	Threatened Species Habitat Preference	51
6.4	ADDITIONAL REVISED TRANSMISSION LINE ROUTES SURVEYED IN 2013	51
6.4.1	Desktop Assessment of Alternative Route Section	52
6.5	KEY ECOLOGICAL ISSUES	55
6.5.1	Transmission Line Study Area Key Ecological Issues	55

7	IMPACT ASSESSMENT	56
7.1	APPROACH TO IMPACT ASSESSMENT	56
7.2	SPECIFIC PROPOSAL IMPACTS – WORST CASE SCENARIO	56
7.2.1	Interpretation of Impact Assessment Tables	56
7.2.2	Habitat Loss (Vegetation Clearing)	57
7.2.3	Habitat Loss (Microchiropteran Bats)	65
7.2.4	Indirect and Peripheral Impacts	66
7.3	COMPARISON OF ROUTE OPTIONS	67
7.3.1	Summary of Route comparison	67
7.4	THREATENED SPECIES / COMMUNITIES WITH POTENTIAL FOR IMPACT	69
8	SIGNIFICANCE OF IMPACTS	72
8.1	ASSUMPTIONS	72
8.2	FLORA AND VEGETATION COMMUNITIES	72
8.2.1	Summary of Assessment Outcomes	72
	BOX GUM WOODLAND	73
	CONCLUSION – EPBC ACT	73
8.3	FAUNA	74
8.3.1	Summary of Assessment Outcomes	74
	CONCLUSION – TSC ACT	75
8.3.2	Conclusion	76
9	RECOMMENDATIONS	78
9.1	MEASURES TO AVOID IMPACT	78
9.2	MEASURES TO MINIMISE IMPACT	79
9.3	MEASURES TO OFFSET IMPACT	83
9.4	DECOMMISSIONING	85
10	CONCLUSION	86
11	REFERENCES	90
APPENDIX A	DIRECTOR GENERAL REQUIREMENTS	A-I
APPENDIX B	SPECIES LISTS AND HABITAT ASSESSMENT DATA	B-I
APPENDIX C	THREATENED SPECIES EVALUATIONS	C-I
APPENDIX D	ASSESSMENTS OF SIGNIFICANCE	D-I
APPENDIX E	MAPS	E-I
APPENDIX F	OFFSET STRATEGY	F-I
APPENDIX G	TEAM QUALIFICATIONS AND EXPERIENCE	G-I

APPENDIX H EXAMPLE DATA SHEETH-II

TABLES

Table 1-1 Director–General’s Requirements (OEH) and Environmental Assessment Requirements (Dept. of Planning) and corresponding report reference.4

Table 4-1 Six-point condition class scale for grassy woodland communities20

Table 4-2 Six-point condition class scale for shrubby forest communities.....20

Table 4-3 Weather data recorded at Merriwa weather station during the field surveys 2012 and 2013...25

Table 4-4 Transmission line flora effort summary.27

Table 4-5 Transmission line fauna effort summary.27

Table 4-6 Constraint classes.....32

Table 5-1 Conservation status of natural vegetation types in the Transmission Line Study Area.....36

Table 5-2 Threatened flora species that could possibly occur in the Transmission Line Study Area.39

Table 6-1 Habitat features present at each habitat assessment site within the Transmission Line Study Area.....44

Table 6-2 Value of habitat features for fauna groups at each habitat assessment site within the Transmission Line Study Area.44

Table 6-3 Threatened or migratory listed species that could occur (possible) in the Transmission Line Study Area.....45

Table 6-4 Threatened species recorded during field surveys within the Transmission Line Study Area....48

Table 6-5 Species recorded during bat detection surveys in the Transmission Line Study Area49

Table 6-6 Number of threatened bat species calls recorded in the Transmission Line Study Area (2012 results).50

Table 6-7 Number of threatened bat species calls recorded in the Transmission Line Study Area (2013 results).50

Table 6-8 Habitat utilisation by threatened species in the Transmission Line easement areas.....51

Table 7-1 Estimated worst-case clearing extents of the proposal by vegetation type, based on each infrastructure layout option within the Transmission Line Study Area.....60

Table 7-2 Clearing of vegetation types by condition class based on each infrastructure layout option within the Transmission Line Study Area.....61

Table 7-3 Proposed vegetation clearing of TSC Act EEC and EPBC Act CEEC based on the worst case scenario across the entire project area including both the Wind Farm Study Area and the Transmission Line Study Area.64

Table 7-4 Overall extents of biodiversity constraints relating to the three potential transmission line routes, with the Wind Farm and Transmission Line Study Areas grouped for the EEC calculations.....68

Table 7-5 Species with a moderate risk of impact from the proposal, and identification of impact types.69

Table 9-1 Design, construction and operational measures to minimise impacts for the Liverpool Range wind farm proposal.....80

Table 9-2 Offset measures to maintain or improve biodiversity for the Liverpool Range wind farm proposal.84

1 INTRODUCTION

1.1 THE PROPOSAL

The proposed Liverpool Range Wind Farm project, incorporating the wind farm transmission line, ('the Project') is located between the towns of Coolah and Ulan, approximately 370 km northwest of Sydney, on the Liverpool Range, central NSW (refer Appendix E.1 for Site Location Plan). The Project Area for the Liverpool Range Wind Farm, illustrated in Appendix E.1, would be located across the Warrumbungle, Upper Hunter, Liverpool Plains and Mid-Western Regional Local Government Areas (LGAs). The wind turbines would be primarily located in the Warrumbungle and Upper Hunter Regional LGAs. The Project Area is approximately 40 km (east-west) by 50 km (north-south) and occurs within three Catchment Management Authority (CMA) regions:

- 1) Central West CMA;
- 2) Hunter Central Rivers CMA; and
- 3) Namoi CMA.

The Proposal would directly involve a large number of properties that are currently used for agriculture and grazing purposes, as well as State Conservation Areas and road reserves.

The entire project includes the following infrastructure components:

- Up to 288 wind turbine generators including associated electrical generators (three blades mounted on a tubular tower (165 m));
- High voltage 33 kV transmission line and easement located between Ulan and Cassilis (easement is up to 30 m either side of the transmission line, and up to 38.2 km in length);
- Construction of substations and maintenance facilities;
- Creation of new access tracks and widening of existing tracks; and
- Upgrades to existing public roads.

The indicative infrastructure layout and survey area for the project are mapped in Appendix E.2.

The operational phase of the project would require site access for personnel by light truck or standard 4WD vehicles on a regular basis. A number of permanent onsite staff may be required. The operational life of the wind farm is 30 years, at which time the wind farm may be recommissioned (infrastructure upgraded) or decommissioned (removal of all above ground infrastructure).

The design and layout of the project has been refined based on the findings of the initial 2012 Biodiversity Assessment as well as other considerations. These refinements include:

- Deletion of a number of proposed turbine locations in the far north-eastern corner of the Wind Farm due to identification of areas of high ecological significance.
- Identification of additional potential options (Appendix E) for location of the Transmission Line route in the southern part of the Project area:
 - Preferred route – the route that was surveyed in 2012
 - Alternative route – a potential route surveyed in 2013
 - 2nd Alternative route – a second potential route surveyed in 2013

1.2 OBJECTIVE OF THIS ASSESSMENT

A Biodiversity Assessment of the project has been completed by **ng**h environmental (this report). The assessment aims to provide an ecological impact assessment in accordance with the Director-General's Requirements (DGRs) and Environmental Assessment Requirements (EARs) for the Liverpool Range Wind Farm and NSW and Commonwealth legislation relating to threatened and protected species for the project. Specifically, the assessment:

- Identifies threatened species, populations and communities listed under NSW and Commonwealth legislation that have the potential to occur on site;
- Maps existing vegetation type and condition;
- Documents survey methods and effort;
- Demonstrates a design philosophy of impact avoidance, particularly on ecological values of high significance;
- Provides a worst case estimate of vegetation to be cleared, with a break down by vegetation type;
- Assesses the significance of proposed impacts to native vegetation, listed threatened species, populations and communities and their habitats, including consideration of habitat connectivity and wind-farm specific impacts such as blade-strike;
- Where required, includes details of how flora and fauna impacts would be managed during the construction and operation phases of the project;
- Demonstrates how the project achieves a biodiversity outcome consistent with "maintain or improve" principles;
- Addresses the risk of weed spread and identifies suitable mitigation measures to address the risk; and
- Determines the offsetting requirements and identifies suitable offset areas.

This report documents the findings of onsite ecological studies undertaken for the purposes of impact assessment. The report incorporates relevant information from the *Preliminary Ecological Investigation* (**ng**h environmental 2009) as well as providing an impact assessment pursuant to NSW and Commonwealth guidelines for threatened entities within the Project Area. A summary of relevant legislative considerations are given in Section 3.

1.3 APPROACH

1.3.1 Report Structure

This Biodiversity Assessment for the Liverpool Range Wind Farm project focussed on two broad areas:

- 1) All infrastructure associated with the wind farm area (Wind Farm Study Area); and
- 2) All infrastructure associated with the high voltage (33 kV) transmission line (Transmission Line Study Area).

Given the size of the Project Area, two reports have been created; one for the Wind Farm Study Area and one for the Transmission Line Study Area. Each report can be considered a standalone document, as the key ecological issues for each study area differ in many respects. Where impact assessments and associated quantitative calculations are required to provide a holistic interpretation of ecological impacts, the two study areas have been assessed as a single entity, and the results presented in both reports.

Interpretation of maps

Map sets presenting survey effort, survey results, and biodiversity constraints are provided for each study area. Each map set contains an overview map and a set of detailed maps. The overview map shows the order in which the detailed maps are referenced and their location within the study area. Each detailed map contains a grid reference which has been used to identify specific areas discussed within the body of the report.

When locations are referenced within the report, they are preceded by a code WF (Wind Farm) or TL (Transmission Line) to denote the relevant study area, then a number (denoting the map sheet), then the grid reference (denoting the exact location). For example, the reference 'WF3_A10' refers to the Wind Farm Study Area, map sheet 3, grid reference A10.

1.3.2 Guidelines and Approach for Assessment

The proposal will be assessed under Part 3A of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act), in line with *State Environmental Planning Policy. (Major Projects) 2005*.

DGRs were issued on 31 March 2011 and supplementary DGRs were issued on 16 August 2011 by the NSW Department of Planning and Infrastructure. Recommended EARs were issued by Department for Environment, Climate Change and Water, now Office for Environment and Heritage (OEH) on 24 March 2011 (refer to Appendix A for a copy of the DGRs and EARs).

The DGRs and EARs relevant to the Biodiversity Assessment have been listed in Table 1-1, and reference made to the section of this report where each has been addressed.

Specific guidelines used in the preparation of this report include:

- *Draft Guidelines for Threatened Species Assessment* (DEC, 2005);
- *Biodiversity Offset Principles* (OEH);
- *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities, Working Draft* (Department of Environment and Conservation NSW, November 2004);
- *National Wind Farm Development Guidelines – public consultation draft* (EPHC 2009); and
- *Australian Wind Energy Association Best Practice Guidelines* (AusWind 2006).

Specifically, this report includes consideration of:

- Impacts to native vegetation;
- Impacts of blade strike on birds and bats;
- Impacts associated with development near to National Parks or State Reserves;
- Management of identified impacts (including details of adaptive management protocols and ability to obtain achievable offsets); and
- Measures to avoid, mitigate and offset impacts, with the objective of ensuring an overall 'improve or maintain' environmental outcome for the proposal.

Table 1-1 Director–General’s Requirements (OEH) and Environmental Assessment Requirements (Dept. of Planning) and corresponding report reference.

Director–General’s Requirement (Dept. of Planning)	Report Reference
Identify threatened species, populations and communities listed under both State and Commonwealth Legislation with potential to occur on site.	Flora: Sections 5.3 & 7.1, 7.2 Fauna: Sections 6.3.1 & 7 Threatened Species Evaluations: Appendix C
Map vegetation by community types and condition.	Map Sets: Appendix E
Mapping should include any Environmentally Sensitive Area Mapping held by the four LGAs.	Not Available from LGAs
Provide details of survey methodology, including survey effort.	Methods: Section 4.2 Survey Effort: Section 4.4
Demonstrate a design philosophy of impact avoidance on ecological values, in particular areas of high significance.	Recommendations: Section 10
Provide a worst case estimate of vegetation clearance (ha).	Impact Assessment: Section 8.2
Assess the significance of impacts to native vegetation, listed threatened species, populations, and communities and their habitats, with consideration for local connectivity and distribution of species.	Impact Assessment: Section 8 Significance of Impacts: Section 9 Assessments of Significance: Appendix D
Include details of how flora and fauna impacts would be managed during construction and operation including adaptive management, rehabilitation, regeneration measures and maintenance protocols.	Recommendations: Section 10
Demonstrate how the proposal achieves a biodiversity outcome consistent with ‘maintain or improve’ principles.	Recommendations: Section 10 Assessments of Significance: Appendix D Offset strategy: Appendix F
Address the risk of weed spread and identify mitigation measures.	Noxious Weeds: Section 5.5 Recommendations: Section 10
Environmental Assessment Requirement (OEH)	Report Reference
1) The EA should include a detailed Biodiversity Assessment	Entire Report
2) A field survey of the site should be conducted in accordance with the relevant guidelines (<i>Threatened Biodiversity and Assessment Guidelines for Developments and Activities</i>).	Methods: Section 4
3) Describe the potential nature of barotrauma impacts on threatened bat species and mitigation measures to avoid or mitigate these impacts	Impact Assessment: Section 8 Significance of Impacts: Section 9 Assessments of Significance: Appendix D
4) The EA should contain the following:	
4a) The requirements set out in the <i>Guidelines for Threatened Species Assessment</i>	Methods: Section 4 Impact Assessment: Section 8 Significance of Impacts: Section 9 Assessments of Significance: Appendix D
4b) Description and geo-referenced mapping of study area (survey locations, vegetation communities, key habitat, location of threatened species, populations and ecological communities present)	Map sets: Appendix E
4c) Description of survey methodologies used, including timing, location and weather conditions	Methods: Section 4 Map sets: Appendix E
4d) Qualifications and experience of Biodiversity Assessment team	Appendix G

4e) Identification of national and state listed threatened biota known or likely to occur in the study area and their conservation status	Flora: Sections 5.2. 5.3 Fauna: Sections 6.2, 6.3 & 7.1.2 Threatened Species Evaluations: Appendix C
4f) Description of likely impacts of the proposal on biodiversity and wildlife corridors (indirect, direct, construction, operational impacts)	Impact Assessment: Section 8 Significance of Impacts: Section 9 Assessments of Significance: Appendix D
4g) Identification of the avoidance, mitigation and management measures that will be put in place as part of the proposal to minimise impact	Impact Assessment: Section 8 Recommendations: Section 10 Offset Strategy: Appendix F
4h) Description of the residual impacts of the proposal. If the Proposal cannot adequately avoid or mitigate impacts on biodiversity, then a biodiversity offset package is expected.	Offset Strategy: Appendix F
4i) Provision of specific Statement of Commitments relating to biodiversity	Recommendations: Section 10
5) An Assessment of Significance of direct and indirect impacts of the proposal	Impact Assessment: Section 8 Significance of Impacts: Section 9 Assessments of Significance: Appendix D
6) Proposal of offset package should:	
6a) Meet DECCW's <i>Principles for the use of biodiversity offsets in NSW</i>	Offset Strategy: Appendix F
6b) Identify conservation mechanisms to ensure the long term protection and management of the offset sites	Recommendations: Section 10 Offset Strategy: Appendix F
6c) Include an appropriate management plan to be developed as a key amelioration measure to ensure offsets, management measures, monitoring programs are appropriately managed and funded	Recommendations: Section 10
7) Where appropriate, likely impacts on any adjoining and/or nearby DECCW estate reserved under the <i>National Parks and Wildlife Act 1974</i>	Impact Assessment: Section 8
8) Identification of any Matters of National Environmental Significance under the <i>Environment Protection and Biodiversity Conservation Act 1999</i>	EPBC Act: Section 3.6 Impact Assessment: Section 8 Significance of Impacts: Section 9 7 Part tests: Appendix D

2 REGIONAL CONTEXT

The installation and operation of wind farms have the following characteristics that make it necessary to examine a broad environmental context when assessing their impact:

- Turbine arrays may cover multiple ridge tops in an area;
- Turbine arrays may affect migration paths / movement corridors of local and non-local birds and bats;
- The transmission easements required to connect the wind farms to the electricity grid can be long, potentially fragmenting areas of habitat for flora and fauna;
- Avoidance behaviours by birds may result in indirect loss of habitat if the entire wind farm envelope is avoided.

The information provided within this section was considered in developing the survey plan for the Project Area, including which threatened or high-risk species and/or communities to target and the methods applied. The information has also been considered when assessing impacts in relation to how the potential impact from the proposal may affect important regional resources and the dispersal or movement of native flora and fauna beyond the immediate Development Footprint.

While outside of the scope of the Biodiversity Assessment, it should also be acknowledged that as a renewable energy project, the proposed development would assist in the mitigation of rising greenhouse gas emissions, and thereby the future impact of climate change, by providing a source of energy that is not dependent on the burning of fossil fuels. Therefore, long term outcomes of the proposal are also likely to have positive impacts on biodiversity, due to the potential changes in community composition and species declines that have been linked to climate change.

2.1 CMAS AND IBRA SUBREGIONS

The Interim Biogeographic Regionalisation Australia (IBRA) provides an Australia-wide regionalisation for patterns of biodiversity based on climate, geomorphology, landform, lithology and other characteristics (Environment Australia 2000). Each of the 89 IBRA regions is divided into subregions, which group biogeographic patterns at a higher resolution.

The Project Area lies within three Catchment Management Authorities (CMA) and three IBRA subregions. Wind farm:

- Hunter/Central Rivers CMA (Liverpool Range and Pilliga IBRA subregions)
- Central West CMA (Liverpool Range and Pilliga IBRA subregions)
- Namoi CMA (Liverpool Range IBRA subregion)

Transmission line:

- Hunter / Central Rivers CMA (Kerrabee and Pilliga IBRA subregions)
- Central West CMA (Pilliga IBRA subregion)

2.1.1 Hunter/Central Rivers CMA

The Kerrabee and Pilliga subregions of the Hunter/Central Rivers CMA include the sandstone of the Great Dividing Range and the open grasslands and woodlands of the Upper Hunter. In the Hunter-Central Rivers CMA region there are currently 313 threatened entities listed under the NSW *Threatened Species*

Conservation Act 1995 (TSC Act) plus 8 species listed on the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Of the 313 NSW listings there are 178 vulnerable species, 69 endangered species, 12 critically endangered species, 13 endangered populations, 29 endangered ecological communities (EECs) and two vulnerable ecological communities. The Hunter-Central Rivers CMA is also subject to 35 key threatening processes.

2.1.2 Central West CMA

The Central West CMA covers a wide diversity of landforms and vegetation, with more than 550 vertebrate species recorded in the catchment and 3183 species of plants in 81 broad vegetation types. The soil and land types range from sandstones to granites and basalts.

Before European settlement the catchment supported a complex mosaic of forests, temperate and semi-arid woodlands, wetlands, shrub lands, heaths and grasslands. Clearing and subsequent degradation have reduced this natural vegetation cover to a large number of small, isolated remnants on the less fertile and productive soils. For example, the Box and Ironbark woodlands which originally occupied large parts of the slopes and plains have been reduced by as much as 90%, and are now among the most significantly altered plant communities in NSW.

In the Central West CMA region there are currently 154 threatened entities listed under the TSC Act plus five species listed on the EPBC Act. Of the 154 NSW listings there are 93 vulnerable species, 40 endangered species, 3 critically endangered species, and 11 EECs. The Central West CMA Region is also subject to 33 key threatening processes.

2.1.3 Namoi CMA

The catchment is bounded by the Great Dividing Range in the east, the Liverpool Range and Warrumbungle Range in the south, and the Nandewar Range and Mt. Kaputar to the North. The catchment covers a wide diversity of landforms and vegetation, with 91 broad vegetation types, including EECs, such as Box Gum woodlands and native grasslands.

In the Namoi CMA region there are currently 150 threatened entities listed under the TSC Act plus four species listed on the EPBC Act. Of the 150 NSW listings there are 85 vulnerable species, 27 endangered species, four critically endangered species, one endangered population, and 15 EECs. The Namoi CMA is also subject to 33 key threatening processes. In particular, the Pilliga region of the Namoi is also home to the largest population of Barking owls (listed as vulnerable) in Southern Australia. The Namoi is home to a large number of threatened woodland birds such as the endangered Regent Honeyeater and the vulnerable Grey-crowned Babbler.

2.2 LANDUSE AND ISSUES COMMON TO THESE CMAS

The Project Area is largely agricultural, characterised by intensively modified broad floodplains (used for cereal cropping and grazing) beneath broad basalt ridges (grazing). The midslopes contain the majority of the remnant native vegetation, from sparse to densely treed woodlands.

In particular, the composition and structure of vegetation types within the Project Area has been modified as a result of managed stock grazing as well as grazing by feral goats. Large numbers of feral goats, foxes and rabbits were observed in the Project Area and continue to have a deleterious effect on native vegetation. When goats, rabbits, and stock occupy the same area the resultant combined grazing

pressure inhibits plant regeneration on a broad scale. The high abundance of foxes within the Project Area contributes to reduction of fauna biodiversity in an already compromised landscape.

Overall, key biodiversity issues in all CMAs include: grazing levels that exceed land capacity, habitat degradation and fragmentation, increasing dryland salinity, loss of native vegetation (i.e. clearing of native woodlands and grasslands) and invasive pest species (foxes, goats, environmental, agricultural and noxious weeds), and conserving remnant vegetation on private lands (CMA 2012).

2.3 LOCAL COUNCILS AND BIODIVERSITY

The Project Area covers four (LGAs): Warrumbungle, Upper Hunter, Liverpool Plains, and Mid-Western Regional.

Liverpool Plains Shire has endorsed a Biodiversity Strategy for the Liverpool Plains focusing on maintaining and improving biodiversity within the region (ELA 2010). The Liverpool Plains LGA is contained within the Namoi River Catchment, with a common boundary with the Upper Hunter. As the Liverpool Plains LGA is largely agricultural with both cropping and grazing the need for conservation of natural landscapes is increasingly important.

Liverpool Plains Shire has a variety of biodiversity assets and supports 25 vegetation communities, of which eight are endangered under the TSC Act, and several threatened flora (2 TSC Act, 3 EPBC Act listed species) and fauna species (19 bird species, 20 mammal, 1 reptile species listed under the TSC Act). Of the vegetation communities recorded within the LGA, several fall into the category of the state- and nationally-threatened Box Gum Woodland, which is also found within the Liverpool Range Wind Farm Study Area. This EEC includes White Box - Yellow Box - Blakely's Red Gum Woodland, which is one of the most locally abundant vegetation types identified for the LGA, covering 77,900 ha (ELA 2010).

The biodiversity strategy identifies several threats to the LGA, the most serious threats include land clearing, weeds, feral animals, and inappropriate fire regimes. Land clearing, weed and feral animal proliferation is the most obvious threat associated with agricultural practices, especially within the Liverpool Range Wind Farm Project Area. In turn, there is opportunity for this proposal to play an active role in management of the above threats and for development to also result in a positive outcome.

Many of the biodiversity assets and threatened entities are also found in the surrounding LGAs, and the conclusions of the Liverpool Plains Shire Biodiversity Strategy are also generally relevant to the Warrumbungle, Upper Hunter and Mid-Western Regional LGAs.

2.4 PROTECTED AREAS

Goulburn River National Park (NP) is present within the Transmission Line Project Area along with a number of State Conservation Reserves and large patches of remnant vegetation, including Munghorn Gap Nature Reserve, Durrigere State Conservation Area (SCA), and Turill SCA. These areas have environmentally important features, and provide habitat for several threatened species including nocturnal birds, woodland birds, and microchiropteran bats. The value of each protected area is explained in more detail below.

2.4.1 Goulburn River National Park and Munghorn Gap Nature Reserve

Goulburn River National Park lies approximately 1.5 km south-east of the transmission line easement. The Park covers approximately 70 100 ha. It extends along approximately 90 km of the Goulburn River.

The Central Goulburn Valley group of land systems, of which Goulburn River National Park occupies a large proportion, is dominated by the Goulburn River and its headwaters. Munghorn Gap Nature Reserve lies approximately 4.5 km south of the transmission line easement. The Reserve lies approximately 34 kilometres north-east of Mudgee, adjacent to Goulburn River National Park. The reserve covers approximately 5 900 ha.

The national park and nature reserve are botanically significant as they form part of a transitional zone containing a mixture of plants from the south-east, north-west and western parts of the State; a variety of plant species endemic to the Sydney Sandstone reach their northern and western limits in the Park. Threatened fauna including the Brush-tailed Rock Wallaby, New Holland Mouse, Square-tailed Kite, Powerful Owl, Large Pied Bat, Common Bent-winged Bat, Swift Parrot, Turquoise Parrot, Painted Honeyeater, Glossy-black Cockatoo, Red-tailed Black, Cockatoo, Malleefowl, Regent Honeyeater and the Broad-headed Snake are thought to occur in the park (NSW National Parks and Wildlife Service, November 2002).

2.4.2 Coolah Tops National Park

Coolah Tops National Park lies approximately 2 km east of the Wind Farm Study Area, and thus is not particularly close to the Transmission Line Study Area, which is further to the south. The Park is one of a series of conservation reserves sampling the basalt country of the Mount Royal and Liverpool Range and is approximately 12 000 ha in area. Located at the junction of the Liverpool and the Warrumbungle Range, Coolah Tops provides a link between the more easterly basalt reserves and Warrumbungle National Park to the northwest.

The Coolah Tops National Park Plan of Management (POM) attributes the regional conservation significance of the park to the following reasons:

- It protects an area of tall montane forest on basalt;
- It lies on a westerly extension of the northern tablelands and thus supports different plant and animal communities to other basalt reserves in the region;
- It has small areas of old growth forest and extensive areas of structurally well-developed Snow Gum including the largest recorded individuals of this species;
- The endangered Grassy White Box Woodland community and the rare plants *Discaria pubescens* and *Teucrium* sp. are found in the park, and it has significant populations of the poorly reserved Silvertop Stringybark and Mountain Ribbon Gum;
- It provides optimum habitat for arboreal mammals, including large populations of The Greater Glider;
- The threatened Regent Honeyeater, Glossy Black Cockatoo, Powerful Owl, Barking Owl, Masked Owl, Common Bent-Wing Bat and Large Pied Bat are found in the park; and
- Many species of native animals are at or near the western limits of their distribution in the park and the park protects the headwaters of several major rivers and creeks (NSW National Parks and Wildlife Service, November 2002; Kavanagh 1995).

2.4.3 Durridgere State Conservation Area

Dependent on the final transmission line route, Durridgere State Conservation Area (Durridgere SCA) will either lie approximately 1.2 km east of the easement, or fall directly in the easement. The SCA was created in 2005 and covers approximately 5 463 ha. Durridgere SCA lies north of Ulan and east of Ulan Road. Durridgere SCA provides a link between the forested areas within private lands to the west and Goulburn River National Park to the south. Prior to its dedication as a state conservation area Durridgere was used as a state forest and heavily logged. As a consequence a mosaic of regrowth and more mature forest (including hollow-bearing trees) exist within the area.

The broad vegetation types of the Conservation Area include Dry Sclerophyll Forest, Grassy Woodlands, and Semi-arid Woodlands. The SCA is known to support several threatened birds (owls and woodland birds) and microbat species. Regularly recorded threatened birds include Varied Sittella, Speckled Warbler, Grey-crowned Babbler, Glossy Black-cockatoo and Barking Owl. As with Goulburn River NP, a number of species endemic to the Sydney region reach their western limit here, a good example of which is the Rock Warbler (*Origma solitaria*).

2.4.4 Turill State Conservation Area

Turill SCA is found towards the northern end of the Transmission Line Study Area and south of the Wind Farm Study Area. It covers an area of approximately 996 ha, making it approximately 18% of the size of Durridgere SCA. The majority of Turill SCA consists of undulating Pilliga sandstone, although there is at least one area in the southwest corner where the underlying rock is basalt. The sandstone areas of the SCA are vegetated with Sandstone Forest communities consisting of Ironbarks and Cypress Pines, and where basalt is present, the vegetation becomes typical Box Gum Woodland. In the immediate vicinity of creeklines the vegetation becomes more of an open Riparian Woodland community containing Rough-Barked Apples (*Angophora floribunda*), Blakely's Red Gum (*Eucalyptus blakelyi*), and Yellow Box (*Eucalyptus melliodora*). The vegetation within Turill SCA is known to contain a number of flora species found at their eastern or western limits, and also provides habitat for a mix of coastal and inland bird species.

2.5 LANDSCAPE CONNECTIVITY

The term 'landscape connectivity' describes the broad spatial configuration of areas of vegetated lands and includes a consideration of barriers to connectivity such as roads, clearing and rows of turbines (Lindenmayer & Fischer 2006; Brett Lane & Associates 2009). Connectivity is maintained through intact forest and woodland, 'corridors' of vegetation and 'stepping stones' (i.e. scattered trees; or patches of shrubs or trees that act as stepping stones across an otherwise cleared landscape). Such connectivity may be used by fauna to traverse generally inhospitable landscapes, allowing for immigration and emigration from populations that may not otherwise occur. This may help to alleviate issues such as inbreeding depression and the effects of demographic stochasticity that can increase the risk of extinction for isolated or small populations. However, it has also been suggested that corridors may also transmit contagious diseases between habitat patches, expose native fauna to predators, exotic and domestic animals and poachers, and produce other negative effects (Simberloff & Cox 1987).

The Project Area comprises a series of broad ridges and valleys, within the Liverpool Range. Aerial imagery demonstrates the site itself varies between cleared and sparsely treed areas of vegetation. At a local scale the Project Area is densely treed to the north, north-east of the wind farm (Coolah Tops National Park and surrounding private landholdings) and at the southern end of the transmission line.

At a regional scale, the Project Area can be seen to be located with a loop of connecting woodland and forested habitat. Vegetation in the northern tip of the Project Area facilitates east-west linkages towards areas of forest to the east (Coolah Tops National Park). Vegetation in the southern sections of the Project Area facilitate east-west and southern connectivity to extensive areas of protected forest (Durridgere SCA, Goulburn River National Park and Wollemi National Park).

Between the Project Area and the additional forested areas to the east, vegetation is patchy. This pattern of habitat and connectivity, while patchy and therefore compromised in some locations, may allow for an increased level of fauna activity within the Project Area. Particularly for fauna, such as birds and bats, which are highly mobile and have large ranges, and for species that are tolerant of some level of disturbance (clearing and habitat modification).

3 STATUTORY CONSIDERATIONS

3.1 NSW ENVIRONMENTAL PLANNING AND ASSESSMENT ACT 1979

The EP&A Act provides for a co-ordinated approach to development and includes the objective to encourage protection of the environment including threatened species, populations and ecological communities listed under the TSC Act. Section 5A of the EP&A Act provides a list of factors that must be considered in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats. While not required for Part 3A assessments, they are a systematic and transparent means to characterise impacts, allowing for the development of mitigation measures to avoid a significant impact.

The proponent obtained DGRs to guide the assessment of impacts of the Liverpool Range Wind Farm under Section 75F, Part 3A of the EP&A Act. Part 3A has since been repealed but transitional arrangements are in place to deal with such projects. It is understood that the submission will be assessed by the NSW Department of Planning and Infrastructure, under the provisions of Part 3A.

The recommendations in this report would form Statements of Commitment (SoCs), formulated to avoid impacts where possible, minimise where avoidance is not possible and offset residual impacts to ensure the 'improve or maintain' environmental outcome is met.

3.2 NSW THREATENED SPECIES CONSERVATION ACT 1995

The TSC Act lists threatened flora and fauna species, populations and ecological communities ('threatened entities') and key threatening processes in Schedules 1 through to 3. The TSC Act gives provisions for recovery plans, threat abatement plans and action statements. The Director-General (D-G) for the Office of Environment and Heritage (within the Department of Premier and Cabinet) must consider the effect of the proposal based on the factors listed in Section 94, which match those in Section 5A of the EP&A Act (assessment of significance). The D-G may grant a licence to harm threatened entities, which may include conditions.

This report considers threatened entities and critical habitat that may occur in the Project Area and the affect that the proposal may have upon them, including key threatening processes. Assessments of significance are undertaken in accordance with the *Threatened Species Assessment Guidelines: the assessment of significance* (DEC 2007).

3.3 NSW NATIONAL PARKS AND WILDLIFE (NPW) ACT 1974

The D-G for the Office of Environment and Heritage (within the Department of Premier and Cabinet) is the authority for the protection and care under the *NSW National Parks and Wildlife Act 1974* (NPW Act) of protected fauna (Part 7) and native plants (Part 8), including threatened entities (Part 8A). This report considers threatened fauna and flora that may occur in the Project Area and the affect that the proposal may have upon them.

The NPW Act also provides a mechanism for conservation on private land under Part 4 Division 69. A Conservation Agreement provides legally binding protection for private land, with conditions attached to the land title.

The proponent commits to securing a formal vehicle to manage an offset site in perpetuity; however a Property Vegetation Plan rather than a Conservation Agreement is proposed. Property Vegetation Plans are set up by catchment management authorities and are attached to the land title. The offset strategy outline is provided in Appendix C to ensure that an overall ‘maintain or improve’ outcome is met for the proposal.

3.4 NSW FISHERIES MANAGEMENT (FM) ACT 1994

The *Fisheries Management Act 1994* (FM Act) aims to conserve fish stocks and key fish habitats including threatened species, populations and ecological communities of fish and marine vegetation. The FM Act is administered by the D-G of the Department of Industry and Investment. There are a range of activities that may come under the jurisdiction of this act.

The FM Act covers freshwater and marine habitats and species. Freshwater includes any body of freshwater that is naturally or artificially stored. Any dredging or reclamations works (which includes removing material from land submerged by water, filling in or depositing any material onto land submerged by water or draining water to reclaim land) requires consideration under the FM Act, unless it is an artificial waterbody not connected to a natural waterbody.

Division 8 provides that the passage of fish must not be blocked by obstructions unless a permit under the Act has been obtained. This affects proposals that include water crossings.

Part 7A provides for the listing of threatened species, populations and ecological communities (threatened entities) and key threatening processes. Any development should consider harm to threatened entities as required by the EP&A Act.

3.5 STATE ENVIRONMENTAL PLANNING POLICY NO. 44 – KOALA HABITAT PROTECTION

This policy encourages the conservation and management of natural vegetation that provides habitat for Koalas. Koalas are listed under the TSC and EPBC Acts as a vulnerable species. Liverpool LGA is subject to this State Environmental Planning Policy No. 44 – Koala Habitat Protection (SEPP 44); this LGA is the only shire of the four LGAs detailed on Schedule 1 of the Policy. Liverpool LGA cannot approve development in an area affected by the policy without an investigation of core koala habitat. SEPP 44 aims to identify areas of potential and core Koala Habitat. These are described as follows:

- **Potential Koala Habitat:** areas of native vegetation where the trees listed in Schedule 2 of SEPP 44 constitute at least 15% of the total number of trees in the upper or lower strata of the tree component; and
- **Core Koala Habitat:** an area of land with a resident population of Koalas, evidenced by attributes such as breeding females, and recent and historical records of a population.

This report considers whether any part of the Project Area could be described as potential or core koala habitat under SEPP 44.

3.6 ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION (EPBC) ACT 1999 (CWTH)

The EPBC Act aims to conserve native flora and fauna species of national conservation significance including threatened and migratory species, communities and populations, termed 'Matters of National Environmental Significance' (MNES). If there is potential for a MNES to be impacted because of a proposed development, the nature and potential magnitude of impact must be characterised according to the *Significant Impact Guidelines* (2006). This will determine whether an action is likely to have a significant impact on MNES, in which case the proposal must be referred to the Federal Minister for assessment and approval.

A protected matters search was completed for MNES of which 26 threatened species, five vegetation communities, 14 migratory birds, and one wetland of international importance was returned (Hunter Estuary Wetlands). The Hunter Estuary Wetland is situated on the northern edge of Newcastle and is not considered further in this assessment as it will not be affected by the proposal. Threatened species evaluations were undertaken and are provided in Appendix C. The proposal was not considered to have a significant impact on any listed EPBC threatened species. There is potential for impact on one Critically Endangered Ecological Community (CEEC), *White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland* and further assessment was applied to this community (refer to Sections 10 and 11, Appendix D).

4 METHODS

4.1 DESKTOP ASSESSMENT

4.1.1 Background Research

Existing information relevant to the proposal was reviewed, including:

- Aerial imagery;
- DoE (formerly DSEWPaC) website for Species Profiles and Threats (SPRATs), recovery plans, conservation advices and policy statements for nationally-listed species and ecological communities;
- Birds Australia and Shorebirds 2020 websites; and
- Web-based literature, journal articles and other published information on bird migration patterns and bird collision risk associated with wind turbines (cited in the text where used).

This information was used to build a picture of:

- Native vegetation types within the Project Area and immediate surrounds;
- Previous survey effort in the area;
- Vegetation associations present (including associations of significance);
- Flora and fauna species (including species of national, state or local conservation significance) known or likely to occur in the area;
- Potential ecological constraints and opportunities for the proposal; and
- Key threatening processes (e.g. weeds, pest animals) that may require specific management.

4.1.2 Database Searches

A desktop assessment was undertaken involving database searches of NSW and Commonwealth listed entities. The desktop assessment included searches of the following databases:

- 1) *Atlas of NSW Wildlife database*, searched by the three CMAs (searched 3 October 2012). Database results returned: 46 flora species; four amphibian, 12 microbat, 54 bird, one invertebrate, 12 mammals (excluding bats), five reptile species, and six vegetation communities listed as threatened for the three CMAs.
- 2) EPBC Act *Protected Matters Search Tool*, using the Project Area boundary as the search area with a 10 km buffer ((searched 3 October 2012, updated 5 November 2013).). Database results returned included: 26 threatened species, five vegetation communities, 14 migratory birds, and one wetland of international importance.

The results of the above database searches were combined and are presented in Appendix C.

Other key web-based databases including NSW Threatened Species database, Birdlife Australia Birddata database and the Commonwealth Species Profile and Threats (SPRAT) were consulted in the preparation of this report.

Threatened Species, Populations, and Vegetation Communities Evaluations

A threatened species evaluation has been undertaken to evaluate the presence of habitat in the Project Area and the likelihood of occurrence and impact from the proposal development for each species and community returned from database searches (NSW Wildlife Atlas and EPBC Protected Matters Search). The potential for these entities to occur in the Project Area was evaluated post field work based on specific habitat preferences and Project Area characteristics.

In the evaluation, the presence of habitat rated as either:

Present: Potential or known habitat is present within the Project Area.

Marginal: Habitat present is not typical but may be suitable, or habitat is typical but condition is poor or microhabitat requirements are not present.

Absent: No potential or known habitat is present within the Project Area.

There are four categories for likelihood of occurrence:

None: Species known or predicted to occur within the locality but no suitable habitat present within the Project Area.

Unlikely: Species known or predicted within the locality. Suitable habitat may be present in the Project Area but the proximity of nearest records suggests it is unlikely to occur.

Possible: Suitable habitat present and the species could occur in the Project Area based on the proximity of nearest records.

Present: Species was recorded during the field investigations.

Based on the habitat present and the likelihood of occurrence categories above, a threatened species will be placed into one of the four categories for potential for impact:

No: The proposal would not result in an impact to this species.

Low: The proposal is unlikely to result in an impact to this species. No Assessment of Significance (AoS) is considered necessary for this species.

Moderate: The proposal could impact this species or its habitats but risks are considered highly manageable. No Assessment of Significance (AoS) is considered necessary for this species. Management measures have been developed to address the risks.

High: The proposal is likely to impact this species or its habitats. An AoS has been applied to these entities to properly characterise the impact and provide information then used to either develop management measures to protect the entity or justify avoidance of the entity.

An assessment of significance was applied to those considered a Moderate or High risk (refer to Appendix C). Therefore evaluation of threatened entities has been undertaken at two points: evaluation of likelihood of occurrence and then evaluation of risk of impact. Recommendations (Section 10) have been formulated prior to final impact assessment. Finally, in Section 11 a conclusion is drawn about the significance of impacts under the EP&A Act and the need for a referral of the proposal to the Commonwealth under the EPBC Act. The conclusion assumes the effective implementation of the stated recommendations.

4.2 FIELD SURVEY METHODS

4.2.1 Survey Timing

Two Spring-time surveys were undertaken as part of this assessment, the first in 2012 and a second survey in 2013. The 2013 survey focussed primarily on the Transmission Line and was undertaken to address specific information gaps and address new proposed route options.

Proposed routes for the transmission line corridor were revised following the 2012 survey based on the findings of the biodiversity assessment and other considerations. The 2013 survey focussed on:

- A *preferred route*, which is generally the easternmost alignment and passes through Durridgere SCA in the central part of the Study area.
- An *alternative route*, which is generally located to the west of the preferred route. This route avoids Durridgere SCA, passing through private land, including some areas of intact sandstone forest.
- A *second alternative route*, which passes through Turill SCA along the general east-west alignment of the Golden Highway and provides an alternative connection between the preferred and alternative routes.

A section of the alternative route in the southern part of the TLSA that passes through land owned by the Ulan Coal Mine could not be surveyed due to access restrictions. Detailed ecological assessment has been undertaken in recent years in this area by Umwelt (2009) and results from these assessments have been considered where appropriate.

4.2.2 Flora

Survey Personnel

The 2012 and 2013 flora surveys along the transmission line were conducted by three botanists:

- Jackie Miles (JM);
- Brenton von Takach Dukai (BvTD); and
- Kelly Simpson (KS)

Detailed Survey Methods

The flora assessment approach was designed to achieve suitable site coverage of the Transmission Line Study Area, as well as incorporate more specialised surveys to compile detailed species lists, collect data on structural and floristic characteristics and review significant flora species considered potential occurrences in the study area. The flora survey program developed for the site consists of a series of complementary assessment and survey techniques.

Prior to the commencement of the field survey program, a series of field maps were produced identifying:

- The proposed route options for the transmission line from Ulan in the south to the southern extent of the Wind Farm Study Area;
- Proposed locations of access tracks within the Transmission Line Study Area; and
- Recorded locations of threatened flora from the Atlas of NSW Wildlife.

This data was uploaded to field GPS units to allow for accurate identification of proposed infrastructure locations in the field.

These maps were analysed to ensure that the field survey would include assessment of all vegetation types and a suitable distribution of survey effort across the site. The majority of areas located within the potential impact corridor of the transmission line route options were surveyed by vehicle or on foot. Some sections of the Transmission Line Study Area could not be surveyed as a result of property access issues at the time of survey, most importantly the alternative route located within the Ulan Coal Mine Limited property. For some areas, particularly on largely cleared and disturbed ridges of the wind farm, areas were surveyed visually from neighbouring ridges or roadways due to time constraints. The survey effort maps make clear which areas were inspected and to which areas results data was extrapolated based on these inspections.

Flora plot / random meanders

Formal random meanders (after Cropper 1993) of between 15 and 45 minutes duration (depending on the vegetation condition and patch size) and each covering up to 1 ha were undertaken. A total of 47 sites were surveyed in 2012 and 90 sites in the 2013 survey, sampling each vegetation type occurring within the Transmission Line Study Area. The random meander was used in preference to standard 0.04 ha quadrats because it maximises the opportunity to detect all the species present in a particular vegetation type at a particular location and improves opportunities for detecting significant or sparsely distributed plant species. Floristic, structural and physical data were recorded as for a quadrat. Cover abundance scores according to a modified Braun-Blanquet cover abundance scale¹ were recorded for the majority of sites, with the score applying to general abundance in the area of the random meander. A copy of the Flora plot record sheet formulated for the project is provided in Appendix 11B.1

Inspections and targeted searches

In addition, the majority of the study area was inspected by vehicle to confirm vegetation types and assist with mapping the distribution of EECs. Threatened communities and areas of natural vegetation in better condition were usually assessed by a thorough random meander, while more disturbed vegetation received only a short inspection. Dominant species occurring at the sites were recorded to adequately confirm the vegetation type and condition where necessary. Another 90 locations were assessed briefly in this way during the 2012 and 2013 surveys, making a total of 180 vegetation assessment locations across the Transmission Line Study Area.

Targeted searches for potential threatened flora species were undertaken within survey sites and areas of suitable habitat where access and time constraints permitted. As part of the 2013 survey large sections of the Transmission Line route options were traversed on foot, particularly through Durridgere SCA, Turill SCA and other vegetated areas noted as being of moderate to high constraint as part of the 2012 survey. Targeted searches for potential threatened flora species were maintained at all times along these traverses.

Dedicated searches were not undertaken for threatened grass species during the surveys, as most native grasses were not flowering and therefore not identifiable in the time frame of the surveys (October). The majority of the Transmission Line Study Area is located on sandstone and does not provide suitable habitat for these grass species.

¹ modified from that described by Mueller-Dombois and Ellenberg (1974)

Understorey condition assessment

Condition assessment was undertaken at all flora plots and inspection points within the survey area. Vegetation across the broader site boundary has not been assigned a condition class as surveys of the detail necessary to ascertain condition were not undertaken in these areas. Vegetation condition was most closely assessed along the proposed transmission line.

Vegetation surveyed was rated according to a six-point condition class scale. For areas of grassy woodland such as Box Gum Woodland the condition classes focus on floristic integrity in the groundlayer (Table 4-1). For shrubby forest types encountered along the proposed Transmission Line route options, a separate set of condition classes were delineated based upon overall floristic diversity, tree age class, presence of old mature trees, grazing pressure and the extent to which canopy cover was intact (Table 4-2).

Biometric assessment: condition categorisation

The Biobanking assessment pathway was not used for this assessment. However, the following text relates the vegetation condition classes used in this assessment to those defined under the NSW OEH Biometric guidelines (DECC 2008a) (outside of this section, all condition categories discussed are as defined in the first column of Table 4-1 and not the biometric condition classes).

Under the Biometric guidelines,

Native woody vegetation is in low condition if:

- The over-storey per cent foliage is <25% of the lower value of the over-storey per cent foliage cover benchmark for that vegetation type, AND
- <50% of vegetation in the ground layer is indigenous species or >90% ploughed or fallow

Native grassland or herbfield is in low condition if:

- <50% of vegetation in the ground layer is indigenous species or >90% ploughed or fallow.

If native vegetation is not in low condition then it is considered to be in moderate to good condition. Hence, for some open woodland communities, treeless native pasture derived from woodland and dominated by native grasses would be classed in 'moderate to good' condition under this categorisation (depending on the overstorey benchmark). Similarly, areas where the groundcover is exotic but suitable overstorey cover is present would also be classed in 'moderate to good condition'.

Application of condition ratings to current survey

Table 4-1 and Table 4-2 below demonstrate how the two-class biometric condition classes relate to the six-point condition class scale used in this survey. The six-point scale was used to provide greater differentiation between condition classes, useful in considering the significance of impacts.

Table 4-1 Six-point condition class scale for grassy woodland communities

Condition class	Characteristics	CEEC	EEC	Biometric condition
Exotic	Groundlayer dominated by exotics, no native overstorey present.	No	No	Low
Poor	Trees absent to very sparse and groundlayer dominated by one or two native grass species, <5 native non-grass species OR native overstorey present and groundlayer dominated by exotics.	No	Yes	Low
Poor-moderate	Groundlayer dominated by native grasses, 5-11 native non-grass species present in very low numbers.	No	Yes	Moderate-Good
Moderate	Groundlayer dominated by native grasses, 5-11 native non-grass species present and common.	No	Yes	Moderate-Good
Moderate-good	Groundlayer dominated by native grasses with a diversity of native non grass (at least 12 native non-grass species).	Yes	Yes	Moderate-Good
Good	Groundlayer dominated by native grasses with a diversity of native non grass (at least 20 native non-grass species)	Yes	Yes	Moderate-Good

Table 4-2 Six-point condition class scale for shrubby forest communities

Condition class	Characteristics	Biometric condition
Exotic	Groundlayer dominated by exotics, no native overstorey present.	Low
Poor	Trees absent to very sparse and shrub and groundlayer dominated by one or two common species. Grazing pressure moderate to high.	Low
Poor-moderate	Partially cleared, scattered trees, low diversity within the shrub and groundlayer. Grazing pressure moderate.	Moderate-Good
Moderate	Relatively intact canopy cover, young age class of trees (regrowth), moderate shrub and groundlayer diversity. Grazing pressure low.	Moderate-Good
Moderate-good	Intact canopy cover, advanced tree age class, moderate to high shrub and groundlayer diversity. Grazing pressure low.	Moderate-Good
Good	High structural and floristic diversity, old growth canopy trees with hollows present. Grazing pressure absent.	Moderate-Good

4.2.3 Fauna

Survey Personnel

The fauna surveys undertaken in 2012 and 2013 were conducted by ten field members:

- Brenton von Takach Dukai (BVT);
- Paul Shipway (PS);
- Mark Free (MF);
- Rena Gaborov (RG);
- Deb Frazer (DF);
- Kelly Simpson (KS).
- Jacqui Coughlan (JC);
- Freya Gordon (FG);
- George Madani (GM);

Detailed Survey Methods

Habitat assessment was the primary survey method for species with potential to be affected by the project. Fauna effort is detailed in Section 4.4, and shown on the survey effort maps in Appendix E.2.

The fauna assessment approach was designed to achieve suitable site coverage of the Transmission Line Study Area, as well as incorporate more specialised surveys to target fauna species of conservation significance. The fauna survey program developed for the site consists of a series of complementary assessment and survey techniques:

Habitat assessment & fauna point surveys

Prior to the commencement of the field survey program, a series of field maps were produced identifying:

- The proposed route options for the transmission line from Ulan in the south to the southern extent of the Wind Farm Study Area;
- Proposed locations of access tracks within the Transmission Line Study Area; and
- Recorded locations of threatened fauna from the Atlas of NSW Wildlife.

This data was uploaded to field GPS units to allow for accurate identification of proposed infrastructure locations in the field.

These maps were analysed to ensure that the field survey would include assessment of all habitat types and a suitable distribution of survey effort across the site. The majority of areas subject to disturbance from clearing for the transmission line or creation of access tracks were surveyed by vehicle or on foot. Some sections of the transmission line could not be surveyed as a result of land access issues at the time of survey, specifically within the Ulan Coal Mine Limited property.

Fauna point surveys were undertaken at regular intervals along the Transmission Line route options, ensuring all habitat types occurring within the Transmission Line Study Area were covered. These fauna point surveys consisted of:

- Completion of a Fauna Habitat Assessment data sheet (Appendix 11B.1), which involved an assessment of site habitat characteristics including abundance of mature trees, tree hollows and rock habitats, presence of waterbodies, dense groundcover and shrub layer and/or mistletoe and identification of microhabitats suitable for significant fauna species;

- A 10 minute bird census;
- A 5-10 minute herpetofauna search including lifting of fallen logs and surface rock; and
- A 5 minute tracks, scats and signs search for evidence of fauna use.

Targeted surveys

Targeted surveys included use of specific survey techniques and increased effort to target significant fauna species and nocturnal fauna. These specialised surveys include:

- Morning and dusk bird surveys. These surveys consisted of a minimum 0.5 hr bird survey at locations identified as having generally higher habitat values for bird species. Bird utilisation surveys including recording abundance and behaviour. All bird surveys were carried out by very experienced bird observers using good quality high-powered binoculars;
- Herpetofauna surveys. These surveys consisted of a minimum 20 min active search for reptiles at locations identified as having generally higher habitat values for reptiles, particularly significant species.
- Microbat census using 'Anabat' ultrasonic microbat call detection recording equipment. Four Anabat units were used during the survey at different locations across the site. In all, 9 locations were surveyed for a total of 12 nights of Anabat recording in 2012 and 7 locations for a total of 19 nights in 2013. Anabat data was analysed by Dr Greg Richards following completion of the survey program; and
- Nocturnal surveys including call playback and spotlighting, focussing on threatened owls and mammals in suitable habitat. Call playback was undertaken following the methods of DEC (2004) and included a 10 minute initial listening period followed by broadcast of recorded calls of the Squirrel Glider, Powerful Owl, Barking Owl, Masked Owl, and, in most cases, Koala. Each call was followed by a 5 minute listening period. Spotlighting surveys then consisted of survey of the call playback location and adjacent areas for generally 30 mins to 2 person hours on foot. Vehicle-based spotlighting was used as a supplementary survey technique where possible.

In addition, opportunistic fauna sightings were recorded during the course of the survey program and the following were recorded by hand-held GPS to assist spatial analysis:

- All raptor sightings;
- All threatened species sightings; and
- All habitat features of importance.

Further details on fauna survey techniques utilised are discussed below.

Habitat assessment

A copy of the standard datasheets used for the habitat assessment is provided in Appendix 11B.1. Information recorded relates to the vegetation structure and habitat components of a site, including leaf litter, fallen timber, hollow-bearing trees, rock features, presence of water and canopy connectivity. Habitat quality was classified as either absent, poor, average, good or excellent for various fauna groups. Fauna habitat quality² is rated on the presence of the following components:

² Habitat 'quality' and vegetation 'condition' classes are not interchangeable, as different criteria are used to distinguish fauna and flora values.

- Diverse structure, that is, structural components at a range of stratum levels (understorey, midstorey, canopy) and age or size classes (trees of different ages, fallen timber of different sizes);
- Shelter and refuge, that is, low shrub or tussock grasses, rocky outcrops, hollow logs (ground dwelling fauna);
- Mature trees, which are more likely to bear hollows and mature hollow-bearing trees, which are more likely to bear multiple hollows of a range of sizes, including those with large internal dimensions. Mature trees also produce more foraging resources for nectar and seed eating fauna;
- Habitat complexity, including ecotones³ between vegetation types, or areas with different management regimes, which produce a habitat mosaic. Within a habitat patch, there may be a recently disturbed area, as well as a mature area with little recent disturbance. This increases the range of foraging and shelter opportunities within a habitat; and
- Key habitat components such as hollow-bearing trees, Glossy Black-cockatoo feed trees, Koala feed trees and mistletoe.

Bird utilisation survey

- The area search method was used for bird surveys of 30 minutes duration;
- Birds were recorded by sight and vocalisations.;
- Species present within the search area, flying overhead and outside the search area were recorded; and
- As well as species observed, the following variables were recorded: number of individuals, distance from observer, and bird behaviour.

Herptofauna search

- Depending on habitat extent and quality, searches varied between 15 and 45 minutes;
- One significant reptile species was targeted: Pink-tailed Worm-lizard (*Aprasia parapulchella*); and
- Active searching was undertaken in suitable habitat including rolling rocks, logs, and other debris. Rocks and logs were scanned for basking individuals prior to active searching. The species was targeted in rocky outcrops particularly those on slopes within grassland and woodland. The Pink-tailed Worm-lizard was targeted by rolling debris (rocks, logs, bark, etc.) in areas of potential habitat.

Microchiropteran bat surveys (Anabat)

Microchiropteran bats were surveyed using a ground-based Anabat detector (passive survey). The detector was left in place overnight in locations chosen to maximise the potential for detecting multiple species of bats, such as in likely flyways through vegetation, along drainage lines and near dams. Recording was typically from approximately 30 minutes before sunset to daybreak the following morning.

³ Ecotones are transition zones, where one habitat element grades into another. These zones are usually more bio-diverse, as they contain resources used by a greater number of species, ie the pasture/forest edge is used by both pasture and forest species.

Nocturnal surveys (Evening listening and stagwatching; spotlighting; call playback)

Evening listening / stagwatching

Evening listening involved observing hollows and listening for fauna activity, particularly owls, for approximately 30 minutes before and after sunset.

Spotlighting

Foot-based and vehicle-based spotlighting was undertaken using an area search method searching for nocturnal, arboreal and scansorial vertebrate fauna along the edge and through the middle of patches of vegetation. Spotlighting was conducted using hand-held 12v 50w spotlights. Surveys were of variable duration from 15 minutes to two hours. The length of vehicle-based transects was determined by length of track suitable for spotlighting. Foot-based spotlight surveys were undertaken by one spotlight operator and vehicle-based surveys were undertaken by one to two spotlight operators (not including the driver).

Call playback

As described above in *Targeted surveys*.

4.3 SURVEY EFFORT

The total survey effort completed for the Transmission Line Study Area is presented in Table 4-4 and Table 4-5. For the TLSA, 308 hours (plus Anabat & Infrared camera survey) and 80.3 hours was applied to survey effort for fauna and flora, respectively. Generally, the amount of hectares covered for the Transmission Line Study Area has been provided, however this was not possible for nocturnal survey effort.

4.4 WEATHER CONDITIONS DURING SURVEY PERIOD

Weather data for the field surveys (8 – 20 October 2012 and 1 – 8 October 2013) is presented in Table 4-3. This data has been taken from the nearest weather station, Merriwa station 061287, which has both rainfall and temperature data available (Bureau of Meteorology 2012 and 2013).

Table 4-3 Weather data recorded at Merriwa weather station during the field surveys 2012 and 2013

Date	Minimum temperature (°C)	Maximum temperature (°C)	Rainfall (mm)	Direction of maximum wind gust	Speed of maximum wind gust (km/h)	Time of maximum wind gust	9am Temperature (°C)	9am relative humidity (%)	9am cloud amount (oktas)	9am wind direction	9am wind speed (km/h)	9am MSL pressure (hPa)	3pm Temperature (°C)	3pm relative humidity (%)	3pm cloud amount (oktas)	3pm wind direction	3pm wind speed (km/h)	3pm MSL pressure (hPa)
8/10/12	3.4	21.7	0	ESE	35	8:03	13.1	68		ESE	24	1016.1	20.9	31		NW	11	1011
9/10/12	1.5	22.4	0	WSW	43	14:08	12.7	65		WSW	9	1012.8	21	29	3	WSW	20	1009.7
10/10/12	2.1	25.7	0	NW	48	13:37	12	74		WSW	9	1012.7	24.8	27		WNW	24	1007.5
11/10/12	7.6	18.4	1.2	W	56	13:34	10.3	94	8	NNE	9	1005.9	16.7	40	3	W	28	1005.4
12/10/12	2.3	16.4	0.6	SW	56	13:19	8.3	74	8	WNW	33	1011.2	13.3	58	7	WSW	31	1013.5
13/10/12	4.9	20.7	0.8	WNW	37	11:29	12.3	57		W	17	1021.1	19.2	32	2	W	17	1018.8
14/10/12	2.8	21.1	0	ESE	28	12:33	10.4	81		W	6	1025.4	19.6	34		SE	13	1022.7
15/10/12	1.2	27.1	0	WNW	48	15:21	13.3	67		WNW	7	1026.8	26.3	19		W	15	1022.3
16/10/12	5.4	30.6	0	NNW	35	14:42	18	39		WSW	11	1022.5	30.2	17		NW	24	1017.4
17/10/12	14.9	31.2	0	WNW	46	12:50	23.5	34		WNW	24	1017	30.5	17		WSW	24	1014.9
18/10/12	11.3	26.9	0	ESE	35	7:07	16.6	70	8	E	20	1021.5	26.5	34		ESE	17	1017.6
19/10/12	8.3	33.7	0	NW	50	13:59	17.4	75		WSW	9	1017.8	32.9	18	2	NW	30	1012.9
20/10/12	11.5	33.1	0	WNW	54	11:11	26.5	34		WNW	20	1012.1	32.2	9		W	26	1011
1/10/13	6.7	30.4	0	WNW	83	12:08	26.8	34		NNW	43	1008.6	17.2	80	8	WNW	24	1011.6
2/10/13	3.4	23.7	4.0	NW	41	14:10	15.9	43		N	7	1017.4	23.2	27		WNW	24	1011.6

Date	Minimum temperature (°C)	Maximum temperature (°C)	Rainfall (mm)	Direction of maximum wind gust	Speed of maximum wind gust (km/h)	Time of maximum wind gust	9am Temperature (°C)	9am relative humidity (%)	9am cloud amount (oktas)	9am wind direction	9am wind speed (km/h)	9am MSL pressure (hPa)	3pm Temperature (°C)	3pm relative humidity (%)	3pm cloud amount (oktas)	3pm wind direction	3pm wind speed (km/h)	3pm MSL pressure (hPa)
3/10/13	10.1	17.0	0	SW	57	11:02	13.6	58	8	W	26	1013.9	15.3	37	1	WSW	35	1015.0
4/10/13	0.3	22.0	0.2	NNE	20	09:57	13.0	51		E	11	1022.8	20.8	28		SSE	11	1018.0
5/10/13	1.9	27.2	0	WNW	39	13:47	17.1	51		W	9	1018.8	26.3	20		W	19	1013.6
6/10/13	3.5	31.1	0	WSW	46	13:52	15.7	45		W	9	1013.6	29.9	12		W	28	1009.0
7/10/13	10.5	27.6	0	WNW	37	14:32	17.9	42		SW	19	1011.1	26.5	19		WNW	11	1008.1
8/10/13	5.1	24.9	0	SW	39	15:21	14.6	70		WNW	15	1015.4	22.1	25	2	S	22	1013.5

Source of data: Bureau of Meteorology 2012 and 2013 (www.bom.gov.au. Accessed 14/11/2012 and 21/10/2013)

Merriwa, New South Wales, October 2012 and 2013 Daily Weather Observations

Observations were drawn from Merriwa (Roscommon) {station 061287}.

Transmission Line Study Area Survey effort

Table 4-4 Transmission line flora effort summary.

Date	Method	Target species	No. Surveys	Effort - Time			Effort - Area	
				Time Spent / per survey	No. People	Total (hrs)	Area Covered	Known Total (ha)
2012 Field survey								
Oct 8-19	Random meanders (including targeted searches)	All flora species	41	30mins ea.	1	20.5	50m X 50m	10.25 ha
	Inspection searches	All flora species	30	10 mins ea.	1	5	25x25m	1.875 ha
2013 Field survey								
Oct 1-8	Random meanders (including targeted searches)	All flora species	90	30mins ea.	1	45	50m X 50m	22.5 ha
	Inspection searches	All flora species	59	10mins ea.	1	9.8	25m X 25m	3.6875 ha
TOTAL						80.3 hrs		38.3125 ha

Table 4-5 Transmission line fauna effort summary.

Date	Method	Target Species	No. Surveys	Effort - Time			Effort - Area		
				Time Spent	No. People	Total (hrs)	Area Covered	Known Total (ha)	
2012 Field survey									
Oct 8-19	Habitat assessment, including Hollow-bearing tree survey	All species	49	20 mins ea.	1	16.3 hrs	50mx50m	12.25 ha	
	Bird survey	All birds	49	10 mins ea.	1	8.2 hrs	50mx50m	12.25ha	
	Herpetofauna search	All reptiles	49	10 mins ea.	1	8.2 hrs	50mx50m	12.25ha	
	Bird utilisation survey	All birds	17	30 mins ea.	1-2	8.5 hrs	~100x100m	17 ha	
	Extended herpetofauna search	All species	7	30 mins ea.	1-2	3.5 hrs	50mx50m	1.75ha	
	Nocturnal Survey	Stagwatching / Evening listening	All nocturnal fauna, with focus on threatened species*	10	20 mins ea.	2	6.7 hrs	N/A	N/A
		Spotlighting - On-foot	All nocturnal fauna, with focus on threatened species *	10	60 mins ea.	2	20 hrs	N/A	N/A
		Spotlighting -Vehicle-based	All nocturnal fauna, with focus on threatened species*	8	30 mins ea.	2	8 hrs	N/A	N/A
		Call Playback	All nocturnal fauna, with focus	8	30mins ea.	2	4 hrs	N/A	N/A

Date	Method	Target Species	No. Surveys	Effort - Time			Effort - Area		
				Time Spent	No. People	Total (hrs)	Area Covered	Known Total (ha)	
		on threatened species**							
	Anabat	Microchiropteran Bat species	11	8 hrs		88 hrs	N/A	N/A	
2013 Field survey									
Oct 1-8	Habitat assessment, including Hollow-bearing tree survey	All species	86	20 mins ea.	1	28.7 hrs	50mx50m	21.5 ha	
	Bird survey	All birds	86	10 mins ea.	1	14.3 hrs	50mx50m	21.5 ha	
	Herpetofauna search	All reptiles	86	10 mins ea.	1	14.3 hrs	50mx50m	21.5 ha	
	Bird utilisation survey	All birds	39	30 mins ea.	1-2	19.5 hrs	~100x100m	39 ha	
	Extended herpetofauna search	All species	21	30 mins ea.	1-2	10.5 hrs	50mx50m	5.25 ha	
	Nocturnal Survey	Stagwatching / Evening listening	All nocturnal fauna, with focus on threatened species*	11	20 mins ea.	2	7.3 hrs	N/A	N/A
		Spotlighting - On-foot	All nocturnal fauna, with focus on threatened species *	11	60 mins ea.	2	22 hrs	N/A	N/A
		Spotlighting -Vehicle-based	All nocturnal fauna, with focus on threatened species*	9	30 mins ea.	2	9 hrs	N/A	N/A
		Call Playback	All nocturnal fauna, with focus on threatened species**	11	30 mins ea.	2	11 hrs	N/A	N/A
	Anabat	Microchiropteran Bat species	31	8 hrs	N/A	248 hrs	N/A	N/A	
	IR Camera	All nocturnal fauna, with focus on threatened species ***	67	8 hrs	N/A	536 hrs	N/A	N/A	
TOTAL			676			1092 hrs		164.25	

*Powerful Owl, Barking Owl, Masked Owl, Squirrel Glider, Brush-tailed Phascogale, Koala, Grey-headed Flying-fox, Bush Stone-curlew, Yellow-bellied Glider, Spotted-tailed Quoll

** Powerful Owl, Barking Owl, Masked Owl, Squirrel Glider, Koala

***Squirrel Glider, Spotted-tailed Quoll, Brush-tailed Phascogale

4.4.1 Limitations

Survey coverage

Surveys of the TLSA Area were designed to encompass as much of the preferred route, the alternative route, and the second alternative route as possible. In particular, the majority of the 2013 survey effort was spent in the TLSA, as the proposed routes either traverse or are located near large, contiguous patches of relatively undisturbed vegetation. As these patches were likely to contain many of the threatened species expected to occur in the area, the concentration of effort on Turill SCA, Durridgere SCA and other contiguous patches of vegetation is well-justified.

Coverage of the entire TLSA was not possible due to limited access constrained by impassable areas (i.e. steep slopes, rocky terrain, and no access tracks), or land access permission constraints. In particular, permission was not granted to access the section of the alternative route that traverses Ulan Coal lease land in the far south of the TLSA. area of the access was not agreements and the need for a chaperone prevented surveys from taking place on the As extensive surveys have historically taken place along most of this section of the route, the ecological value of the area can be largely determined by assessing the results of previous surveys. Whilst this area is shown on the figures within the “combined survey area” it has not been surveyed on the ground.

Due to the size of the survey area and access restrictions, not all vegetation patches within the Project Area could be searched comprehensively in the time allowed, nor surveyed in detail for fauna. Instead, representative areas were surveyed, with most time spent in areas of good quality vegetation. Vegetation patches that could not be accessed were assessed from the roadside or other vantage points. Condition for these areas was extrapolated from other known areas of similar vegetation that had been surveyed in detail. The survey effort maps clearly illustrate the location of all survey and inspection points so it can clearly be seen which areas have been extrapolated.

The fauna survey utilised a combination of non-invasive survey techniques and fauna habitat assessment to identify areas that may support threatened species, rather than undertaking a comprehensive trapping program or using any invasive survey techniques. Night fauna work was targeted toward areas of forest and woodland that were safely accessible at night. Some forested areas in the proposal area were not surveyed at night due to unsafe access in the dark. Detailed habitat assessments were generally undertaken in these areas during the day. A precautionary approach has been taken in regard to these areas.

Field data collected during the Spring 2012 and 2013 surveys, combined with database records, background research and aerial photography analysis, is considered to provide an adequately detailed assessment of the flora, fauna and their habitats that occur and are likely to occur within the Project Area.

Species detection

The 2012 and 2013 surveys corresponded with the peak flowering time for many plant species. Despite this, dry conditions were experienced at the time of the 2012 survey and some plant species may have gone undetected at that time, e.g. if they were dormant, inconspicuous or lacked distinguishable features such as flowers or seed. In particular the dry conditions may have reduced the appearance of some spring flowering species such as orchids and lilies in some areas. The survey timing was too late in the year to detect threatened grass species known from previous records in the area and known to occur within Box Gum Woodland habitats. While spring-flowering exotic annuals such as Bromes (**Bromus*

spp.), Barley Grass (**Hordeum* sp.) and Rye Grasses (**Lolium* spp.) were easy to identify in October, most of the native grasses were neither flowering nor carrying old seed heads from the previous season. The diversity of native grasses has therefore been underestimated, and the proportional cover of the different species at any site was thus difficult to determine accurately. Given the degraded nature of most of the Project Area and the open understorey, it is considered that most species would have been detected in the areas surveyed and the resultant flora species list is comprehensive, with the exception of some native grass species. This limitation is more relevant to the Wind Farm Survey Area, which had more expansive areas of degraded grass-dominated Box Gum Woodland.

The information obtained from the surveys and database records represent limited fauna survey effort over small snapshots in time. Additional species, such as migratory birds, could utilise or fly over the area only occasionally and thus may not be captured by current records. It is likely that additional fauna species would be recorded at different times of the year. These limitations, whilst recognised, can be said for any chosen survey period, and are unlikely to substantially change any conclusions drawn from the collected data.

Precautionary approach

As it is difficult to rule out the presence of any particular species without surveying all potential habitat, no matter how atypical that habitat may be, a precautionary approach has been adopted. That is, if suitable habitat is present and desktop assessment has determined the species may occur in the area, the species has been assumed to have potential to utilise habitat within the proposed Project Area.

Anabat results

The bat call identifications presented in this report are based on a combination of manual and automated methods using either reference calls from the region or from species calls recorded outside the region if they are likely to represent the calls from species in the survey region. Some bat species are readily identified via Anabat recordings, but many are not able to be distinguished by a call recording alone.

Anabat recordings alone may only represent a proportion of the bat species that are actually present. The number of bat calls recorded is not a measure of species' abundance as the calls could be from one bat or many bats. The recording of calls on any one night may be influenced by many factors including temperature, humidity, insect activity, wind and associated vegetation movement.

Anabat call analysis is affected by many factors these include: placement of detector (Anabats were located on the ground and not at flight height of several bats; the suite of species present in an area; the quality of calls recorded (equipment settings, microphone quality, background noise from wind, insects, echoes); and the quality of the reference call database for the region and the experience of the analyst.

4.5 GIS MAPPING & ANALYSIS

Figures have been produced using ArcView 10. Geo-referenced aerial imagery, survey areas and infrastructure layout shapefiles were provided by Epuron.

Vegetation and habitat mapping have been hand-digitised by **ngh**environmental based on aerial imagery and field survey. Vegetation type and condition has been mapped for the Transmission Line Study Area (100 m buffer either side of proposed route). Vegetation types were unable to be mapped to any greater extent due to time constraints during the field survey work and limited access.

No existing environmentally-sensitive vegetation mapping data was available for any of the four LGAs that contain the project.

4.6 LANDSCAPE CONNECTIVITY ANALYSIS

A landscape connectivity analysis was undertaken with reference to aerial imagery, considering the spatial configuration of vegetation including percentage vegetation cover and connectivity across the landscape. The field surveys also provided an opportunity to ground truth assumptions about local connectivity (refer to *Section 2.0 Regional Context*).

4.7 VEGETATION TYPE CLASSIFICATION & NOMENCLATURE

The identification of specific vegetation types is based on the NSW Vegetation Classification and Assessment developed for the South Western Slopes (Upper Slopes) Bioregion by Benson (2008) and Benson *et al.* (2010), which provides the most recent classification for the Project Area.

Botanical nomenclature follows Harden (1990-2002), except where recent taxonomic changes have occurred. Noxious weeds identified are those declared for the four LGAs control area under the *Noxious Weeds Act 1993*.

4.8 CONSTRAINTS ANALYSIS

A constraint, for the purposes of this assessment, is an ecological feature (or combination of features) that reduces the suitability of a site to accommodate the proposed development. Constraints mapping was undertaken at several stages throughout the project in order to guide the development of the infrastructure layout to minimise ecological impacts. Constraints were identified and assessed based on a combination of desktop assessment and field surveys, including aerial photo interpretation and GIS mapping. Aerial photo interpretation was used initially to allow interpretation in areas that were not directly assessed during field survey. Following the initial constraints analysis in 2012, and in response to constraints identified, a preferred route, an alternative route and a 2nd alternative route were nominated for investigation in 2013. Additional field survey was undertaken in spring 2013 to allow further detailed survey of areas visited in 2012, as well as additional route options identified since the 2102 surveys.

Following the completion of spring 2013 surveys, further adjustments were made to accommodate newly identified constraints. Notably, an adjustment has been made to the alignment of the preferred route to ensure it avoids impact to an active Square-tailed Kite nest.

This iterative process of constraints identification, design adjustments and follow up field survey has enabled conclusions to be made about the relative level of ecological impact of the three alternative routes

Residual constraints (i.e. where impact could not be entirely avoided) are classified and mapped according to four constraint classes (Table 4-6). Constraints maps are provided in Appendix E.4.

Table 4-6 Constraint classes

Level of Constraint	Description	Management Options
High	<ul style="list-style-type: none"> Impacts in these areas <u>are</u> significant. Impacts would be difficult, costly, or not able to be offset, and should be avoided. Approval is unlikely to be permitted in these areas. 	<ul style="list-style-type: none"> Avoid direct or indirect impacts in these areas
Moderate	<ul style="list-style-type: none"> Impacts have <u>potential</u> to be significant if not managed carefully. Further survey work to guide mitigation and management strategies. 	<ul style="list-style-type: none"> Mitigate through specific management actions (i.e. micro-siting, pre-clearance surveys for HBTs). Offsetting may require a larger offset ratio.
Low	<ul style="list-style-type: none"> Impacts <u>highly unlikely</u> to be significant in these areas. Infrastructure is most appropriately located in these areas. 	<ul style="list-style-type: none"> Standard mitigation actions required. Offset residual impacts (a lower offset ratio will apply).

5 RESULTS - FLORA

5.1 VEGETATION COMMUNITIES

Nine vegetation types as defined by Benson *et al.* (2010), plus two exotic vegetation types occur within the Transmission Line Study Area:

- Rough-barked Apple - Blakely's Red Gum – Yellow Box woodland on alluvial clay to loam soils on valley floors in the northern South-west Slopes and BBS Bioregions (ID281);
- Narrow-leaved Ironbark - Black Cypress Pine +/- Blakely's Red Gum shrubby open forest on sandstone low hills in the southern BBS Bioregion (ID468);
- Inland Scribbly Gum – Red Stringybark – Black Cypress Pine – Red Ironbark open forest on sandstone hills in the southern Brigalow Belt South Bioregion and northern NSW South Western Slopes Bioregion (ID477);
- Red Ironbark - Black Cypress Pine - stringybark +/- Narrow-leaved Wattle shrubby open forest on sandstone in the Gulgong - Mendooran region, southern BBS Bioregion (ID478);
- Narrow-leaved Ironbark- Black Cypress Pine - stringybark +/- Grey Gum +/- Narrow-leaved Wattle shrubby open forest on sandstone hills in the southern BBS - Sydney Basin Bioregions (ID479);
- Black Cypress Pine - ironbark +/- Narrow-leaved Wattle low open forest mainly on Narrabeen Sandstone in the Upper Hunter region of the Sydney Basin Bioregion (ID480);
- Rough-barked Apple - Blakely's Red Gum - Narrow-leaved Stringybark +/- Grey Gum sandstone riparian grass fern open forest on in the southern BBS and Upper Hunter regions (ID481);
- Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region (ID483);
- Derived Speargrass – wallaby grass – wire grass mixed forb grassland mainly in the Coonabarabran – Pilliga – Coolah region (395);
- Planted Vegetation (windbreaks); and
- Exotic Pasture and Crops

The vegetation code in parentheses corresponds to the classification used by Benson *et al.* (2010). These vegetation types are described below. The natural vegetation types are classified according to the communities described for the Brigalow Belt South Bioregion in Benson (2008) and Benson *et al.* (2010). Vegetation types that do not represent a natural vegetation type (e.g. highly modified) have been given a generic name. The distribution of these communities is displayed on the maps in Appendix E.2. A species list for the site is provided as Appendix B.2. A representative photo of each community and the vegetation description documented by Benson *et al.* (2010) are provided in Appendix B.3.

Rough-barked Apple / Blakely's Red Gum / Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern South Western Slopes and BBS Bioregions (ID281)

This community is essentially the same as ID481 described below, but includes Yellow Box (*E. melliodora*) as a dominant tree species and is typically found on larger creek flats and adjacent lower slopes within sandstone areas (for example, along Kurrajong Gully north-west of Turill SCA, on the proposed Alternative line). It may also include Apple Box (*E. bridgesiana*) and typically has fewer sandstone forest shrub species than ID481, with the most typical shrub again being Sifton Bush (*Cassinia arcuata*). The ground cover is generally near-continuous except for rock outcrops and may have a moderate to high diversity of native grasses and forbs. Weeping Grass (*Microlaena stipoides*) and Wiregrass (*Aristida*

ramosa) are usually the dominant groundcover species with Reedgrass (*Arundinella nepalensis*) also often present.

This community is considered to be vulnerable by Benson *et al.* (2010), who identify it as “probably” part of the listed EEC Box-Gum Woodland. For the purposes of this assessment we have assumed that stands of this community do belong to the Box-Gum Woodland EEC. Most stands seen were in moderate, moderate-good or good condition, with a relatively high diversity of non-grass groundcover species. In addition, the number of large old hollow-bearing trees was generally greater in this community than in the sandstone forests, making them potentially quite significant for fauna.

Sandstone Forest Types (ID468, 477, 478, 479, 480)

Sandstone Forest types dominate the Transmission Line Study Area and were found in Turill SCA, Durridgere SCA and surrounding private properties and on the Ulan colliery leasehold land. The dominant tree varies from place to place but is usually an ironbark, either Narrow-leaved Ironbark (*E. crebra*) or Red Ironbark (*E. fibrosa*). In certain areas, Inland Scribbly Gum (*E. rossii*) was found to be dominant. Co-dominant trees are often common and include Grey Gum (*E. punctata*), Red Stringybark (*E. macrorhyncha*) and in places Black Cypress Pine (*Callitris endlicheri*) or Narrow-leaved Wattle (*Acacia linearifolia*). Rarer canopy trees are Inland Grey Box (*E. microcarpa*), Grey Box (*E. moluccana*), Blakely's Red Gum (*E. blakelyi*), Brown Bloodwood (*Corymbia trachyphloia*) and Narrow-leaved Stringybark (*E. sparsifolia*). As might be expected of a forest growing on low fertility sandy soils, the shrub layer is prominent and diverse, while the groundcover is sparse and dominated by graminoids such as *Lomandra*, *Lepidosperma* and *Gahnia* species. These vegetation communities are generally not grazed, although where they abut cleared paddocks there may be some penetration of livestock for a short distance. The groundcover may be grassier and with a lower shrub diversity in these areas. Past logging is the principal disturbance, which has led to a shortage of large old hollow-bearing trees and to localised dominance of *Callitris* and *Acacia* rather than eucalypts. Exotic species are very rare.

These communities are generally considered to be of least concern by Benson *et al.* (2010), as substantial areas are conserved in large local reserves such as Goulburn River, Gardens of Stone and Wollemi National Parks, as well as a number of smaller reserves such as Durridgere SCA. Three of them (477, 478 and 479) are identified as near threatened, but this would most likely be with reference to occurrences in the Upper Hunter Valley, and to stands carrying Slaty Gum (*E. dawsonii*) which is listed as an EEC in the North Coast and Sydney Basin bioregions. No Slaty Gum stands occur in the study area. None of these vegetation communities are listed as an EEC under NSW or Commonwealth legislation.

Rough-barked Apple / Blakely's Red Gum / Narrow-leaved Stringybark +/- Grey Gum Sandstone Riparian Grass Fern Open Forest in the Southern BBS and Upper Hunter Regions (ID481)

This community is dominated by Rough-barked Apple (*A. floribunda*) and Blakely's Red Gum (*E. blakelyi*) but may include other tree species more typical of the surrounding sandstone forests (as discussed above) and is typically found on creek banks and narrow creek flats and upper drainage lines within sandstone areas. There may be a small tree layer of Narrow-leaved Wattle (*Acacia linearifolia*). Shrubs are generally sparse and include numerous species from surrounding sandstone forests, but the most typical shrub is Sifton Bush (*Cassinia arcuata*). The ground cover is generally near-continuous except for rock outcrops and may have a moderate to high diversity of native grasses and forbs depending on grazing history and the degree of development of relatively fertile small alluvial flats. On steep-banked creeks the diversity tends to be low. Weeping Grass (*Microlaena stipoides*) is usually the dominant groundcover with a conspicuous grass species confined to this vegetation community being the tall, cane-like grass *Arundinella nepalensis*.

This community is considered to be vulnerable by Benson *et al.* (2010), as substantial areas have been cleared, though some remain within reserves such as Durridgere SCA. Despite regarding this community as being vulnerable, and despite one of its dominant trees being an indicator species for the listed EEC Box-Gum Woodland, Benson *et al.* (2010) does not identify this community as part of that EEC.

Grey Box / White Box Grassy Open Woodland on Basalt Hills in the Merriwa Region (ID483)

This community occurs on lower to upper slopes in the northern part of Transmission Line Study Area which is on basalt derived soils rather than sandstone, and in a couple of smaller localised patches of basalt which occur south of the Golden Highway. The dominant tree is White Box, which throughout the study area occurs as a hybrid (*E. X albens*) with other box species, specifically Grey Box (*E. moluccana*), rather than as the more typical blue-foliaged and large-fruited form found on the nearby Liverpool Plains. Co-dominant or locally dominant may be Yellow Box (*E. melliodora*) and Blakely's Red Gum (*E. blakelyi*), although these are more typical of valley floor flats. Shrubs are generally absent, as this community is the most heavily subjected to grazing within the study site. The ground cover is generally near-continuous except for rock outcrops and usually has a low diversity of native grasses and forbs due to this grazing history. Native forbs are generally restricted to the more widespread and grazing tolerant species such as *Dichondra repens*, *Asperula conferta*, *Hydrocotyle laxiflora*, *Vittadinia* spp. and *Calotis lappulacea*. In fragmented stands, particularly on ridge tops where grazing pressure is most intense the groundcover is dominated by exotic pasture species such as clovers (**Trifolium* spp.) and Rye Grass (**Lolium* spp.).

This community is considered to be critically endangered by Benson *et al.* (2010), as substantial areas have been cleared and virtually all are subject to grazing. It is listed as an EEC under the TSC Act and a CEEC under the EPBC Act (Box-Gum Woodland).

Derived Speargrass / Wallaby Grass / Wire Grass Mixed Forb Grassland mainly in the Coonabarabran – Pilliga – Coolah Region (ID395)

This community is extensive in the north-eastern part of the Transmission Line Study Area. Shrubs are absent in this community, but there may be scattered eucalypts, such as Rough-barked Apple and Blakely's Red Gum on flats or Narrow-leaved Ironbark and Inland Grey Box on low rises. The ground cover is generally near-continuous and usually has a low diversity of native grasses and forbs due to grazing history of the region. However, occasional sites were found on lower slopes where the native forb diversity was moderate.

Although this community was identified as of "least concern" by Benson *et al.* (2010) it could be regarded as being part of the Box Gum Woodland EEC under the Scientific Committee's determination which includes treeless remnants with native groundcover. Subsequently, where this community occurs adjacent to Box Gum Woodland EEC, ie: the original vegetation type is considered to have once been consistent with Box Gum Woodland, then these areas are considered to be part of the EEC.

This community is considered to be common in the region and may be of value to native fauna as a largely native matrix within which higher quality patches of remnant woodland are embedded.

Ecotonal Vegetation

In many locations the vegetation is transitional between one of the sandstone forest types (ID468, 477, 478, 479, 480) and one of the valley flat types (ID281 or 481), including both Ironbarks or Stringybarks and trees typical of Box-Gum Woodland EEC (Yellow Box, Blakely's Red Gum and more rarely, White Box hybrids). This typically occurs around the edges of large flats, in saddles above drainage line heads and in small upper drainage lines. In these instances we have identified the vegetation according to which suite

of eucalypts is more numerous, sandstone species or Box-Gum Woodland species, also giving some weight to the nature of the understorey (shrubby or grassy).

Planted Vegetation

A number of planted windbreaks occur within some of the Transmission Line Study Area. These consist of a mixture of exotic trees (mostly pines, **Pinus* sp.), local eucalypts (Blakely's Red Gum) and non-local eucalypts (Willow Peppermint, *E. nichollii*).

Exotic Pasture and Crops

Exotic pasture is uncommon in the Transmission Line Study Area, due to the lower fertility soils and lower rainfall compared with the Wind Farm Study Area. The transmission line routes do cross an occasional cropping paddock, growing canola or wheat/oats. Native pasture on the site may be enhanced to some extent with clovers (**Trifolium* spp.) and pasture grasses such as Rye Grass (**Lolium* spp.), Phalaris (**Phalaris aquatica*), bromes (**Bromus* spp.) and Barley Grass (**Hordeum* spp.).

Conservation status of natural vegetation communities

The conservation status and significance of vegetation communities recorded within the Transmission Line Study Area is presented below in Table 5-1. This data was obtained from the Vegetation Information System (VIS) Classification database.

Table 5-1 Conservation status of natural vegetation types in the Transmission Line Study Area.

Vegetation Type	Pre-1750 Extant (ha)	Extant Area (ha)	Total Area Reserved or Protected (ha)	Conservation Status (Benson <i>et al</i> 2010)	EEC (yes / no)
Narrow-leaved Ironbark - Black Cypress Pine +/- Blakely's Red Gum shrubby open forest on sandstone low hills (ID 468)	30,000 ha	20,000 ha	9,700 ha	Least Concern	No
Inland Scribbly Gum – Red Stringybark – Black Cypress Pine – Red Ironbark open forest on sandstone hills (ID 477)	2,000 ha	1,200 ha	420 ha	Near Threatened	No
Red Ironbark - Black Cypress Pine - stringybark +/- Narrow-leaved Wattle shrubby open forest on sandstone (ID 478)	12,000 ha	8,500 ha	1,350 ha	Near Threatened	No
Narrow-leaved Ironbark- Black Cypress Pine - stringybark +/- Grey Gum +/- Narrow-leaved Wattle shrubby open forest on sandstone hills (ID 479)	25,000 ha	15,000 ha	4,910 ha	Near Threatened	No
Black Cypress Pine - ironbark +/- Narrow-leaved Wattle low open forest mainly on Narrabeen Sandstone (ID 480)	2,000 ha	1,800 ha	770 ha	Least Concern	No
Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region (ID 483);	20,000 ha	2,000 ha	0 ha	Critically Endangered	Yes

Vegetation Type	Pre-1750 Extant (ha)	Extant Area (ha)	Total Area Reserved or Protected (ha)	Conservation Status (Benson <i>et al</i> 2010)	EEC (yes / no)
Rough-barked Apple / Blakely's Red Gum / sandstone riparian forest (ID 481)	18,000 ha	13,000 ha	4,406 ha	Vulnerable	No
Rough-barked Apple / Blakely's Red Gum / Yellow Box valley flat woodland (ID 281)	150,000 ha	50,000 ha	1,001 ha	Vulnerable	Yes
Derived Speargrass – wallaby grass – wire grass grassland (ID395)	100 ha	10,000 ha	730 ha	Least concern	Yes, if likely to be derived from Box Gum Woodland EEC.

5.2 ENDANGERED ECOLOGICAL COMMUNITIES

One EEC - White Box Yellow Box Blakely's Red Gum Woodland - was recorded within the Transmission Line Study Area during the surveys and includes Benson *et al.* (2010) communities ID281, 483 and sections of 395 that would have previously supported Box Gum Woodland species prior to clearing. Areas of EEC located within the Transmission Line survey area are mapped in Appendix E.5.

Despite the presence of Blakely's Red Gum, Benson *et al.* (2010) do not regard ID481 as belonging to the Box-Gum Woodland threatened community, which listed as Endangered under the TSC Act, and Critically Endangered under the Commonwealth EPBC Act (listed as *White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland*). ID481 is common on drainage lines within the Transmission Line site, being found as small patches on all three route options.

With an additional Box-Gum Woodland indicator species (Yellow Box), ID 281 is characterised by Benson *et al.* (2010) as "probably part of grassy box-gum woodland" listed under the TSC and EPBC Acts. It is essentially the same community as ID481 (J. Miles, pers. obs.), including several species never found in more typical Box-Gum Woodland growing on fertile soils, such as Rough-barked Apple (often co-dominant with Yellow Box in the study area) and Reedgrass (*Arundinella nepalensis*), a groundcover species which is often dominant in ID481 and frequently present in ID281. This grass is typical of drainage lines and flats on sandstone-derived alluvium. ID281 occurs on larger drainage lines than ID481, for example along Kurrajong Gully west of Turill SCA on the alternative route option, and on Ironbark Creek south-east of the Ulan Road/Golden Highway junction on the second alternative route option. It may also occur away from drainage lines in areas which are on sandstone, but with basalt close by. Within the Transmission Line Study Area it was generally found to be in better than average condition than Box-Gum remnants within the Wind Farm Study Area, with less evidence of grazing and more large old hollow-bearing trees. This is likely to be a consequence of its location on less fertile sandstone-derived soils where clearing and grazing has been less intense as opposed to basalt-derived soils.

Box-Gum Woodland dominated by White Box hybrids (ID483) was also found within the Transmission Line Study Area, primarily at the northern end, although smaller patches occur within the southern section as well. Most areas of this community on private land in the northern part of the study area were found to be in poor to moderate condition as a result of past clearing and grazing history. Within Turill SCA a patch of basalt occurs in the south-west corner, adjacent to the western access route on Perimeter Fire Trail and comprises an area of good condition Box Gum Woodland, which also meets the requirements of the EPBC-listed CEEC community.

Another small remnant of White Box dominated Box-Gum Woodland occurs on the Power property north of Turill Bus Route Road on an isolated patch of basalt. This area was found to be in variable condition, with low native forb diversity and a high proportion of exotics among large old trees where livestock had caused elevated nutrient levels, but fewer weeds and more native forbs among a dense patch of Yellow Box regrowth within the same remnant. The whole remnant could probably be characterised as being in moderate-good condition, based on the presence of large old trees as well as the state of the groundcover.

The presence of Inland Grey Box (*E. microcarpa*) raises the possibility of another EEC being present, one listed under both the TSC and EPBC Acts. *Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Penneplain, Nandewar and Brigalow Belt South Bioregions* is the listing under the TSC Act, and *Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-Eastern Australia* is the listing under the EPBC Act, for the same community. Benson *et al.* (2010) describe several communities which include Inland Grey Box, including some of their “sandstone forest” types. Only one of their Inland Grey Box communities is stated to belong to this EEC, *Western Grey Box – cypress pine shrub grass tall woodland in the BBS Bioregion* (ID81). Samples of vegetation along the Transmission Line routes in which a Grey Box species was prominent were compared with the indicator species list of ID81 and other communities which include Inland Grey Box, and were found to be a better match to one of the other communities. We have therefore concluded that Inland Grey Box Woodland EEC is not present on the Transmission Line site.

5.3 CONSERVATION-SIGNIFICANT FLORA SPECIES

Two threatened flora species, *Swainsona sericea* and *Acacia ausfeldii*, were recorded during the surveys within the Transmission Line Study Area. Waypoints for these records are provided in Appendix 11B.7.

Silky Swainson-pea (*Swainsona sericea*) was found in 2012 at one location within the site (TL1_J14), and was located in woodland derived from partial clearing of Sandstone Forest, within a lightly grazed area on a steep south-facing slope. Its continued presence at this location was confirmed in 2013 with three individuals noted in the same area. A thorough walkover of the surrounding area recorded no additional individuals. This suggests that threatened flora may persist within the grazed parts of the landscape in certain niches which have a reduced impact from grazing such as through being steep or rocky. Such areas were usually found to have a higher diversity of native groundcover species.

Acacia ausfeldii was recorded at two locations within the Transmission Line Study Area during the recent survey in 2013. Two plants were recorded growing on basalt (but close to an old sandstone quarry) in the south-western corner of Turill SCA and a second occurrence of a single plant was recorded north of the Turill Bus Route Road, on sandstone, near alternative route option. A wider search of an area of 300 x 50 metres in the vicinity of the single plant failed to locate any other plants.

The Commonwealth and State online database searches and NSW Wildlife Atlas threatened species records indicated 46 recorded or predicted threatened species which could occur in the wider study area (including nominated species). Because the Project Area is close to the boundary of several CMA subregions and three IBRA Bioregions a lengthy list of threatened species was generated for the region. The threatened species evaluation in Appendix C.1 determined that 5 threatened species have at least moderate potential to be present on parts of the Transmission Line Study Area, based on site quality, disturbance history, known distribution ranges and the results of the field survey Table 5-2.

The Transmission Line Study Area contains four principal habitat types:

- Dry forest on sandstone with a range of dominant tree species;

- Native pasture derived from clearing of this forest on sandstone-derived soils and having scattered paddock trees of species such as Narrow-leaved Ironbark or Inland Grey Box;
- A wetter forest type found mostly in narrow strips associated with drainage lines on sandstone typically dominated by Blakely's Red Gum and Rough-barked Apple (ID481) or by these two species in addition to Yellow Box (ID281); and
- Exotic pasture.

In addition small areas of hybrid White Box grassy woodland occur on basalt soils. These areas are typically heavily grazed, although not in the case of the Turill SCA remnant.

Areas of sandstone forest provide potential habitat for a number of threatened species including one tree species, the Capertee Stringybark (*E. cannonii*), nine shrub species (*Acacia ausfeldii*, *Homoranthus darwinoides*, *Ozothamnus tessellatus*, *Persoonia marginata*, *Philothea ericifolia*, *Prostanthera cryptandroides*, *Prostanthera stricta*, *Pultenaea* sp. Olinda and *Rulingia procumbens*) and one vine (*Kennedia retrorsa*). The proposed transmission line route options were only inspected at a few points in 2012, but sections were walked from end to end in 2013, particularly within Durrigere SCA and a number of other vegetated sections on private land where good quality habitat is present. *Acacia ausfeldii* is the only one of these sandstone species recorded during the surveys and the only species with records close to the site, with two records about a kilometre east of the proposed route near the Ulan colliery. Given the lack of close records and level of detailed survey undertaken as part of the recent fieldwork it is considered unlikely that any other of these species are present within the Transmission Line Study Area.

Further survey for threatened plant species would be desirable once a decision is made between the three current options, or any others which might yet be considered (for example, east of Ulan Road, avoiding the Ulan Colliery land).

Table 5-2 Threatened flora species that could possibly occur in the Transmission Line Study Area.

Species	Status	Habitat
Ausfeld's Wattle <i>Acacia ausfeldii</i>	V TSC	Forest on sandstone
Bluegrass <i>Dichanthium setosum</i>	V TSC V EPBC	Woodland or native pasture on basalt soils
Finger Panic Grass <i>Digitaria porrecta</i>	E TSC E EPBC	Woodland or native pasture on basalt soils
Lobed Blue-grass <i>Bothriochloa biloba</i>	V EPBC	Woodland or native pasture on basalt soils
<i>Homoranthus darwinoides</i>	V TSC V EPBC	Forest on sandstone
Capertee Stringybark <i>Eucalyptus cannonii</i>	V TSC V EPBC	Forest on sandstone
<i>Kennedia retrorsa</i>	V TSC V EPBC	Forest on sandstone
<i>Ozothamnus tessellatus</i>	V TSC V EPBC	Forest on sandstone
Clandulla Geebung <i>Persoonia marginata</i>	V TSC V EPBC	Forest on sandstone
<i>Lasiopetalum longistamineum</i>	V TSC V EPBC	Forest on sandstone

Species	Status	Habitat
Leek Orchid <i>Prasophyllum</i> sp. Wybong	CE EPBC	Open woodland and grassland, most likely vegetation communities 281 or 481, which are less affected by grazing. Flowering period is given as Spring, so the survey timing may have been suitable for its detection.
<i>Philothea ericifolia</i>	V EPBC	Forest on sandstone
Wollemi Mint Bush <i>Prostanthera cryptandroides</i>	V TSC V EPBC	Forest on sandstone
Mount Vincent Mint Bush <i>Prostanthera stricta</i>	V TSC V EPBC	Forest on sandstone
<i>Pultenaea</i> sp. Olinda	E TSC	Forest on sandstone
<i>Rulingia procumbens</i>	V TSC V EPBC	Sandy soils, often near water or in seasonally wet areas.
Silky Swainson-pea <i>Swainsona sericea</i>	V TSC	Grassy woodland and secondary grassland in areas with low grazing pressure

KEY: TSC Act – Threatened Species Conservation Act 1995; EPBC – Environment Protection and Biodiversity Conservation Act 1999; V – Vulnerable; E – Endangered; CE – Critically Endangered.

5.4 VEGETATION CONDITION

As discussed above, vegetation condition varies considerably throughout the Transmission Line Study Area, and includes relatively undisturbed forest and woodland, forest which has been logged and is regenerating, fragmented forest and woodland to which livestock have access, reducing understorey condition and native pasture with scattered retained or regrowth trees. There are also small areas of cropping paddock, areas of pasture in which exotic species are dominant and planted windbreak vegetation of both native and exotic species.

In general the areas of forest are in good condition, in the sense of containing few exotic species. However, it does not conform to the definition of good condition used for woodland in farming areas (more than 20 non-grass groundcover species) since forest on sandstone-derived soils naturally has most of its species diversity in the shrub layer rather than the groundcover. For sandstone forest types, we recorded forest as being mostly in moderate condition, based on the young age of the trees. Stands with more large trees were recorded as moderate-good, and those with at least some large hollow-bearing trees as good. Few stands of sandstone forest types contained more than an isolated weed or two (usually Prickly Pear *Opuntia* sp.).

5.5 NOXIOUS WEEDS

Of the ten weeds listed as Noxious in the Mid-Western Regional and Warrumbungle Council control areas within the Project Area, none are common in the Transmission Line Study Area, and some were not recorded there at all. Prickly Pear is the most widespread, but is generally present only as scattered small plants. Blackberry (*Rubus fruticosus*) and Tree of Heaven (*Ailanthus altissima*) are occasionally present near creeklines. The tenth species, Coolatai Grass (*Hyparrhenia hirta*) was recorded only on the Transmission Line site. It is listed as noxious in Class 4 (plants must be fully and continuously suppressed and destroyed). It is present as isolated roadside plants, on Ulan Road near the Ulan Colliery and on the southern verge of the Golden Highway about 50 metres east of the entrance to Turill SCA.

Two other significant weeds were found in the latter location near the entrance to Turill SCA, on both sides of the Golden Highway (part of the second alternative route option). They are African Lovegrass (**Eragrostis curvula*) and Galenia (**Galenia pubescens*). Neither is listed as Noxious in the relevant LGAs, although both are highly invasive, with African Lovegrass particularly being a major threat to both agricultural productivity and biodiversity. It favours poor sandy soils and can proliferate to the point of eliminating most other understorey plants in grassy woodlands. From the low density of roadside and paddock infestations seen on the Transmission Line Study Area, it appears that this species is in the early stages of invasion in the region. Its spread is likely to be rapid if it is not checked, but could be further exacerbated by works associated with the construction and maintenance of the Transmission Line, as could Coolatai Grass. Maintenance slashing along powerline easements is a very common means of spread for weedy grasses.

6 RESULTS - FAUNA

6.1 HABITAT TYPES AND CONDITION

Habitats in the Project Area can be considered as four broad fauna habitat types (excluding exotic pasture). The four habitat types are:

- Open pasture with scattered trees;
- Open woodland;
- Forest, and
- Aquatic / riparian areas.

In general, less vegetated parts of the study area provide habitat for wider ranging mobile fauna (birds and bats). The study area does contain more intact tracts of native woodland and forest vegetation that provide better quality habitat for a higher diversity of native fauna, including smaller forest birds, reptiles and terrestrial and arboreal mammals that do not occur in disturbed open habitat types.

Important habitat features include:

- Hollow-bearing trees, and
- Rocky outcrops.

6.1.1 Open Pasture with Scattered Trees

This habitat type describes extensive sections of the proposed route that pass through areas of grazing land or other agricultural land. These habitats support a generally low diversity of native fauna. Mature trees and hollow-bearing trees do occur, but often are too widely spaced to be used by arboreal mammals and the lack of a shrub layer and developed groundcover provides little habitat for smaller forest and woodland birds, reptiles and smaller ground mammals. Native fauna that occur in these habitats include Eastern Grey Kangaroo (*Macropus giganteus*), parrots and larger birds. Microchiropteran bats may roost in hollow-bearing paddock trees.

Open pasture areas may support isolated sandstone outcrops and intermittent drainage lines, typically with little natural riparian vegetation present.

6.1.2 Woodland

Open woodland remnants and regenerated patches of woodland occur throughout the Project Area. Agricultural activities have often simplified the structural and floristic diversity of this habitat type and this reduces the range of species likely to occur. Tree cover can range from low to quite dense. Woodland trees included mature and hollow-bearing trees as well as some rare occurrences of large dead stags. Mistletoe is present in several areas, although rarely at high densities. Sandstone outcrops, rockpiles and patchy growth of tussock forming grasses are all relatively common in woodland habitats. Fallen timber is generally common and includes larger logs and smaller fallen branches in varying stages of decay, providing a continuity of microhabitats for log dwelling fauna.

Drainage lines in woodland areas include some deeper creeklines with rocky substrates and standing pools of water at the time of survey. Riparian vegetation along these creeklines is rarely dense but typically includes larger native trees along banks of creeks. Some woodland areas contain a more intact shrub and native groundcover layer and provide a greater range of microhabitats including fallen logs,

surface rock and areas of deeper leaf litter. *Allocasuarina* is present as scattered patches and denser stands throughout several of the woodland areas.

6.1.3 Forest

Forest habitats occur where there is a denser tree canopy and are generally restricted to areas of Turill and Durridgere SCAs and the private property to the west along the alternative transmission line route. These areas, although inclusive of both remnant and regrowth vegetation, are generally less disturbed and border areas of relatively intact woodland habitat. Forest habitats contain a diversity of canopy tree species as well as a greater diversity of sub-canopy trees and shrubs including *Callitris* and *Allocasuarina* species. Habitat features such as hollow-bearing trees, large hollow logs, a deeper leaf litter layer, and rocky drainage lines are common.

A greater diversity of fauna species is typical of these forest areas, including more common species such as the Short-beaked Echidna (*Tachyglossus aculeatus*), Common Wombat (*Vombatus ursinus*), Red-necked Wallaby (*Macropus rufogriseus*), Feathertail gliders (*Acrobates pygmaeus*) and Sugar Gliders. A number of threatened species were recorded within larger tracts of forest habitat, including the Speckled Warbler, Glossy Black-cockatoo and several records of the Grey-crowned Babbler (*Pomatostomus temporalis temporalis*).

6.1.4 Aquatic / Riparian Areas

The generally low topography Transmission Line Study Area features intermittent drainage lines, usually with areas of exposed sandstone and occasional deep pools of standing water. Riparian vegetation is variable but typically sparse. In some sections, dense growth of Cumbungi (*Typha orientalis*) or Common Reed (*Phragmites australis*) chokes the creek channel. Creeklines provide a source of water for aquatic fauna as well as other animals including microchiropteran bats and small birds. Riparian vegetation also typically forms movement corridors in otherwise fragmented landscapes. Rock Warblers were recorded amongst sandstone overhangs by deep standing pools in the NE corner of private property at general location TL3_J6, and in a similar environment near a waterway in Durridgere SCA.

Farm dams occur throughout agricultural lands in the study area and typically feature minimal fringing vegetation, although dense patches of sedges and reeds are present on some dams. Water quality in dams and creeklines is likely to be variable depending on surrounding land use and rainfall conditions.

As for the Wind Farm Study Area, threatened fish listed under the FM Act are not anticipated in the minor creeklines or drainage lines of the Transmission Line Study Area. The development is not expected to have an adverse impact on riparian habitats; however recommendations to design Creek crossings in accordance with NSW Fisheries Policy and Guidelines for Fish Friendly Waterway Crossings (2003) are provided in Section 10.

No groundwater dependent ecosystems occur within the Transmission Line Study Area or will be affected by the proposal.

6.1.5 Habitat Features

Hollow-bearing trees

Hollow-bearing trees are relatively common throughout the Transmission Line Study Area, including within areas of woodland and forest as well as within remnant patches of trees in agricultural areas and as isolated paddock trees. Table 6-1 shows that tree hollows were present in 68% of the sites assessed,

although were common or abundant in only 25%. In general, the majority of hollows were of small to medium hollow entrance size, most likely to be utilised by small to medium birds and microchiropteran bats, rather than owls and gliders. However, the more vegetated sections of the Transmission Line Study Area was noted as supporting a greater density of larger hollows in better-quality forest; understorey diversity increased in this area in comparison to the rest of the easement. These hollows have the potential to support larger birds such as the Glossy Black-cockatoo, or arboreal mammals such as the Squirrel Glider. These areas of more mature forest often include fallen timber greater than 50 cm in diameter. Connectivity between areas with hollow bearing trees is compromised in areas by prior clearing and fragmentation for agricultural practices.

Rocky outcrops

Rocky habitats in the Transmission Line Study Area typically consist of low outcropping sandstone ridges with overhangs and deep crevices and rocky drainage lines. Larger sandstone boulder formations are located in the southern section of Durrigere SCA and the neighbouring property to the south. Lower extensive sandstone ridges occur south of Durrigere SCA within the property at general location TL3_G10 either side of the proposed route as well as to the west of the proposed alignment at general location TL3_I3. Areas of scattered surface rock or rock outcrops are generally uncommon in comparison with the Wind Farm Study Area (Table 6-1).

Table 6-1 Habitat features present at each habitat assessment site within the Transmission Line Study Area.

Habitat Type	Absent (No. sites)	Scattered (No. sites)	Common (No. sites)	Abundant (No. sites)	Relative Importance Score*
Tree hollows	20	77	34	11	1.25
Mature trees	5	69	49	17	1.56
Leaf litter	13	34	60	32	1.80
Fallen logs <50cm	12	31	60	37	1.87
Fallen logs >50cm	20	54	49	17	1.45
Mistletoe	73	40	21	5	0.70
Rock outcrop	90	18	18	12	0.65
Small surface rock	54	52	27	7	0.91
Large surface rock	80	27	26	6	0.70
Cliffs	117	14	6	2	0.23

Table 6-2 Value of habitat features for fauna groups at each habitat assessment site within the Transmission Line Study Area.

Fauna Group	Absent	Poor	Average	Good	Excellent	Relative Importance Score*
Log dependent fauna	4	32	45	38	19	2.26
Small birds	2	20	39	52	28	2.60
Waterbirds	120	15	3	2	0	0.19
Glossy black-cockatoo feed trees	93	24	10	6	6	0.62

*Note. A relative importance score has been applied to the habitat assessment data recorded during the field surveys to collate qualitative data on the relative abundance and value of fauna microhabitats (Table 6-1) and the relative abundance and value of fauna microhabitats for specific fauna groups (Table 6-2). The raw data is provided in Appendix

B.5. The relative importance score is arrived at by assigning a value of 0 for sites where the value of the habitat is absent, 1 where it is considered Poor, 2 where it is considered Average, 3 where it is considered Good and 4 where it is considered Excellent. This total is then divided by the number of sites where a value has been recorded.

Other habitat features

Tables 8-1 and 8-2 provide a summary of data from fauna habitat locations throughout the Transmission Line Study Area. The results show that for many fauna groups, key habitat resources are available and relatively widespread throughout the study area. It should be noted that there is some inherent bias in the data as fauna survey locations were focussed on areas of intact native vegetation and therefore open grassland and disturbed habitats are underrepresented in the data set.

The great majority of sites contain at least some mature trees, with mature trees considered to be common or abundant in 47% of sites. Mature trees provide structural complexity as well as a present or future source of hollows and provide better quality roosting and nesting sites for many bird species, including raptors. Leaf litter provides microhabitats for many smaller reptiles, frogs (particularly when in riparian zones) and a forage resource for small mammals and insectivorous birds. Two-thirds of the sites surveyed were recorded as having common or abundant leaf litter habitats. The great majority of sites provided fallen logs of varying size, with smaller fallen logs common or abundant in 69% of sites and larger logs (> 50cm diameter) common or abundant in 47% of sites.

Foraging habitat for Glossy Black-cockatoos was not so widely distributed, with preferred *Allocasuarina* species present in 33% of sites. Mistletoe was present in just under 50% of sites, although was common or abundant in only 19%. Habitat for small forest birds (as evidenced by structural diversity and a well-developed shrub layer, was considered to be average or better in 84% of sites, with 57% of sites ranked as good or excellent.

6.2 CONSERVATION-SIGNIFICANT FAUNA SPECIES

6.2.1 Database Searches

The Commonwealth and State online database searches and NSW Wildlife Atlas threatened species records indicated 88 recorded or potential threatened species that could occur in the wider study area (including species nominated for listing as threatened). Because the Project Area is close to the boundary of several CMA subregions and three IBRA Bioregions a lengthy list of threatened species was generated for the region. On closer review the threatened species evaluation in Appendix C.3 concluded that 31 threatened species have at least moderate potential to be present on parts of the Wind Farm Study Area, based on site quality, disturbance history, known distribution ranges and the results of the field survey (Table 6-3).

Table 6-3 Threatened or migratory listed species that could occur (possible) in the Transmission Line Study Area.

Species	Status	Habitat
Reptiles		
Pink-tailed Worm Lizard <i>Aprasia parapulchella</i>	V TSC V EPBC	Open woodland with predominantly native grasses and natural temperate grasslands on well-drained slopes with scattered, partially-buried rocks.
Birds		

Species	Status	Habitat
Speckled Warbler <i>Chthonicola sagittata</i>	V TSC	Habitats typically are structurally diverse with a grassy understorey, a sparse shrub layer and an open canopy.
Brown Treecreeper (eastern subspecies) <i>Climacteris picumnus victoriae</i>	V TSC	Occurs in eucalypt woodlands, mallee and drier open forest of eastern Australia, preferring woodlands lacking dense understorey.
Varied Sittella <i>Daphoenositta chrysoptera</i>	V TSC	The Varied Sittella is sedentary and inhabits most of mainland Australia except the treeless deserts and open grasslands.
White-fronted Chat <i>Epthianura albifrons</i>	V TSC	In NSW, it occurs mostly in the southern half of the state, in damp open habitats along the coast, and near waterways in the western part of the state.
Regent Honeyeater <i>Anthochaera phrygia</i>	E TSC E EPBC M EPBC	Most records are from box-ironbark eucalypt associations and it appears to prefer wetter fertile sites within these associations.
Painted Honeyeater <i>Grantiella picta</i>	V TSC	Inhabits dry open forests and woodland including Boree, Brigalow and Box Gum Woodlands and Box-Ironbark open forests, also paperbark and casuarinas.
Black-chinned Honeyeater (eastern subspecies) <i>Melithreptus gularis gularis</i>	V TSC	Inhabits the upper levels of drier open forests or woodlands most often dominated by box and ironbark eucalypts, particularly Mugga Ironbark, White Box, Grey Box, Yellow Box and Forest Red Gum.
Hooded Robin (south-eastern form) <i>Melanodryas cucullata cucullata</i>	V TSC	This species generally occurs in woodland remnants with high habitat complexity and uses stumps, posts or fallen timber for nesting and locating prey on the ground.
Scarlet Robin <i>Petroica boodang</i>	V TSC	In NSW it occupies open forests and woodlands from the coast to the inland slopes. Scarlet robins breed in dry eucalypt forests and temperate woodland.
Flame Robin <i>Petroica phoenicea</i>	V TSC	Breeds in upland forests and woodlands and migrates to more open lowland habitats in winter.
Diamond Firetail <i>Stagonopleura guttata</i>	V TSC	Restricted largely to ungrazed or lightly grazed woodland remnants of grassy eucalypt woodlands, including Box-Gum and Snow Gum Woodlands, and grassland and riparian areas, and sometimes lightly wooded farmland.
Grey-crowned Babbler <i>Pomatostomus temporalis temporalis</i>	V TSC	Prefers Box Gum Woodlands although also inhabits open forests, scrub lands, even farmlands and suburbs.
Little Lorikeet <i>Glossopsitta pusilla</i>	V TSC	Forages primarily in the canopy of open <i>Eucalyptus</i> forest and woodland, yet also finds food in <i>Angophoras</i> , <i>Melaleucas</i> and other tree species. Riparian habitats are particularly used, due to higher soil fertility and hence greater productivity.
Glossy Black-cockatoo <i>Calyptorhynchus lathami</i>	V TSC	Inhabits open forest and woodlands of the coast and the Great Dividing Range up to 1000 m in which stands of She-oak species, particularly Black She-oak (<i>Allocasuarina littoralis</i>), Forest She-oak (<i>A. torulosa</i>) or Drooping She-oak (<i>A. verticillata</i>) occur
Gang-gang Cockatoo <i>Callocephalon fimbriatum</i>	V TSC	Often a seasonal altitudinal migrant, moving to lower altitudes and more open forests and woodlands (particularly Box-Ironbark assemblages for winter. This species requires large hollows in which to breed.
Square-tailed Kite <i>Lophoictinia isura</i>	V TSC	Occurs primarily in coastal and sub-coastal open forest, woodlands and mallee. It has been recorded inland along timbered watercourses and adjacent areas.

Species	Status	Habitat
Barking Owl <i>Ninox connivens</i>	V TSC	Occurs in dry box-dominated forest and woodlands and roosts in dense foliage of <i>Acacia</i> , <i>Casuarina</i> or <i>Eucalyptus</i> species. It nests in large hollows (20-46 cm diameter) of large, old eucalypts including River Red Gum, White Box, Red Box and Blakely's Red Gum.
Powerful Owl <i>Ninox strenua</i>	V TSC	This species occurs primarily in tall, moist productive eucalypt forests of the eastern tableland edge and the mosaic of wet and dry sclerophyll forests occurring on undulating, gentle terrain nearer the coast.
Masked Owl <i>Tyto novaehollandiae</i>	V TSC	Roosts and breeds in moist eucalypt forested gullies, using large tree hollows or sometimes caves for nesting. Lives in dry eucalypt forests and woodlands from sea level to 1100 m.
Mammals		
Koala <i>Phascolarctos cinereus</i>	V TSC E EPBC	Occurs in woodland communities, coastal forests, woodlands of the tablelands and western slopes and the riparian communities of the western plains.
Large-eared Pied Bat <i>Chalinolobus dwyeri</i>	V TSC V EPBC	Found mainly in areas with extensive cliffs and caves, from Rockhampton in Queensland south to Bungonia in the NSW Southern Highlands. It is generally rare with a very patchy distribution in NSW. It roosts in caves (near their entrances), crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of the Fairy Martin.
Little Pied Bat <i>Chalinolobus picatus</i>	V TSC	Occurs in dry open forest, open woodland, mulga woodlands, chenopod shrublands, cypress-pine forest, mallee, bimbil box.
Little Bentwing-bat <i>Miniopterus australis</i>	V TSC	Moist eucalypt forest, rainforest, vine thicket, wet and dry sclerophyll forest, Melaleuca swamps, dense coastal forests and banksia scrub. Generally found in well-timbered areas.
Eastern Bentwing-bat <i>Miniopterus schreibersii oceanensis</i>	V TSC	This species roosts and raises its young in caves and mine tunnels. The species appears to forage above the forest canopy in a diverse range of forest types.
Corben's Long-eared Bat <i>Nyctophilus corbeni</i>	V TSC V EPBC	Overall, the distribution of the south eastern form coincides approximately with the Murray Darling Basin with the Pilliga Scrub region being the distinct stronghold for this species.
Yellow-bellied Sheathtail-bat <i>Saccolaimus flaviventris</i>	V TSC	It roosts alone or in groups of up to six, in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows.
Eastern Cave Bat <i>Vespadelus troughton</i>	V TSC	The Eastern Cave Bat is found in a broad band on both sides of the Great Dividing Range from Cape York to Kempsey, with records from the New England Tablelands and the upper north coast of NSW.
Eastern False Pipistrelle <i>Falsistrellus tasmaniensis</i>	V TSC	Found in wet sclerophyll forest and coastal mallee. It appears to prefer wet sclerophyll forest although also utilises open forest at lower altitudes.
Greater Broad-nosed Bat <i>Scoteanax rueppellii</i>	V TSC	Utilises a variety of habitats from woodland through to moist and dry eucalypt forest and rainforest, though it is most commonly found in tall wet forest.
Greater Long-eared Bat <i>Nyctophilus timoriensis</i>	V TSC V EPBC	Inhabits a variety of vegetation types, including mallee, bullock but more commonly box/ironbark/cypress-pine communities that occurs in a north-south belt along the western slopes and plains of NSW and southern Queensland.

KEY: TSC Act – Threatened Species Conservation Act 1995; EPBC – Environment Protection and Biodiversity Conservation Act 1999; V – Vulnerable; E – Endangered; M – Migratory

6.2.2 Koala – SEPP 44

Schedule 2 of SEPP 44 lists Koala feed tree species to be considered under the SEPP. One of these species, White box, occurs on the Transmission Line Study Area, where it occurs as a hybrid with other box species, usually hybridising with Grey Box. It is present on the lower to upper slopes in the northern part of the Transmission Line Study Area where basalt derived soils are present rather than sandstone.

In some locations, this White Box hybrid constitutes over 15% of the tree canopy, indicating that “potential koala habitat” as defined by SEPP 44 is present. The fauna survey program completed as part of this assessment (including call playback) did not record any Koalas or evidence of Koala use and this, together with analysis of database records, suggests that the Transmission Line Study Area does not provide any areas of “core koala habitat” as defined by SEPP 44.

6.3 FAUNA SPECIES RECORDED

A range of fauna species were recorded across the Project Area (Wind Farm & Transmission Line Study Area), including:

- 26 species of herpetofauna (reptiles and amphibians);
- 38 species of mammal (including 16 microchiropteran bats and 9 exotic species); and
- 128 species of bird.

Refer to Appendix B.4 for a full species list.

6.3.1 Threatened Species

Ten species of threatened birds and five threatened microchiropteran bat species were recorded (Table 6-4); locations of observations are shown in the maps in Appendix E.3.

Table 6-4 Threatened species recorded during field surveys within the Transmission Line Study Area.

Name	Status	Observation Location
Birds		
Brown Treecreeper	V TSC	Recorded in several locations including the northern section of study area within Turill SCA, the northern part of Durridgere SCA, near Murrumbline Creek and in vegetation off Bobadeen Road.
Speckled Warbler	V TSC	Recorded in several locations south of the Golden Highway including Durridgere SCA, west of Sawpit Creek, near Murrumbline Creek, private property west of Durridgere and in vegetation off Bobadeen Road.
Painted Honeyeater	V TSC	West of proposed transmission line route south of Durridgere SCA and in roadside vegetation near the Ulan mine site.
Black-chinned Honeyeater	V TSC	North-eastern section of route along Golden Highway.
Glossy Black-cockatoo	V TSC	Birds and/or evidence of foraging widely recorded to the north of the Ulan mine site, within Turill SCA and in many locations in the central part of the site within and around Durridgere SCA and in vegetation on the eastern side of Ulan Road south of the village of Turill. Glossy Black-cockatoo foraging activity and bird sightings were common in the last of these locations.
Grey-crowned Babbler	V TSC	Various locations around Durridgere and central section of route as well as Turill SCA.
Varied Sittella	V TSC	Recorded in Durridgere SCA and Turill SCA.

Name	Status	Observation Location
Square-tailed Kite	V TSC	Recorded nesting in riparian vegetation along the Goulburn River in the southern part of the Study Area on the preferred alignment. Route has been re-aligned to avoid this location.
Diamond Firetail	V TSC	Recorded in vegetation off Ulan Road north of Bobadeen Road, in two locations in the central part of the study area (west of the preferred and alternative routes) and west of Turill SCA.
Powerful Owl	V TSC	The Powerful Owl responded to call playback during the 2013 survey on two occasions within the southern part of the Transmission Line Study Area, although it is likely to have been the same individual, and could have been called in from a distance.
Mammals (excluding bats)		
Squirrel Glider	V TSC	Recorded in the Wind Farm Study Area in the 2012 survey. Recorded in riparian vegetation along the Goulburn River in the southern part of the Study Area on the preferred route in the 2013 survey. Route has been re-aligned to avoid this location.
Microchiropteran bats		
Yellow-bellied Sheath-tail-bat	V TSC	Possible record from near NE corner of Durrigere SCA in 2012. Definite record in 2013 - in the vicinity of Bobadeen Road (north of Ulan Coal Mine, and west of Ulan Rd. It runs between the preferred route (along Ulan Rd) and the alternative route (further west).
Eastern Bentwing-bat	V TSC	Various locations
Corben's Long-eared Bat	V TSC V EPBC	Various locations
Large-eared Pied Bat	V TSC	Various locations
Eastern Cave Bat	V TSC	Various locations

KEY: TSC Act – Threatened Species Conservation Act 1995; EPBC – Environment Protection and Biodiversity Conservation Act 1999; V – Vulnerable.

6.3.2 Microchiropteran Bat Results

Sixteen bat species were recorded in the Project Area (Table 6-5), five of which are listed under the NSW TSC Act, and one listed under the EPBC Act.

Table 6-5 Species recorded during bat detection surveys in the Transmission Line Study Area

Species	Common Name	TSC Act	EPBC Act
<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	V	-
<i>Chalinolobus gouldii</i>	Gould's Wattled Bat	-	-
<i>Chalinolobus morio</i>	Chocolate Wattled Bat	-	-
<i>Miniopterus schreibersii</i>	Eastern Bentwing Bat	V	-
<i>Mormopterus ridei</i>	Eastern Freetail Bat	-	-
<i>Mormopterus</i> sp. 4	Southern Freetail Bat	-	-
<i>Nyctophilus corbeni</i>	Corben's Long-eared Bat	V	V

<i>Nyctophilus</i> spp.	Long-eared Bats	-	-
<i>Rhinolophus megaphyllus</i>	Eastern Horseshoe-bat	-	-
<i>Saccolaimus flaviventris</i>	Yellow-bellied Shear-tail-Bat	V	-
<i>Scotorepens balstoni</i>	Inland Broad-nosed Bat	-	-
<i>Tadarida australis</i>	White-striped Freetail Bat	-	-
<i>Vespadelus darlingtoni</i>	Large Forest Bat	-	-
<i>Vespadelus regulus</i>	Southern Forest Bat	-	-
<i>Vespadelus troughtoni</i>	Eastern Cave Bat	V	-
<i>Vespadelus vulturnus</i>	Little Forest Bat	-	-

KEY: For clarity, the taxonomy of *Miniopterus* follows Richards *et al* (2012), though *M. schreibersii* has been considered as *M. oriana* (Churchill 2008).

6.3.3 Threatened Bat Species

Although threatened species were quite widespread in the TLSA, relative activity levels were quite low. Table 6-6 shows the number of calls identified during the 2012 bat survey (including both Wind Farm and Transmission Line Study Areas). Over 11,000 calls were recorded; 104 calls of threatened species constituting less than 1% of the total activity recorded. For the 2013 bat survey in the TLSA, the proportion of calls from threatened species was slightly higher, with 83 of a total of 2911 definite identifications from recorded calls (2.85%) coming from threatened species.

Table 6-6 Number of threatened bat species calls recorded in the Transmission Line Study Area (2012 results).

Species	Definite Identification	Probable Identification	Total Calls
<i>Chalinolobus dwyeri</i>	4	1	5
<i>Miniopterus schreibersii</i>	62	0	62
<i>Nyctophilus corbeni</i>	13	0	13
<i>Saccolaimus flaviventris</i>	4	0	4
<i>Vespadelus troughtoni</i>	0	0	0
			84

Table 6-7 Number of threatened bat species calls recorded in the Transmission Line Study Area (2013 results).

Species	Definite Identification	Probable Identification	Total Calls
<i>Chalinolobus dwyeri</i>	8	1	9
<i>Miniopterus schreibersii</i>	57	0	57
<i>Nyctophilus corbeni</i>	17	0	17
<i>Saccolaimus flaviventris</i>	0	1	1
<i>Vespadelus troughtoni</i>	20	0	20
			104

6.3.4 Threatened Species Habitat Preference

The detailed habitat identifications from the vegetation surveys were condensed to a smaller set for the purposes of bat utilisation patterns. It is well known that bats respond to habitat structure, rather than species composition, especially where some species have evolved to occupy cluttered habitats, others to open habitats, and others to airspace free of obstacles. There is some relationship between understorey type and wooded habitats such as forest or woodland, where a different community structure can be found in those with different types of understorey.

The Large-eared Pied Bat utilised all four habitats within the TLSA, while the Eastern Bentwing Bat utilised three of them, and the only call attributed to the Yellow-bellied Sheath-tail Bat was from an area of sandstone forest. Contrary to general patterns, and the observations from the Wind Farm Study Area, Corben's Long-eared Bat was recorded in open forest with grassy understorey and in pasture with scattered trees in 2012, although it was recorded from sandstone forest in the 2013 survey. It is possible that the few calls recorded in open habitats were from Corben's Long-eared Bat commuting to denser habitats. The Eastern Cave Bat was only found in open forest with grassy understorey and in sandstone forest. The Eastern Cave Bat was not recorded in the 2013 survey.

Table 6-8 Habitat utilisation by threatened species in the Transmission Line easement areas

Habitat	No. of Sites in Habitat	<i>Cdwy</i>	<i>Msch</i>	<i>Ncor</i>	<i>Sfla</i>	<i>Vtro</i>	Total Listed Species
Open forest, grassy understorey	2	1	7	2	-	4	4
Pasture with scattered trees	3	1	11	1	-	-	3
Sandstone forest	12	10	78	13	4+1?	9	3 or 4
Woodland - remnant	1	1	-	-	-	-	1
Habitat type occurrence for each species		4	3	3	1	2	

KEY: Species mnemonics are as follows: *Cdwy* = *C. dwyeri*, *Msch* = *M. schreibersii*, *Ncor* = *N. corbeni*, *Sfla* = *S. flaviventris* and *Vtro* = *V. troughtoni*. The number of calls recorded is shown in cells. The number of calls recorded is shown in cells.

6.4 ADDITIONAL REVISED TRANSMISSION LINE ROUTES SURVEYED IN 2013

The *alternative* and *second alternative* routes as well as some route revisions of the original preferred route that had been made since the 2012 work was conducted were surveyed in October 2013. Additional survey effort was undertaken of the original route in areas where the quality of fauna habitat warranted extra survey (particularly Durridgere SCA).

The *alternative* and *second alternative* routes, like the preferred route, pass through some substantial forest remnants in Turill SCA north of the Golden Highway, south of the Golden Highway and west of Ulan Road on private property west of Ulan Road and between Ulan Road and Durridgere SCA.

The bulk of this is of sandstone forest types, but the route crosses numerous minor drainage lines with ID481 (Blakely's Red Gum woodland, non-EEC) vegetation type in them. This vegetation community

appears less cleared or logged than the sandstone forest types on private property and typically contains higher than average numbers of large hollow-bearing trees.

The alternative and second alternative routes also pass through areas of Box-Gum woodland EEC: ID281 (Yellow Box) on larger creeks in the north of the Transmission Line site and ID483 (White Box) on areas of basalt-derived soils in Turill SCA (not on the route, but potentially providing access to it via an existing Fire Trail) and on private property north of Turill Bus Route Road and west of Ulan Road. These areas are in moderate-good to good condition. The second alternative follows Kurrajong Gully, all of which carries ID281, for some distance on the Crown Land west of Turill SCA. In general the biodiversity values increase in the vicinity of drainage lines, particularly as they appear to be the main location for both EECs and hollow-bearing trees. However, the alternative and second alternative routes are aligned along drainage lines for some distance. The preferred route also does this in the area north of Ulan Colliery, along the Goulburn River (where there was also a notable occurrence of a nesting Square-tailed Kite).

6.4.1 Desktop Assessment of Alternative Route Section

As noted in Section 4.2 a section of TLSA alternative route which passes through Ulan Coal land could not be accessed during 2013 field work and therefore could only be assessed using existing information. A detailed Ecological Assessment was undertaken by Umwelt Environmental Consultants (Umwelt) as part of an Environmental Assessment for continued mining operations for the Ulan Coal Mine within this area: *Umwelt Environmental Consultants (2009) Ecological Assessment: Ulan Coal – Continued Operations*. Information from this assessment was used to inform constraints mapping for the area; however vegetation mapping has not been extrapolated in this area. Follow-up survey work in moderate-high constraint areas would be required should development of this route be pursued. Results from the Umwelt (2009) report are provided below.

Background

A total of 13,435 ha were surveyed as part of the Ecological Assessment (Umwelt 2009) and included the alternative transmission line easement which extends along the eastern edge of the Project Area. The Ecological Assessment included a detailed literature review of numerous reports and previous ecological surveys which have been undertaken throughout the Ulan Complex. The assessment also included extensive surveys undertaken during spring and autumn seasons over a three year period. In total, 86 ten-hour person days were used to comprehensively sample vegetation communities and flora species within the Project Area. Detailed fauna surveys including a variety of trapping methods were undertaken over the same period between 2006 and 2008. In total 67 person days (of 10-16 hrs each) were used to sample fauna assemblages of the Project Area.

Vegetation Mapping and EECs

A total of 37 vegetation communities were delineated by Umwelt (2009) across the Project Area. Based upon detailed vegetation mapping produced as part of the assessment, the proposed transmission easement would extend through mostly Sandstone Forest types along the eastern edge of the Ulan project area.

The dominant vegetation communities identified by Umwelt (2009) along this section of the transmission line include:

- Ironbark Open Forest Complex on Sandstone
- Scribbly Gum Woodland – Heathland on Sand Plateaux
- Narrow-leaved Ironbark Open Forest on Alluvium/Colluvium

- Stringybark-Ironbark Open Forest on Sandstone Slopes

Additionally, alluvial flats and drainage lines which dissect the proposed transmission line easement in a number of locations have been mapped as Blakely's Red Gum Open Forest and Rough-barked Apple Open Forest, respectively. Two areas of Blakely's Red Gum Open Forest occur within or directly adjacent to the proposed transmission line easement. These areas have been identified by Umwelt (2009) as being part of the White Box-Yellow Box-Blakely's Red Gum Woodland EEC listed under the TSC Act and White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grasslands CEEC listed under the EPBC Act. However, in the event that this community is similar to those surveyed along the transmission line and is consistent with Benson *et al.*, (2010) community ID481, then this community would not form part of the EEC. Follow up survey work is required to confirm these assumptions.

Yellow Box was identified in some of **ng**h environmental's vegetation sampling sites from this area in both 2012 and 2013, but in general the vegetation community fits the description of ID481 (non-EEC, Blakely's Red Gum dominated) more than ID281 (EEC, Yellow Box co-dominant). Even where Yellow Box is present, typical sandstone shrubs are present in some diversity while grassy woodland forbs are uncommon (for example 2012 site A35). This part of the site is also located in the upper end of a drainage line, a more typical location for ID481 than ID281. We have therefore chosen to regard this area as not including any Box-Gum Woodland EEC.

Threatened Flora

A total of five threatened flora species were recorded during the survey period within the Ulan project area consisting of:

- *Acacia ausfeldii*;
- *Diuris tricolor*;
- *Eucalyptus cannonii*;
- *Leucochrysum albicans* var. *tricolor*; and
- *Homoranthus darwinioides*.

Based on mapping provided in the Ecological assessment report (Umwelt 2009), none of these species were recorded along or adjacent to the proposed transmission line easement. Considering the extensive survey effort involved in the flora surveys and the inclusion of surveys in different seasons over a three year period it is likely that any threatened flora species would have been recorded within the current proposed transmission line easement should they be present.

Threatened Fauna

A total of 34 threatened fauna species, primarily woodland birds and microchiropteran bats, were recorded across the mine lease project area during surveys undertaken by Umwelt (2009). Of these the Glossy Black Cockatoo, Flame Robin, Grey-crowned Babbler, Large-eared Pied Bat, Little Lorikeet, Powerful Owl, Speckled Warbler and Squirrel Glider were recorded in habitats located directly adjacent to the proposed transmission line easement.

Potential Impacts

The alternative transmission line route option in this area would extend along an existing linear disturbance area where a dewatering pipeline system and an adjacent powerline are currently located within the Ulan Complex. It is likely however that there would be additional clearing needed to meet the required width of the transmission easement.

Based on an analysis of the Ecological Assessment (Umwelt 2009) and consideration of flora and fauna assessment completed on nearby land as part of the current assessment, impacts associated with the location of the alternative transmission line route within this part of the Ulan lands are likely to consist of:

- Loss of areas of native Sandstone Forest types, potentially including areas that could be interpreted as belonging to White Box-Yellow Box-Blakely's Red Gum Woodland EEC listed under the TSC Act and, if of high quality, White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grasslands CEEC listed under the EPBC Act;
- Loss of habitat for native fauna, including threatened species known from the surrounding area such as the Glossy Black-cockatoo, Flame Robin, Grey-crowned Babbler, Large-eared Pied Bat, Little Lorikeet, Powerful Owl, Speckled Warbler and Squirrel Glider; and
- Loss of fauna habitat resources including a relatively high abundance of hollow-bearing trees.

6.5 KEY ECOLOGICAL ISSUES

6.5.1 Transmission Line Study Area Key Ecological Issues

The following are the key flora issues for the Transmission Line Study Area:

- The presence of Box-Gum Woodland EEC in several locations: ID281 on drainage lines on the preferred option, alternative and second alternative routes in the northern part of the site; and ID483 on basalt soils on the alternative and second alternative route or access points.
- The presence of a threatened flora species, Silky Swainson-pea, in small numbers at a single location in woodland within paddocks: TL1_J14;
- The presence of the threatened Ausfeld's Wattle (*Acacia ausfeldii*) at two locations, one individual on the second alternative route and two plants on a potential access route to the second alternative line in Turill SCA; and
- The potential, however unlikely, for 11 threatened flora species, mostly shrubs, to be present in relatively undisturbed forest within sandstone vegetation.

The following are the key fauna issues for the Transmission Line Study Area:

- The presence of six threatened bird species (Brown Treecreeper, Speckled Warbler, Painted Honeyeater, Black-chinned Honeyeater, Glossy Black-cockatoo, Grey-crowned Babbler, Varied Sittella);
- The potential occurrence of additional threatened bird species that may occur in woodland and forest habitats and may be impacted to various degrees by clearing of native vegetation along the transmission line easement;
- The presence of five threatened microchiropteran bat species (Yellow-bellied Sheath-tail-bat, Eastern Bentwing-bat, Corben's Long-eared Bat, Large-eared Pied Bat, Eastern Cave Bat);
- The presence of hollow-dependent species including arboreal mammals, microchiropteran bats and a range of bird species that may be impacted to various degrees by clearing of native vegetation along the proposed route;
- The presence of rocky outcrops that provide high quality habitat for reptiles and other species and may provide roosting habitat for microchiropteran bats, including threatened species.
- The presence of riparian habitats, including rocky drainage lines;
- The presence of larger areas of intact relatively undisturbed forest in Turill and Durrigere SCAs, within the northern part of the Ulan mine site and in private properties; and
- The presence of exotic fauna species, including non-native predators that may be encouraged into more intact areas of forest by the creation of cleared power line easements.

7 IMPACT ASSESSMENT

7.1 APPROACH TO IMPACT ASSESSMENT

The calculation of estimated impact area has been defined within the map sets as the 'worst case impact area' and was identified as the longest transmission line route option being considered. Where cumulative impacts within the Wind Farm Study Area and the Transmission Line Study Area have been considered together for the sake of impact assessment, it includes the upper number of turbines (288) and associated infrastructure (i.e. proposed tracks, overhead powerlines, and substations) being considered. Vegetation clearance has been calculated on this worse cast scenario. Section 7.2.1 provides further detail on how to interpret the calculations within the impact assessment tables.

This section focusses on discussion of impacts associated with vegetation clearance and associated habitat loss arising from clearance of the transmission line easement. Following construction, low growing shrubs and groundcover vegetation can re-establish within the easement, although vehicle access will need to be maintained.

Proposed routes for the transmission line corridor were revised following the 2012 survey based on the findings of the biodiversity assessment and other considerations. The 2013 survey focussed on:

- A *preferred route*, which is generally the easternmost alignment and passes through Durridgere SCA in the central part of the Study area.
- An *alternative route*, which is generally located to the west of the preferred route. This route avoids Durridgere SCA, passing through private land, including some areas of intact sandstone forest.
- A *second alternative route*, which passes through Turill SCA along the general east-west alignment of the Golden Highway and provides an alternative connection between the preferred and alternative routes.

A section of the alternative route in the southern part of the Study area that passes through land owned by the Ulan Coal Mine could not be surveyed due to access restrictions. Detailed ecological assessment has been undertaken in recent years in this area by Umwelt (2009) and results from these assessments have been considered where appropriate.

7.2 SPECIFIC PROPOSAL IMPACTS – WORST CASE SCENARIO

7.2.1 Interpretation of Impact Assessment Tables

The impact assessment tables (Table 7-1, Table 7-2, and Table 7-3) show the impact areas (extents within the Development Area) for both the Wind Farm and Transmission Line Study Areas for the worst case scenario.

The following provisions apply to Table 7-1:

- The **Total area** rows/columns for the Wind Farm and Transmission Line Study Areas are an *overestimation* of total clearance as some areas still include buffer zones or are larger than required. These include the overhead powerline cabling / easement, substations, and new tracks (tracks will mostly be 5 m, but up to 10 m in some areas for crane access). These areas will be reduced pending the final alignment.

- The survey areas for both the Wind Farm and Transmission Line Study Areas have been calculated using GIS mapping software and have excluded areas in which infrastructure overlaps. The vegetation clearance hectare totals are also presented for each infrastructure type and can therefore be read in isolation.
- For the Wind Farm Study Area, vegetation clearance has been calculated per turbine footing (288 turbines) for each vegetation type based on the indicative turbine locations.
- Unknown: these are areas not surveyed during the field work, or for which vegetation mapping cannot be confidently extrapolated. Constraints analysis has been extrapolated to these areas (refer Section 4.8) using a precautionary approach.
 - Within the Transmission Line Study Area the main unknown area includes a southern section that lies to the west. Section 6.4.1 provides some background information on this area, as delineated by Umwelt (2009).
 - Within the Wind Farm Study Area the main areas unknown include: 1) an area within the north-east section of the wind farm, 2) minor areas of overhead powerline, transmission line and proposed tracks within northern sections of the wind farm.

7.2.2 Habitat Loss (Vegetation Clearing)

A 60 m wide easement (30 m either side of centreline) is assessed for approval in order to provide flexibility in micro-siting infrastructure at the construction stage. The actual width of clearing for the transmission line is likely to be no more than 30 m along its entire length. Thus the impact assessment uses a highly conservative approach to vegetation clearing impacts. Actual impact is likely to be half what is assessed.

Vegetation clearing is required for construction of the transmission line for a length of approximately 38 km depending on the route option (or combination of options) chosen. The transmission line physically continues into the Wind Farm Study Area, but impacts in that part of the Project Area are considered in the Wind Farm assessment.

In derived grassland areas or areas where previous clearing has already been undertaken, the extent of clearing required will also be much lower than that assessed. In fact clearing will not actually be required at all for infrastructure placement in the majority of these areas, although some vegetation disturbance will occur.

Non-threatened Vegetation Types

The survey area for the total Project Area covers approximately 7920 ha. The bulk of vegetation clearance within the defined Development Area affects exotic vegetation.

Within the Development Area of the TLSA, Sandstone Forest in good condition occurs in 31.6 ha of the preferred corridor, 62.3 ha of the alternative corridor and 70.3 ha of the second alternative corridor, which was substantially higher than any other vegetation type for the easement. A further 201.5 ha, 199.0 ha, or 233.6 ha of lower condition Sandstone Forest is present in the preferred, alternative and second alternative corridors respectively. Communities that fall into the broad group of Sandstone Forest are generally considered to be of least concern by Benson *et al.* (2010), as substantial areas are conserved in large local reserves such as Goulburn River, Gardens of Stone and Wollemi NPs as well as a number of smaller reserves such as Durrigere SCA. However, Sandstone Forest has the potential to support threatened flora and fauna species by providing habitat, and any areas of good quality vegetation are therefore considered important in this regard.

The Sandstone Forest provides potential habitat for one threatened tree (*Eucalyptus cannonii*), nine threatened species of shrub (*Acacia ausfeldii*, *Homoranthus darwinoides*, *Ozothamnus tessellatus*, *Persoonia marginata*, *Philothea ericifolia*, *Prostanthera cryptandroides*, *Prostanthera stricta*, *Pultenaea* sp. *Olinda* and *Rulingia procumbens*), and one vine (*Kennedia retrorsa*).

Sandstone Forest is considered important for threatened woodland birds, arboreal mammals (gliders and microchiropteran bats) and threatened cockatoos, in particular the Glossy Black-cockatoo. The value of Sandstone Forest to fauna species is considered in more detail in the Assessments of Significance (Appendix D).

It should also be noted, however, that development of the area as a transmission line easement, after the clearing, also has the potential to be advantageous for shrub species, in that it relieves them from the competition of a tree canopy. The disturbance of easement construction may also provide recruitment opportunities, as long as the existing plants are not damaged or removed in the process.

Box Gum Woodland EEC/CEEC

Table 7-3 provides details on the extent of Box Gum Woodland EEC and CEEC to be cleared as a result of the proposed development. These calculations are expressed for the entire project area including the Wind Farm Study Area and the Transmission Line Study Area in order to assess a cumulative impact to this EEC. Calculations have been determined for the three infrastructure layouts so comparisons may be made. Under the TSC Act areas of degraded native pasture which once comprised Box Gum Woodland canopy species may still be considered part of the EEC. The extent of native pasture which would be included within the definition of Box Gum Woodland EEC is also provided in Table 7-3, however the discussion below of the condition classes is limited to areas comprising a native tree component.

The EEC over the vast majority of the entire Project Area is characterised by low diversity native pasture in poor or poor-moderate condition. Ninety-five percent of Box Gum Woodland in the preferred infrastructure layout (and 84% for the alternative and 90% for the second alternative) is in poor or poor-moderate condition. Within the entire Project Area (approximately 7920 ha), the maximum estimated amount of EEC to be cleared (i.e. the Development Area) is approximately 441.7 ha (preferred option), 445.1 ha (alternative option) or 462.8 ha (second alternative option). This represents approximately 0.63% of the total extent of the Box Gum Woodland EEC in the South-western Slopes Bioregion, and 0.22% of the total extent in the Brigalow Belt South Bioregion, both of which contain part of the Wind Farm Project Area. If the extents of Box Gum Woodland in these two bioregions are considered together, the maximum extent of Box Gum Woodland to be cleared for the project represents 0.16% of this total.

Only 2% (preferred layout), 11% (alternative layout) and 7% (2nd alternative layout) of the total EEC recorded across the entire project area was found to be in good or moderate-good condition. The majority of these areas are located within the Transmission Line Study Area at the northern part around the Golden Highway where basalt intrusions occur amongst the sandstone. These areas have generally been subject to less grazing pressure and pasture improvement than areas of EEC within the Wind Farm Study Area.

Within the Transmission Line Study Area there are patches of moderate-good to good condition EEC located on all three options. Some of these patches are quite large, as for example along Kurrajong Gully on the alternative route west of Turill SCA in Crown Land. Patches on the preferred route are smaller and more degraded by grazing (in the north-east portion of the route on either side of the Golden Highway), though one site was found with tree regeneration despite the presence of grazing. Areas of moderate-good and good EEC within the Transmission Line site are considered to belong to the Commonwealth Box

Gum Woodland CEEC, due to (1) their large (> 2 ha) size and current regeneration of overstorey species, (2) the presence of >12 non-grass understorey species, or (3) both of these factors.

Similar vegetation to this is widespread in farmland throughout the region, and particularly within the northern section of the Transmission Line survey area. It is typical of similarly-degraded areas throughout the surrounding bioregions, including the South-western Slopes Bioregion and the Brigalow Belt South Bioregion. The long history of grazing, fertiliser use and weed invasion in these areas means that the potential for natural regeneration is likely to be very low. Given the low conservation value of this vegetation, its abundance in the local district and wider region, and the highly localised and limited impacts associated with the proposal, impacts to Box Gum Woodland are not expected to be significant (Appendix D).

Habitat Loss (Hollow-bearing Trees and Landscape Connectivity)

Hollow-bearing trees are present across the Transmission Line Study Area, and may occur in all habitat types and condition classes. Isolated and scattered paddock trees often provide hollow resources. The majority of hollows were of small to medium hollow entrance size, most likely to be utilised by small to medium birds and microchiropteran bats, although larger hollows that may provide nest sites for larger birds including owls and cockatoos or arboreal mammals such as the Squirrel Glider are not uncommon.

Drainage line and creek areas typically support a higher than average density of large old hollow-bearing trees, as well as being located on relatively fertile soils (for sandstone areas) and therefore being more productive generally for fauna. The presence of large old trees also means these areas are more likely to be productive of other fauna requirements such as nectar, and hence insects and other items of prey for smaller birds.

Recommendations have been made to the proposal in order to avoid impact upon fauna connectivity and habitat patch size and integrity, as well as hollow-bearing trees, where possible. These provisions include follow up survey work, pre-clearance surveys and micrositing of infrastructure within the Transmission Line Study Area. Refer to Section 10.3.2 – landscape connectivity and protected areas for more detail on the value of these areas.

Table 7-1 Estimated worst-case clearing extents of the proposal by vegetation type, based on each infrastructure layout option within the Transmission Line Study Area

Vegetation Community	Preferred TL corridor (ha)	Alternative TL corridor (ha)	2 nd Alternative TL corridor (ha)	Proposed and Existing tracks (all routes)
Riparian forest – Blakely’s Red Gum, Rough-barked apple and Yellow Box (ID 281)	3.9	23.2	13.8	0.4
Riparian forest – Blakely’s Red Gum and Rough-barked apple (ID 481)	23.7	41.0	32.4	5.5
Sandstone Forest - Narrow-leaf Ironbark dominant forest (ID 468 and 479)	44.4	76.2	83.9	7.1
Sandstone Forest - Inland Scribbly Gum dominant sandstone forest (ID 477)	22.9	11.2	11.2	9.6
Sandstone Forest - Red Ironbark dominant sandstone forest (ID 478)	17.8			
Sandstone Forest - Black cypress pine dominant sandstone forest (ID 480)	2.9			
White Box – Grey Box Grassy Woodland (ID 483)	10.4	10.6	11.5	0.4
Native Pasture (ID 395)	94.2	88.6	142.2	18.8
Exotic	12.8	10.6	9.0	1.9
Unknown				87.7
TOTAL AREA	233.1	261.3	303.9	131.5

Table 7-2 Clearing of vegetation types by condition class based on each infrastructure layout option within the Transmission Line Study Area

Vegetation Community	Good	Moderate-good	Moderate	Poor-moderate	Poor	Exotic	Unknown	TOTAL AREA ⁴
PREFERRED TL CORRIDOR								
Riparian forest – Blakely’s Red Gum, Rough-barked apple and Yellow Box (ID 281) (EEC)	1.3	2.6			0.4			4.3
Riparian forest – Blakely’s Red Gum and Rough-barked apple (ID 481)	12.1	2.0	2.9	9.5				26.5
Sandstone Forest - Narrow-leaved Ironbark dominant (ID 468 and 479)	7.5	27.7	15.3	0.5	0.2			51.1
Sandstone forest - Inland Scribbly Gum dominant (ID 477)	7.8	23.7						31.5
Sandstone forest - Red Ironbark dominant (ID 478)	2.8	15.0						17.8
Sandstone forest - Black cypress pine dominant (ID 480)			2.9					2.9
White Box – Grey Box Grassy Woodland (ID 483) (EEC)				1.8	8.9			10.7
Native Pasture (ID 395) (parts of this community are EEC)			0.4	106.8	5.1			112.3
Exotic						14.4		14.4
Unknown							87.7	87.7
TOTAL AREA	31.6	71.1	21.5	118.6	14.6	14.4	87.7	359.4

⁴ These totals do not exactly match the calculations for each vegetation type in Table 7-1 due to the inclusion of track areas in Table 7-2 as well as some potential overlap between proposed tracks and easement clearing areas.

Vegetation Community	Good	Moderate-good	Moderate	Poor-moderate	Poor	Exotic	Unknown	TOTAL AREA ⁴
ALTERNATIVE TL CORRIDOR								
Riparian forest – Blakely’s Red Gum, Rough-barked apple and Yellow Box (ID 281) (EEC)		22.5			0.9			23.4
Riparian forest – Blakely’s Red Gum and Rough-barked apple (ID 481)	19.1	8.8	7.5	7.7	2.2			45.3
Sandstone forest - Narrow-leaved Ironbark (ID 468 and 479)	28.4	32.1	13.5	7.4	0.5			82.0
Sandstone forest - Inland Scribbly Gum dominant (ID 477)	14.7	4.8						19.5
Sandstone forest - Red Ironbark dominant (ID 478)								0
Sandstone forest - Black cypress pine dominant (ID 480)								0
White Box – Grey Box Grassy Woodland (ID 483) (EEC)		0.5		7.5	2.8			10.8
Native Pasture (ID 395) (parts of this community are EEC)			5.7	68.3	29.4			103.4
Exotic						12.3		12.3
Unknown							87.7	
TOTAL AREA	62.3	68.6	26.7	91.0	35.9	12.3	87.7	384.5

Vegetation Community	Good	Moderate-good	Moderate	Poor-moderate	Poor	Exotic	Unknown	TOTAL AREA ⁴
2ND ALTERNATIVE TL CORRIDOR								
Riparian forest – Blakely’s Red Gum, Rough-barked apple and Yellow Box (ID 281) (EEC)	4.4	8.2			1.3			13.9
Riparian forest – Blakely’s Red Gum and Rough-barked apple (ID 481)	19.1	1.3	6.4	7.7	2.2			36.8
Sandstone forest - Narrow-leaved Ironbark (ID 468 and 479)	31.2	40.5	10.1	7.4	0.5			89.7
Sandstone forest - Inland Scribbly Gum dominant (ID 477)	14.7	4.8						19.5
Sandstone forest - Red Ironbark dominant (ID 478)								0
Sandstone forest - Black cypress pine dominant (ID 480)								0
White Box – Grey Box Grassy Woodland (ID 483) (EEC)	0.9	0.5		7.5	2.8			11.6
Native Pasture (ID 395) (parts of this community are EEC)			5.7	109.4	41.7			156.7
Exotic						10.8		10.8
Unknown							87.7	87.7
TOTAL AREA	70.3	55.3	22.1	132.0	48.6	10.8	87.7	426.8

Table 7-3 Proposed vegetation clearing of TSC Act EEC and EPBC Act CEEC based on the worst case scenario across the entire project area including both the Wind Farm Study Area and the Transmission Line Study Area.

Condition Class	CEEC ¹	EEC ²	Biometric Condition	Vegetation Clearance (ha) Preferred Infrastructure Layout		Vegetation Clearance (ha) Alternative Infrastructure Layout		Vegetation Clearance (ha) 2 nd Alternative Infrastructure Layout	
				EEC (with native tree component)	EEC (native pasture) ⁵	EEC (with native tree component)	EEC (native pasture)	EEC (with native tree component)	EEC (native pasture)
Poor	No	Yes	Low	161.2	39.3	146.8	35.9	156.1	36.2
Poor-Moderate	No	Yes	Moderate-Good	29.5	43.3	34.8	40.1	35.2	56.8
Moderate	No	Yes	Moderate-Good	5.2	159.3	5.2	159.3	5.2	159.3
Moderate-Good	Yes	Yes	Moderate-Good	2.6		23.0		8.7	
Good	Yes	Yes	Moderate-Good	1.3				5.3	
Subtotal				199.8	241.9	209.8	235.3	210.5	252.3
Total				441.7		445.1		462.8	

KEY:

CEEC¹ EPBC Act Critically Endangered Ecological Community

EEC² TSC Act Endangered Ecological Community

⁵ It is unlikely that native pasture areas will require substantial modification, as there is no, or very little, overstorey requiring clearing, and the impact footprint of most infrastructure relating to the project is relatively small. These numbers are thus likely to be exaggerated beyond the true impact.

7.2.3 Habitat Loss (Microchiropteran Bats)

Habitat Clearance

Loss of foraging habitat and roost sites (hollow-bearing trees) through clearance associated with clearance of the Transmission Line easement has the potential to result in some impact on microbat populations.

In four habitats on the Transmission Line easement, four of the five threatened species were recorded. The highest number of Large-eared Pied Bats, Eastern Bentwing Bat and Eastern Cave Bat calls were recorded in Sandstone Forest suggesting this habitat is an important habitat overall for threatened bat species. It is recommended that selection of the final transmission line route minimise loss of Sandstone Forest types.

Landscape Connectivity and Protected Areas

Goulburn River National Park and Durrigere State Conservation Reserve

The TLSA lies nearby or traverses Goulburn River National Park and Durrigere SCA. Threatened flora and fauna species recorded within or nearby these protected areas include:

Owls	Parrots	Woodland Birds	Bats	Flora
Powerful Owl	Glossy Black-Cockatoo	Diamond Firetail	Corben's Long-eared Bat	Ausfeld's Wattle
Barking Owl		Flame Robin	Eastern Bentwing Bat	
		Hooded Robin		
		Brown Treecreeper		
		Varied Sittella		
		Speckled Warbler		
		Grey-crowned Babbler		

The most noteworthy impacts associated with transmission line development include direct vegetation clearance resulting in habitat loss (including hollow-bearing trees) or fragmentation of habitat. Some alignment options of the transmission line traverse Durrigere SCA and have the potential to fragment the area. Assessments of Significance under the TSC Act have also been applied to several of the above species (Appendix D) and the conclusions have informed the management strategies to be developed and incorporated in to the proposal).

There is also opportunity to promote understorey growth within the transmission line easement after construction (most likely up to 6 m). This would allow the existing shrub matrix that provides connectivity to regrow so that understorey habitat loss would be temporary (during the construction phase only). Therefore, habitat loss and connectivity would therefore be reduced for threatened woodland birds and microchiropteran bats recorded in the Transmission Line Study Area.

Many species of bird are vulnerable to collisions with transmission lines because of the height of these structures and their low visibility (Rioux *et al.* 2013). Studies have found that the bird groups most vulnerable to collisions with transmission lines include shorebirds (40%), waterfowl (24%), cranes and herons (14%), and Passeriformes (12%) (Bevanger 1998; Rioux *et al.* 2013). Species are also susceptible to electrocution, particularly those species such as raptors which are more likely to use these structures for perching (Bevanger 1998). Marking the wires is a recommended mitigation measure which has been found to reduce the risk of collision. A study in south-western Spain showed that both flight intensity and

collision frequency decreased by 60% at those spans of the transmission line where groundwires had been marked with coloured spirals (Alonso *et al.* 1994).

7.2.4 Indirect and Peripheral Impacts

As well as direct clearing impacts, quantified in Section 7.2.2, vegetation surrounding the transmission line easement may be affected by vehicle access and parking, materials laydown and stockpiles. As the easement is to be 60 m in width, it is considered that all site construction activities, with the exception of access in some areas, can be contained within the assessed corridor and impacts on neighbouring areas of retained vegetation can be adequately managed.

The works have the potential to introduce and spread weed species. Common pasture weeds are widespread across the site; however, listed noxious weeds are not in high abundance and generally limited in their distribution. With the implementation of specific weed control measures, the risk of spreading and introducing additional weed species is considered to be manageable.

Pollution risks are associated with the use of concrete, fuels and lubricants and construction chemicals. These risks are considered manageable with appropriate safeguards. Dust would be generated from the excavation and building activities at the construction sites, and by traffic using unsealed access routes. Dust deposition is not expected to significantly affect the habitat values of the site. Noise, vibration and activity during construction phase may disturb fauna during nesting, foraging and migration periods. This disturbance is likely to be of low magnitude temporally and spatially and largely confined to the vegetation clearing stage.

7.3 COMPARISON OF ROUTE OPTIONS

Table 7-1 to Table 7-3 provide data on estimated vegetation loss for the various vegetation communities for each of the different route options. These tables also provide data on the condition class of these communities. This allows for a comparison of the relative impacts of each of the three route options considered. Key conclusions include:

- Vegetation loss associated with clearing for the worst-case transmission line easement (i.e. 60 m wide) is related to the different lengths of the three options as well as vegetation types present. The preferred route is the shortest and would result in both the lowest amount of total clearing (441.7 ha) and the lowest amount of clearance of forest and woodland vegetation types (126 ha). The alternative route would result in the loss of 445.1 ha of which 162.2 ha is forest/woodland. The second alternative route would result in the loss of 462.8 ha of which 152.8 ha is forest/woodland.
- Loss of White box/Grey box Grassy woodland habitat is similar for each of the three options (from 10.7 to 11.6 ha).
- Loss of Sandstone forest vegetation types is lower for the preferred and alternative routes (88 ha and 87.4 ha respectively) than for the second alternative route (95.1ha).
- Loss of Riparian forest vegetation types is substantially lower on the preferred corridor (27.6 ha) than on the second alternative corridor (46.2 ha). The alternative corridor would result in the greatest loss of Riparian forest, at 64.2 ha.
- The alternative route would result in the loss of the least amount of native pasture (at 88.6 ha). The preferred route is slightly higher at 94.2 ha and the second alternative route substantially higher at 142.2 ha.
- In terms of forest habitats in Good and Moderate-good condition, the preferred route would result in the least clearing (102.5 ha), with the alternative route resulting in clearing of 130.9 ha and the second alternative at 125.6 ha.
- In terms of EECs, vegetation clearance is considered together with impacts from the Wind Farm Study Area. The selection of transmission alters the overall impact on EECs from 441.7 ha with the preferred route to 462.8 ha with the adoption of the second alternative route. When considering EECs in Moderate-good to Good condition, the selection of transmission line route is more significant, with 3.9 ha to be removed along the preferred route, 23.0 ha along the alternative route and 14.0 ha along the second alternative route.
- There would be some additional habitat loss for access tracks. The Proposed development includes up to 131.5 ha of tracks, including 23 ha within forest/woodland vegetation types. In reality this is a considerable overestimate, with existing tracks occurring in many of these areas, although some clearance would be required along parts of these existing tracks to ensure they are adequate.

7.3.1 Summary of Route comparison

The alternative and second alternative transmission line route options have no apparent advantages towards biodiversity conservation other than that they avoid Durrigere SCA. However, the second alternative route passes through Turill SCA, and areas with similar vegetation, despite having less habitat connectivity than Durrigere. This route also passes through a similar amount of forest to the first alternative route, though much of it is located on private property rather than conservation estate. However, forest communities on private property appeared to be in as good or better condition than that

in Durridgere SCA. In both the SCA and on private property the vegetation is mostly regrowth from early clearing, with very few trees over 80cm DBH. In Durridgere SCA, more recent logging, when the area was a State Forest, has meant that in general the trees are considerably younger than in many of the forest remnants on private property. So with respect to vegetation quality and fauna habitat, there are large tracts of vegetation on private land that have an equal or higher biodiversity value than the vegetation of Durridgere SCA. This also applies to the habitat for EEC vegetation as the SCA did not contain much Box Gum Woodland.

Impacts associated with the alternative and second alternative routes for the transmission line are likely to consist of:

- Loss of areas of native Sandstone Forest types of an area roughly equivalent to that in Durridgere SCA which would be lost if the preferred route were implemented;
- Loss of habitat for native fauna, including habitat for threatened species known from the area such as the Glossy Black-cockatoo, Grey-crowned Babbler, Speckled Warbler, Diamond Firetail and Varied Sittella;
- Loss of fauna habitat resources including a relatively high abundance of hollow-bearing trees on drainage lines and selectively logged or relatively undisturbed locations;
- Loss of areas of Box-Gum Woodland located along drainage lines and on patches of basalt; and
- Potential damage to watercourses as a result of clearing adjacent to them, where transmission line routes follow watercourses instead of following higher ground.

Table 7-4 Overall extents of biodiversity constraints relating to the three potential transmission line routes, with the Wind Farm and Transmission Line Study Areas grouped for the EEC calculations.

	Preferred Route	Alternative Route	Second Alternative Route
Theoretical maximum area of vegetation to be cleared (ha)	233.1	261.3	303.9
Theoretical maximum area of EEC to be cleared (ha)	441.7	445.1	462.8
Theoretical maximum area of high-quality EEC to be cleared (ha)	3.9	23.0	14.0
Total number of threatened species recorded on route	15	11	13
Number of threatened bird species recorded on route	8	6	7
Number of threatened mammal species (incl. bats) recorded on route	6	4	5
Number of threatened plant species recorded on route	1	1	1
Number of threatened species records on route	50	33	47

Note: numbers of species recorded and number of records do not take into account the survey effort.

7.4 THREATENED SPECIES / COMMUNITIES WITH POTENTIAL FOR IMPACT

A threatened species evaluation has been undertaken to evaluate the potential for threatened species that are present or potentially occur to be impacted by the proposal. This evaluation is presented in Appendix C. In the evaluation, one of four categories was assigned to each of the listed threatened or migratory species in terms of risk of impact, as outlined below:

No: The proposal would not result in an impact to this species.

Low: The proposal is unlikely to result in an impact to this species. No Assessment of Significance (AoS) is considered necessary for this species.

Moderate: The proposal could impact this species or its habitats but risks are considered highly manageable. An AoS has been applied to these entities. Management measures have been developed to address the risks.

High: The proposal is likely to impact this species or its habitats. An AOS has been applied to these entities to properly characterise the impact and provide information then used to either develop management measures to protect the entity or justify avoidance of the entity.

Based on the categories described above, threatened or migratory listed species that are considered to have a moderate or high risk of impact are given in Table 7-5. Impacts to moderate risk species are considered manageable without the need for an Assessment of Significance. Species that are considered to have a high risk of impact have been subject to an Assessment of Significance and are discussed in Appendix D, with conclusions presented in Section 8. In Section 9 recommendations are given for managing risk, which may be included as statements of commitment to be undertaken pending proposal approval.

Table 7-5 Species with a moderate risk of impact from the proposal, and identification of impact types.

Common Name	Species Name	Impact Type	TL Risk	Identified during Survey	AoS
Ecological Community					
Box Gum Woodland		Vegetation clearing	Mod	✓	✓
Flora					
Austral Toadflax	<i>Thesium australe</i>	Vegetation clearing	Mod		✓
Ausfeld's Wattle	<i>Acacia ausfeldii</i>	Vegetation clearing	High	✓	✓
Bluegrass	<i>Dichanthium setosum</i>	Vegetation clearing	Low		✓
Finger Panic Grass	<i>Digitaria porrecta</i>	Vegetation clearing	Low		✓
Lobed blue-grass	<i>Bothriochloa biloba</i>	Vegetation clearing	Mod		✓
Capertee Stringybark	<i>Eucalyptus cannonii</i>	Vegetation clearing	Low		✗
	<i>Homoranthus darwinoides</i>	Vegetation clearing	Low		✗
	<i>Kennedia retrorsa</i>	Vegetation clearing	Low		✗
	<i>Lasiopetalum longistamineum</i>	Vegetation clearing	Mod		✗
	<i>Ozothamnus tessellatus</i>	Vegetation clearing	Low		✗
Clandulla Geebung	<i>Persoonia marginata</i>	Vegetation clearing	Low		✗

Common Name	Species Name	Impact Type	TL Risk	Identified during Survey	AoS
	<i>Philotheca ericifolia</i>	Vegetation clearing	Low		✘
Leek-orchid	<i>Prasophyllum</i> sp. Wybong	Vegetation clearing	Low		✘
Wollemi Mint-bush	<i>Prostanthera cryptandroides</i> subsp. <i>cryptandroides</i>	Vegetation clearing	Low		✘
	<i>Prostanthera discolor</i>	Vegetation clearing	Low		✘
Mount Vincent Mint-bush	<i>Prostanthera stricta</i>	Vegetation clearing	Low		✘
	<i>Pultenaea</i> sp. Olinda	Vegetation clearing	Low		✘
Clandulla Geebung	<i>Persoonia marginata</i>	Vegetation clearing	Low		✘
	<i>Rulingia procumbens</i>	Vegetation clearing	Low		✘
Silky Swainson-pea	<i>Swainsona sericea</i>	Vegetation clearing	Mod	✓	✓
Woodland Birds					
Speckled Warbler	<i>Chthonicola sagittata</i>	Vegetation clearing (habitat loss, connectivity)	Mod	✓	✓
Brown Treecreeper	<i>Climacteris picumnus victoriae</i>	Vegetation clearing (habitat loss, connectivity)	Mod	✓	✓
Varied Sittella	<i>Daphoenositta chrysoptera</i>	Vegetation clearing (habitat loss, connectivity)	Mod	✓	✓
Regent Honeyeater	<i>Anthochaera phrygia</i>	Vegetation clearing (habitat loss, connectivity)	Low		✘
Painted Honeyeater	<i>Grantiella picta</i>	Vegetation clearing (habitat loss, connectivity)	Mod	✓	✓
Black-chinned Honeyeater	<i>Meliphreptus gularis gularis</i>	Vegetation clearing (habitat loss, connectivity)	Mod	✓	✓
Hooded Robin	<i>Melanodryas cucullata cucullata</i>	Vegetation clearing (habitat loss, connectivity)	Low		✘
Scarlet Robin	<i>Petroica boodang</i>	Vegetation clearing (habitat loss, connectivity)	Mod	✓	✓
Flame Robin	<i>Petroica phoenicea</i>	Vegetation clearing (habitat loss, connectivity)	Low		✘
Grey-crowned Babbler	<i>Pomatostomus temporalis temporalis</i>	Vegetation clearing (habitat loss, connectivity)	Mod	✓	✓
Diamond Firetail	<i>Stagonopleura guttata</i>	Vegetation clearing (habitat loss, connectivity)	Mod	✓	✓
Parrots and Cockatoos					
Little Lorikeet	<i>Glossopsitta pusilla</i>	Habitat loss	High	✓	✓
Gang-gang Cockatoo	<i>Callocephalon fimbriatum</i>	Habitat loss	Low		✘

Common Name	Species Name	Impact Type	TL Risk	Identified during Survey	AoS
Glossy Black-Cockatoo	<i>Calyptorhynchus lathami</i>	Habitat loss	High	✓	✓
Turquoise Parrot	<i>Neophema pulchella</i>	Habitat loss	Mod		✓
Raptors					
Square-tailed Kite	<i>Lophoictinia isura</i>	Habitat loss	High	✓	✓
Little Eagle	<i>Hieraetus morphnoides</i>	Habitat loss	Low		✓
Grey Falcon	<i>Falco hypoleucos</i>	Habitat loss	Low		✓
Spotted Harrier	<i>Circus assimilis</i>	Habitat loss	Low		✘
Nocturnal Birds					
Barking Owl	<i>Ninox connivens</i>	Habitat loss	Mod		✓
Powerful Owl	<i>Ninox strenua</i>	Habitat loss	Mod	✓	✓
Masked Owl	<i>Tyto novaehollandiae</i>	Habitat loss	Mod		✓
Mammals (bats)					
Large-eared Pied Bat	<i>Chalinolobus dwyeri</i>	Habitat loss	Mod	✓	✓
Little Pied Bat	<i>Chalinolobus picatus</i>	Habitat loss	Low		✘
Little Bentwing-bat	<i>Miniopterus australis</i>	Habitat loss	Low		✘
Eastern Bentwing-bat	<i>Miniopterus schreibersii oceanensis</i>	Habitat loss	Mod	✓	✓
Eastern Freetail-bat	<i>Mormopterus norfolkensis</i>	Habitat loss	Low		✘
Corben's Long-eared Bat	<i>Nyctophilus corbeni</i>	Habitat loss	Low	✓	✓
Yellow-bellied Sheath-tail-bat	<i>Saccolaimus flaviventris</i>	Habitat loss	Mod	✓	✓
Eastern Cave Bat	<i>Vespadelus troughton</i>	Habitat loss	Mod	✓	✓
Eastern False Pipistrelle	<i>Falsistrellus tasmaniensis</i>	Habitat loss	Low		✘
Greater Broad-nosed Bat	<i>Scoteanax rueppellii</i>	Habitat loss	Low		✘
Greater Long-eared bat	<i>Nyctophilus timoriensis</i>	Habitat loss	Low		✘
Squirrel Glider	<i>Petaurus norfolkensis</i>	Habitat loss	High	✓	✓
Koala	<i>Phascolarctos cinereus</i>	Habitat loss	Low		✘
Reptiles					
Pink-tailed Legless Lizard	<i>Aprasia parapulchella</i>	Vegetation clearing (construction impacts)	Low		✘

8 SIGNIFICANCE OF IMPACTS

8.1 ASSUMPTIONS

The impact assessment, including Assessments of Significance for communities and species listed under TSC and EPBC Acts, is based on the following assumptions:

- The Assessments of Significance have been undertaken based on the specifics of the proposal, known impact types of wind farms and the ecology of the species; and
- Recommendations given herein would form part of SoCs for the proposal.

The full Assessments of Significance pursuant to NSW and Commonwealth guidelines are presented in Appendix D. A summary of assessment outcomes is provided below.

8.2 FLORA AND VEGETATION COMMUNITIES

An Assessment of Significance has been undertaken for:

- *Swainsona sericea*
- *Acacia ausfeldii*
- White Box Yellow Box Blakely's Red Gum Woodland

8.2.1 Summary of Assessment Outcomes

Swainsona sericea

Suitable habitat is widespread throughout the region for this species, however previous clearing and disturbances have reduced population sizes and extents to small areas. Due to this, no particularly suitable habitat for the species is expected to be permanently removed, although some may be temporarily disturbed. Three individuals of this species were observed during the surveys, at one location in the Transmission Line Study Area, but are unlikely to be impacted by the works, particularly as there will be protections put in place prior to the commencement of works to ensure they are not impacted in any manner. Clearing for the easement will result in the temporary loss of potential future habitat for the expansion of the local population of *Swainsona sericea*. Following construction the easement will provide suitable habitat. Grazed grassland and patchy woodland habitat, similar to that where this species was recorded, is widespread in the vicinity and wider locality.

The habitat to be removed or modified is not considered important to the long-term survival of the species in the locality, due to the limited occurrence of the population, and the widespread availability of similar habitat. As a result, it is unlikely that the proposed development would result in a significant impact on this species should it occur in the Project Area.

Acacia ausfeldii

This species was recorded in three locations during the current survey. Two plants were recorded growing on basalt (but close to an old sandstone quarry) in the south-western corner of Turill SCA north of the Golden Highway and a second occurrence of a single plant was recorded north of the Turill Bus Route Road, on sandstone, near the alternative route. A wider search of an area of 300 x 50 metres in the vicinity of the single plant failed to locate any other plants. *Acacia ausfeldii* does not occur along the preferred route but was recorded along the alternative and 2nd alternative transmission line routes.

Clearing for the easement for any of the proposed routes will not result in the direct removal of any of these recorded plants but will result in the temporary loss of potential habitat for this species. Following construction the easement will generally provide suitable habitat for *Acacia ausfeldii* to recolonise. The Proposed development is unlikely to result in a significant impact on the local population of this species.

Box Gum Woodland

The majority of the Box Gum Woodland vegetation on the site is in a degraded state due to past and present agricultural practices. The proposal would result in the removal of up to 462.8 ha of Box Gum Woodland EEC, of which a large proportion is in poor to poor-moderate condition (284.3 ha) with little chance of recovery. Much of this assessment has considered that the worst case scenario would be the total loss of this vegetation type within the turbine envelope and transmission line corridor, however, in reality, the actual impact is likely to be considerably less.

Only 2% (preferred), 11% (alternative) and 7% (2nd alternative) of the total EEC recorded across the entire project area was found to be in good or moderate-good condition. The majority of these areas are located within the TLSA at the northern part around the Golden Highway where basalt intrusions occur amongst the sandstone. These areas have generally been subject to less grazing pressure and pasture improvement than areas of EEC within the Wind Farm Study Area.

Better quality remnants of moderate-good quality Box Gum Woodland vegetation in the Wind Farm Study Area are not likely to be subject to blanket clearing as they are only generally affected where access tracks and powerlines intersect vegetated slopes. There is scope to microsite infrastructure around the moderate-good quality patches of vegetation in these instances. The disturbance of up to 462.8 ha of this community is not considered to be significant given that the majority of the vegetation to be cleared is in poor condition and heavily degraded and a substantial amount of similar vegetation is available within the locality. Other areas of higher quality remnants exist within the site boundary and provide good opportunities for offsetting and maintaining or improving biodiversity values of these areas. The proponent commits to offsetting vegetation of appropriate type to achieve at minimum a 'like for like' offset.

An assessment of significance (Appendix C) concluded that the removal of up to 462.8 ha of this community is not considered to be significant for the Box Gum Woodland EEC with respect to its generally degraded state and the extent of similar vegetation in the locality.

Conclusion – EPBC Act

Areas of moderate-good and good condition Box Gum Woodland are likely to meet the condition thresholds of the CEEC. The proposal has the potential to result in the removal of up to 3.9 ha (preferred), 23 ha (alternative) or 14 ha (2nd alternative) of the EPBC-listed Box Gum Woodland causing a localised reduction in the occurrence of this community. This assessment has considered that the worst case scenario would be the total loss of CEEC within the TL easement (up to 60 m); however in reality the vegetation is open woodland meaning that only scattered trees would need to be cleared. The understorey would also be mostly retained excluding small areas required for footings and a maintenance track. It is considered likely that the community would maintain its existing functionality following construction. Large extents of moderate-good condition Box Gum Woodland occur within the Project Area which will not be affected as a result of the proposed works.

The proposal will not impact on the broader extent of the CEEC within the Project Area. Localised disturbance to hydrological patterns that support the CEEC may result from the proposal but are unlikely to be substantial. The risks associated with the ingress of invasive species and disease and potential

impacts from chemicals and fertilizers are considered to be acceptable if the recommendations included within Section 10 of this report are adhered to.

Large potential offset areas exist within the site boundary that, if properly managed, can assist with the recovery of this community, arresting existing threats and managing the land for biodiversity outcomes in perpetuity. Offsetting is recommended by this report to maintain or improve the biodiversity values associated with the proposal in the longer term. The offset plan for the proposal would include provisions for offsetting Commonwealth listed EEC to demonstrate compliance with the Commonwealth Offset Policy.

With the implementation of the controls and recommendations of this report the proposal is considered unlikely to have a significant impact on the Box Gum Woodland CEEC and, through long-term management and improvement, would result in a net gain. Referral to the Commonwealth government under the EPBC Act is also recommended however, to confirm that the action would not be deemed a Controlled Action on the basis of impacts to the Commonwealth listed EEC.

8.3 FAUNA

Assessments of significance have been undertaken for the following fauna species:

Woodland Birds

- Speckled Warbler
- Brown Treecreeper
- Diamond Firetail
- Varied Sittella
- Painted Honeyeater
- Black-chinned Honeyeater
- Grey-crowned Babbler
- Scarlet Robin
- Turquoise Parrot
- Little Lorikeet
- Glossy Black-cockatoo

Raptors

- Little Eagle
- Square-tailed Kite

Nocturnal Birds

- Powerful Owl
- Masked Owl
- Barking Owl

Mammals (excluding bats)

- Squirrel Glider

Bats

- Eastern Bentwing-bat
- Yellow-bellied Sheath-tail-bat
- Eastern Cave Bat
- Corben's Long-eared Bat
- Large-eared Pied Bat

8.3.1 Summary of Assessment Outcomes

Conclusion – TSC Act

Eight threatened smaller woodland/forest bird species were recorded within the Transmission Line and/or Wind Farm Study Areas: the Speckled Warbler, Brown Treecreeper, Varied Sittella, Painted Honeyeater, Black-chinned Honeyeater, Grey-crowned Babbler, Diamond Firetail and the Scarlet Robin. An eighth species, the Little Lorikeet, was recorded to the north of the study area during the survey period.

Of the species assessed, the Glossy Black-cockatoo, Squirrel Glider, Powerful Owl and microbats have specifically been highlighted as species requiring mitigation. Specific protocols have also been suggested in Section 10 to mitigate impact to these species, such as micro-siting infrastructure, pre-clearance surveys for hollow-bearing trees, installation of gliding poles, and application of buffers in areas of good quality habitat. In particular, these species would be considered a focus species in the flora and fauna management plan and/or the adaptive bird and bat management plan.

Clearing of woodland and forest vegetation for the transmission line will result in the loss of habitat for these species. While the surrounding locality around the Transmission Line Study Area supports extensive areas of forest and woodland, the proposed development has the potential to have a significant impact on the local population of these species.

Glossy Black-cockatoos and evidence of foraging was recorded in several locations in larger tracts of Sandstone Forest in the Transmission Line Study Area. Of the *Casuarina* and *Allocasuarina* species recorded during the present study, two species - *Allocasuarina diminuta* and *A. gymnanthera* – are known to be preferred feed trees for the Glossy Black-cockatoo. Both these species are present throughout areas of Sandstone Forest in the Transmission Line Study Area, with *A. gymnanthera* the more common. Clearing for the transmission line easement will result in the loss of some areas of vegetation containing *A. diminuta* and *A. gymnanthera* as well as the loss of some hollow-bearing trees and stags and mature trees that represent a future source of hollows. These habitat resources are relatively widely available within areas of the transmission line route to be retained and within the surrounding area.

The Powerful Owl was recorded within the Transmission Line Study Area in the 2013 survey and both the Masked and Barking Owls are considered possible occurrences, based on local records and habitat characteristics. These owls may be impacted by loss of habitat, including potential roost hollows and loss of habitat affecting the prey base for these species (primarily arboreal mammals for the Powerful Owl, smaller terrestrial mammals for the Masked Owl and arboreal and terrestrial mammals as well as birds for the Barking Owl). There is also some potential for direct mortality of owls, particularly Powerful Owls, as a result of blade strike in the Wind Farm Study Area. A potential habitat link exists between Coolah Tops NP into forested areas in the north-eastern section of the Wind Farm Study Area providing a potential flight path for this species. A number of turbine locations in this part of the Wind Farm Study Area are no longer proposed. Furthermore, all three owl species are recommended to be considered as part of an operational Bird and Bat Management Plan to confirm the assumptions of this assessment, addressing inherent uncertainty.

The Square-tailed Kite was recorded nesting in riparian vegetation along the Goulburn River in the southern part of the Transmission Line Study Area. The nest site itself is within 50 m or so of the footprint of the preferred route and the final design of the Transmission Line route in this area will need to avoid this tree and observe a buffer distance of at least 200 m. Cumulative impacts of the Transmission line and Wind farm have been considered. The NSW Scientific Committee (2009) considers

that “windfarms may cause occasional collision mortalities of Square-tailed Kites, although this species is a very manoeuvrable, slow flyer and is probably capable of generally avoiding collisions with turbine blades”.

A single Squirrel Glider was recorded during the survey program, in open woodland vegetation along a valley floor within the Wind Farm Study Area. This species was recorded again in the Transmission Line Study Area during the 2013 survey. Vegetation clearance for the Transmission Line easement will result in the loss of areas of woodland and forest that provide foraging and movement habitat for Squirrel Gliders as well as tree hollows that may provide actual or potential den sites. The distance that Squirrel Gliders can travel in a single glide is a function of the height of the tree from which they take off. Tree heights in the Transmission Line Study Area were generally 25m or less and a clearing of 60m for the transmission line easement may impact on movement opportunities for the Squirrel Glider across the cleared easement. It is possible that the proposal could affect a viable local population within the locality and mitigation strategies related to removal of hollows (potential denning sites) and facilitation of crossing easements now form part of the proposal. Recommendations have been provided in Section 10 to minimise the clearance for the transmission line in areas of good Sandstone Forest habitat and site glide poles along the route to support movement of this species.

The Threatened microchiropteran Eastern Bentwing Bat, Eastern Cave Bat and Yellow-bellied Sheathtail Bat were all recorded during the Anabat survey program. The Eastern Bentwing Bat was recorded from 10 locations within the Transmission Line Study Area. The Eastern Cave Bat was recorded from 5 different within the Transmission Line Study Area. The Yellow-bellied Sheathtail bat was recorded from Sandstone Forest in two locations (one definite and one probable record only) on the Transmission Line Study Area. Corben’s long-eared bat and the Large-eared pied bat were recorded from 3 and 9 locations in the Transmission Line Study Area respectively. The Eastern Bentwing Bat and Eastern Cave Bat roost in caves and will therefore not be affected by loss of tree hollows. No roost or maternity caves are known to occur nearby the Project Area. Given that these threatened species are flexible in foraging habitat selection and that very large areas of Sandstone Forest occur, it is not expected that there would be adverse impacts to resident populations from habitat loss *per se*. However, if larger areas of Sandstone Forest are to be cleared recommendations have been made for further survey work in these areas. F

For fauna species considered in this assessment, impacts are unlikely to:

- Adversely affect lifecycle to the extent that a local population would be placed at risk of extinction.
- Fragment or isolate habitat.

In addition to the design measures already implemented, a number of recommendations are given to minimise and offset the impacts of the proposal upon the species. With implementation of recommendations, the proposal is considered generally consistent with recovery objectives and would not exacerbate existing key threatening processes.

8.3.2 Conclusion

Presently, the majority of the land in the Project Area is farm land being used for production and therefore there are no formal agreements or instruments in place that guarantee a halt to land degradation. The management measures and offsets presented here provide an opportunity to arrest existing pressures in the Project Area such feral goats and weeds, and conserve a portion of land for biodiversity outcomes.

Based on assessments of significance, impacts arising from the proposal upon the threatened community and species known and likely to occur in the Project Area are manageable and unlikely to be significant. Referral to the Commonwealth government under the EPBC Act is recommended however, to verify that the action would not be deemed a Controlled Action on the basis of impacts to the Commonwealth listed EEC.

Impacts have been avoided where possible through design changes based on information and constraints provided by **ngh**environmental (2012). Recommendations have been provided to minimise and manage impacts both during the construction and operational phases of the wind farm and the transmission line.

9 RECOMMENDATIONS

9.1 MEASURES TO AVOID IMPACT

Overall vegetation and habitat loss is least on the preferred route as assessed. This route should be prioritised for further refinement, with the following considerations:

- The final alignment of the transmission line route should avoid as much vegetation clearing in areas of good condition sandstone forest vegetation communities where possible, given the potential of this vegetation type to support threatened species;
- Avoidance of moderate-good or good quality EEC within the Transmission Line Study Area;
- Development of SoCs for moderate-high constraint areas or other areas where development has the potential to result in a significant impact. The aim of these commitments is to minimise disturbance and avoid significant impacts. In particular, these areas include:
 - Areas of moderate-good and good quality EEC; and
 - Areas with the potential to support hollow-bearing trees or threatened flora species (e.g. grasses).
- Pre-clearance survey within final development envelope and alignment for HBTs, to determine micro-siting requirements.
- Infrastructure micro-sited to avoid HBT, where possible.
- Ideally, construction and any required tree clearance should avoid the peak breeding time for fauna and nesting time for birds (e.g. spring-summer).
- Unless preclearance surveys confirm that hollows are not being utilised, clearance of HBTs potentially suitable for Glossy Black-cockatoo and Squirrel Gliders should not be undertaken within a 100 m radius over the breeding season (between March and August for Glossy Black-cockatoo and latter half of the year for Squirrel Gliders).
 - For HBTs to be cleared a management plan should be prepared by an ecologist detailing: procedures to minimise impacts to, and relocate resident fauna; timing of works to avoid breeding periods; number and type of HBT to be removed and offset (to be included in Flora & Fauna Mgt Plan).
- Where HBTs are to be cleared, a standard pre-clearance survey, such as that described in Biodiversity Guidelines (ngghenvironmental / RTA 2011), should be undertaken and details of HBTs cleared including number and size of hollows and number of hollow-bearing trees recorded.

9.2 MEASURES TO MINIMISE IMPACT

Measures to minimise impact during the design, construction and operational phase of the wind farm proposal are highlighted in Table 9-1. These measures are designed to ensure potential impacts are minimised at: 1) a broad level in which general management or control measures can be applied to the entire proposal; or 2) at a defined level in which management or control measures can be applied to particular areas, individual species, faunal groups, or communities.

In particular, a flora and fauna management plan as well as an adaptive operational bird and bat management plan should be prepared prior to construction. These management plans would focus on migratory and at risk bird and bat species, and any threatened flora species found during further survey work, as mentioned in Section 8.4 or discussed in Section 9 (Assessments of Significance). Particularly, the latter is required to address inherent uncertainty related to bird and bat collision risks at this site. The construction footprint should be kept to a minimum for least impact on flora and fauna. The proponent commits to upfront offset ratios before clearing proceeds which is an incentive to achieve 'minimal clearance' during the detailed design and construction phases. Management strategies for the construction phase of the proposal need to be developed and incorporated into the flora and fauna management plan. Prescriptions for inclusion in the plan are set out in the tables below. These measures are required to ensure a significant impact is avoided.

Table 9-1 Design, construction and operational measures to minimise impacts for the Liverpool Range wind farm proposal.

MEASURES TO MINIMISE IMPACTS					
Item	Area	Target Species	Objective	Timing	Recommendation
General Measures	Project Area	All species and vegetation communities	Minimise clearance and disturbance	During construction and as required	<ul style="list-style-type: none"> – Clearly demarcating works areas and restricting impacts to these. Including vehicle and equipment parking and access routes. – Co-locating underground and overhead 33 kV powerlines with the track network to minimise additional impact area, where possible. – Establish construction compound(s) in a disturbed area. – Use disturbed areas for vehicle and machinery access, materials laydown, stockpiling of cleared vegetation and deposition and retrieval of spoil, wherever practicable. – Fill in trenches as soon as possible. Trenches left open overnight to be inspected at first light for trapped fauna. Trapped fauna to be released appropriately in a nearby location. – HBTs and sensitive features to be retained to be communicated to staff via inductions and other methods.
Riparian Area Mgt	Project Area	All species and vegetation communities	Minimise clearance and disturbance	During construction	<ul style="list-style-type: none"> – Creek crossing to be designed in accordance with: NSW Fisheries Policy and Guidelines for Fish Friendly Waterway Crossings (2003). – Creek works not to be undertaken when heavy rain is forecast and should be avoided when there is flow. – Implement sedimentation and erosion controls in accordance with best practice guidelines.
General Habitat Mgt	Project Area	All species and vegetation communities	Minimise disturbance		<ul style="list-style-type: none"> – Bird and bat activity levels are generally concentrated around areas of vegetation. A buffer of 100 m from the turbine blades is recommended for areas of high habitat value for birds and bats. – Fallen timber > 50cm to be left in place or moved to a nearby area to retain fauna habitat. – Where rocky outcrops cannot be avoided, replace rock in nearby areas in consultation with an ecologist.

MEASURES TO MINIMISE IMPACTS					
Item	Area	Target Species	Objective	Timing	Recommendation
Weed Mgt	Project Area	All species and vegetation communities	Pre-construction inspection for noxious weeds within Project Area Prevention of spread of weeds and pathogens Weed monitoring	Before commencement of works and as required Monitoring – late spring / early summer after construction	<ul style="list-style-type: none"> – Control noxious weeds in works area according to plans and control measures of the LGAs – Control invasive but not noxious species (such as African Lovegrass and Galenia) where they occur on or adjacent to the site to prevent their spread into uninfested areas – Minimise use and adhere to best practice guidelines for herbicide treatment in environmentally sensitive areas (i.e. Box Gum Woodland) – Establish hygiene plan to ensure vehicle and machinery is absent of organic matter pre- and post-site access – Sign environmentally sensitive areas (i.e. CEEC areas) and designate clean-down area for entry / exit points into these areas. – Monitoring and weed control in areas of known noxious or invasive species. – Understorey vegetation in easements should be managed to maintain composition and quality to prevent weed invasion
Pollution Prevention	Project Area	All species and vegetation communities	Prevention of contaminants and erosion outside works zones	As required	<ul style="list-style-type: none"> – Establish a spill plan to prevent chemicals or pollutants from having an adverse effect on the environment. – Backfill cable trench where cement is used; at least 20 cm of cement free topsoil to be replaced as the top layer in the back fill. – Establish an erosion and sediment control plan so appropriate controls are in place prior to commencement of works.
Site Mgt	Project Area	All species and vegetation communities	Stabilisation of soil, rehabilitation and revegetation to be undertaken progressively to re-establish ground cover	As required	<ul style="list-style-type: none"> – Lightly mulch exposed soils with chipped vegetation or sterile hay in areas dominated by exotic groundcover species. Sow with an appropriate cover crop in consultation with land owners. – Lightly mulch exposed soils with chipped vegetation or sterile hay in areas dominated by native grasses using local provenance species. – Fertiliser should not be used to promote revegetation in areas dominated by native grasses.

MEASURES TO MINIMISE IMPACTS					
Item	Area	Target Species	Objective	Timing	Recommendation
Operational Phase					
Flora & Fauna Mgt Plan	Project Area	All species and vegetation communities	To avoid significant impact to flora and fauna outside of the accepted clearance boundaries and prevent 'unassessed' impacts occurring.	Implement prior to construction.	<ul style="list-style-type: none"> – An ecological professional to develop and implement a Flora and Fauna Management Plan to report on and manage impacts. – The management plan should highlight ecological important areas (vegetation communities and threatened fauna species habitat) and their management. – Specific areas requiring monitoring or management should be highlighted as well as timing for monitoring. – Weed species should be highlighted along with prescriptions for their management.
Habitat Connectivity	Transmission Line Easement	All common species, as well as threatened fauna, particularly owls, gliders and bats	Minimise fragmentation of landscape connectivity	After construction	<ul style="list-style-type: none"> – Promote growth of vegetation under the transmission line to the maximum allowable height to maintain fauna habitat connectivity. – Understorey vegetation in easements should be managed to maintain composition and quality to prevent weed invasion. – Install gliding poles for glider species, particularly the Squirrel Glider, if clearing for the transmission line easement exceeds 40m in areas of habitat for this species. – Near areas of intact woodland or forest a spacing of 600m should be considered for turbines.

9.3 MEASURES TO OFFSET IMPACT

Measures to offset impacts are provided within Table 9-2 to ensure that an overall 'maintain or improve' outcome is met for the proposal; where impacts cannot be avoided, or sufficiently minimised, the residual impact will be offset in perpetuity. Appendix F details the Draft Offset Strategy and how this will guide the identification and management of the offset site. Appendix F also details how offset ratios are to be applied.

No sites have been highlighted as offset areas at the time of writing, however potential offset areas identified during the field work include areas of good quality Sandstone Forest identified within the TLSA. Offsetting any areas of Sandstone Forest will aid to protect a patch of forest of better quality that also provides threatened species habitat;

Table 9-2 Offset measures to maintain or improve biodiversity for the Liverpool Range wind farm proposal.

OFFSET MEASURES TO MAINTAIN OR IMPROVE BIODIVERSITY					
Item	Area	Target Species	Objective	Timing	Recommendation
Construction Phase					
Development of offset strategy and offset plan	Project Area	Box Gum Woodland, Hollow-bearing trees, Threatened species habitat	Proponent will develop an offset plan to offset all permanent native vegetation removal to maintain or improve biodiversity in the longer term	Prior to construction	<ul style="list-style-type: none"> – Develop an offset strategy with input from OEH, the CMA and an ecological professional which will be finalised prior to any construction impacts an ecological professional, in accordance with Appendix F – Develop an offset plan with input from OEH and the CMA prior to operation, demonstrating the suitability of the final offset site and providing detailed management actions specific to the site. – Ensure the offset strategy complies with the <i>Principles for the use of biodiversity offsets in NSW</i> guidance document. – The offset ratio will be determined with reference to: the conservation status of the vegetation, the condition of the vegetation, and the actual threatened species habitat value lost (i.e. known threatened species habitat, not potential habitat). – Where Box Gum Woodland and threatened species habitat is to be cleared and cannot be avoided an offset ratio to be applied at 1:20 for good condition areas, 1:10 for moderate-good condition areas; 1:5 for moderate condition areas, and 1:2 for poor condition areas. – Where non-threatened vegetation is cleared an offset ratio to be applied at 1:1. – Where HBTs are to be cleared and cannot be avoided an offset ratio to be applied at 1:1 and is supplementary to other areas offset. – Include provisions for offsetting Commonwealth listed EEC to demonstrate compliance with the Commonwealth offset policy.

9.4 DECOMMISSIONING

Biodiversity investigations would be required prior to decommissioning, to update the knowledge of site attributes and evaluate specific impact types (given the life span of the proposal is in the order of 30 years). The flora and fauna management plan for the project as well as results from the adaptive bird and bat management plan would inform the investigations. New measures to avoid and mitigate impacts may be required depending on: 1) the results of the investigation; and 2) outcomes of the monitoring programs implemented during the operational phase of the proposal.

10 CONCLUSION

Project Description

The Liverpool Range wind farm covers an area of approximately 40 km (east-west) by 50 km (north-south). This Biodiversity Assessment was created to assess the impacts of the following infrastructure components:

- Up to 288 wind turbine generators including associated electrical generators (three blades mounted on a tubular tower (165 m) (see Wind Farm document for specific details regarding this section of the Proposal);
- High voltage 33 kV transmission line and easement located between Ulan and Cassilis (Up to 60 m by 38.2 km easement);
- Construction of substations and maintenance facilities;
- Creation of new access tracks and widening of existing tracks; and
- Upgrades to existing public roads.

Regional Values and Existing Environment Onsite

The Project Area is largely agricultural, characterised by intensively modified broad floodplains (cereal cropping and grazing) beneath broad basalt ridges (grazing). The midslopes contain the majority of remnant native vegetation, from sparse to moderately treed woodlands. In particular, the composition and structure of vegetation types within the wider region has been modified as a result of managed stock grazing as well as grazing by feral goats. Large numbers of feral goats, foxes and rabbits were observed in the Project Area and continue to have a deleterious effect on native vegetation. Some better quality forested areas exist within the wider area on private lands, but are generally confined within protected areas (National Parks and state Reserves). Better quality forest was largely recorded within the southern half of the Transmission Line Study Area which is known to support several threatened fauna species, particularly woodland birds, forest owls, and microchiropteran bats.

A variety of biodiversity assets are supported within the region and most noteworthy is the state and nationally endangered Box Gum Woodland communities, called *White Box Yellow Box Blakely's Red Gum Woodland* in the TSC Act and *White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland* in the EPBC Act. While this community is endangered, it is also one of the most locally abundant vegetation types identified within the LGAs of the Project Area.

Overall, key biodiversity issues in all CMAs relevant to the Project Area include high stocking rates, habitat degradation and fragmentation, increasing dryland salinity, loss of native vegetation (i.e. clearing of native woodlands and grasslands) and invasive pest species (foxes, goats, environmental, agricultural and noxious weeds), and conserving remnant vegetation on private lands (CMA 2012).

Impacts on National Parks / Reserves

Coolah Tops and Goulburn River National Parks are present nearby to the Project Area, as well as State Conservation Reserves, including Munghorn Gap Nature Reserve, Turill SCA and Durridgere SCA.

- Coolah Tops NP is approximately 2 km east of the Wind Farm Study Area;
- Goulburn River NP is approximately 1.5 km south-east of the Transmission Line Study Area;

- Munghorn Gap Nature Reserve is approximately 4.5 km south of the Transmission Line Study Area at its nearest point;
- Durridgere SCA will either fall within the transmission line easement, or lie 1.2 km east of the alignment, depending on the chosen route; and
- Turill SCA will fall within the transmission line easement if the second alternative is used.

Therefore, no direct impacts are expected within the National Parks and/or reserves, except for Turill or Durridgere SCA. If the alternative and second alternative alignment options are considered further, follow-up survey work has been recommended within Durridgere SCA before development of these areas to provide more detail on their biodiversity value and quantify the potential impacts of the proposal. All other protected areas are considered to be located far enough away from the development to incur any indirect impacts associated with the proposal. However, with the implementation of the management controls recommended in Section 10, no indirect impacts are expected within these areas.

Impacts on Habitat Connectivity

The Project Area comprises a series of broad ridges and valleys, within the Liverpool Range. Aerial imagery demonstrates the site itself varies between cleared and sparsely treed areas of vegetation. At a local scale the Project Area is densely vegetated to the north, north-east of the wind farm (Coolah Tops National Park and surrounding private landholdings) and at the southern half of the transmission line.

At a regional scale, the Project Area can be seen to be located with a loop of connecting woodland and forested habitat. Vegetation in the northern tip of the Project Area facilitates east-west linkages towards areas of forest to the east (Coolah Tops National Park). Vegetation in the southern sections of the Project Area facilitate east-west and southern connectivity to extensive areas of protected forest (Durridgere SCA, Goulburn River National Park and Wollemi National Park).

Between the Project Area and the additional forested areas to the east, vegetation is patchy. This pattern of habitat and connectivity, while patchy and therefore compromised in some locations, may allow for an increased level of fauna activity within the Project Area. Particularly for fauna, such as birds and bats, which are highly mobile and have large ranges, and which are tolerant of some level disturbance (clearing and habitat modification).

The proximity of Coolah Tops NP and Durridgere SCA provide habitat connectivity to forested areas within the survey area and are known to support mobile threatened fauna species. Further survey work in these areas have been recommended to determine the value of this habitat for threatened fauna species and as a movement corridor, particularly woodland birds, forest owls and microchiropteran bats.

Significance of Impacts on Entities Listed as Threatened

The key biodiversity risks identified within this assessment were Box Gum Woodland, woodland birds, forest owls and microchiropteran bats. The proposal was considered to potentially result in a high risk to the Box Gum Woodland and 18 fauna species and an assessment of significance was applied to these species. These species included the: Speckled Warbler, Brown Treecreeper, Varied Sittella, Painted Honeyeater, Black-chinned Honeyeater, Grey-crowned Babbler, Scarlet Robin, Little Lorikeet, Glossy Black-cockatoo, Powerful Owl, Masked Owl, Barking Owl, Little Eagle, Squirrel Glider, Eastern Bentwing Bat, Yellow-bellied Sheathtail-bat, and Eastern Cave Bat.

The Proposal was considered to affect one state and nationally listed endangered community, Box Gum Woodland; however, the areas to be cleared are predominantly in poor condition and only a small area of moderate-good condition EEC could potentially be affected. The EEC and CEEC affected by the proposal would be included within the offset plan for the Proposal. In particular the offset plan would include

provisions for offsetting Commonwealth listed CEEC to demonstrate compliance with the Commonwealth offset policy.

The conclusion of the Assessment of Significance revealed there is potential for the proposal to result in a significant impact for the Powerful Owl, Squirrel Glider and some microchiropteran bats in particular areas if they are developed. To avoid significant impact to these species recommendations for follow up survey work has been prescribed before any development occurs within these areas. With the implementation of the controls and recommendations of this report the proposal is therefore considered unlikely to have a significant impact on threatened fauna species or the Box Gum Woodland EEC / CEEC.

Maintain or Improve Environmental Outcome

The Proposal has been developed with input from a biodiversity constraints analysis to assist in avoiding biodiversity impacts as a starting point. Detailed mitigation prescriptions have been developed to address the remaining risks, aimed at avoiding a significant impact on any listed threatened entity. The development of an offset site to be managed for biodiversity conservation in perpetuity forms part of this proposal.

The objective of the offset plan, which would be developed in detail prior to construction, is to ensure that an overall 'maintain or improve' outcome is met for the Proposal. It would protect important habitat types to be affected by the development.

Another aspect of the 'maintain or improve' outcome is the monitoring of operational risk; bird and bat collisions. While this assessment demonstrates that significant impact is not anticipated for any listed species, an 'insurance' monitoring program is proposed so that the uncertainty inherent in the assessment can be addressed. Baseline (pre-construction) and operational collision and abundance data would be collected, focused on higher risk species and higher risk locations in order that actions can be taken to address unforeseen impacts, should they occur.

Context of Climate Change

There is strong evidence that modification of the environment by humans is resulting in climate change (DECC 2007). *Anthropogenic Climate Change* has been listed as a Key Threatening Process by the NSW Scientific Committee.

Major changes in vegetation composition are expected through shifts in rainfall patterns and will favour the establishment of woody vegetation and encroachment of unpalatable woody shrubs in many areas (Australian Greenhouse Office 2003). Species at particular risk from the effects of climate change include those species with long generations, poor mobility, narrow ranges, specific host relationships, isolated and specialised species and those with large home ranges (Hughes & Westoby 1994, cited in DECC 2007). Pest species may be advantaged by climate change.

As a renewable energy project, the proposed development has an objective of addressing, to some extent, rising greenhouse gas emissions, and thereby the future impact of climate change, by providing a source of energy that is not dependent on the burning of fossil fuels.

Conclusion

The pattern of development proposed would be comprised of a series of sparsely distributed discrete footprints (turbines, substations and control buildings) and narrow linear footprints (transmission line and tracks). Considering the habitat within these areas and that surrounding them, and considering the ecological characteristics of the Project Area, the impacts identified appear able to be managed such that significant impacts can be avoided and such that a maintain or improve outcome can be met for the

proposal. On balance, the impacts are considered acceptable. The proposal would have benefits as the development of this large scale renewable energy project would address, to some extent, rising greenhouse gas emissions, which stands to have broader adverse ecological impacts.

11 REFERENCES

- Atlas of Living Australia (2012) *Mapping and Analysis* [online]. Accessed at: <http://spatial.ala.org.au/> [accessed throughout August 2012]
- AusWEA (2002) *Fact Sheet 8: Wind Farms & Bird & Bat Impacts*, Australian Wind Energy Association
- AusWEA (2006). Best practice guidelines for implementation of wind energy projects in Australia. Auswind, Victoria.
- Australian Greenhouse Office 2003, *Climate Change: An Australian Guide to the Science and Potential Impacts*, B. Pittock ed. Commonwealth of Australia.
- Baerwald E F, D'Amours G H, Klug B J and Barclay R M R (2008) Barotrauma is a significant cause of bat fatalities at wind turbines, *Current Biology* Vol 18; No16.
- Baerwald, E.F. & Barclay, R.M.R. (2009) 'Geographic variation in activity and fatality of migratory bats at wind energy facilities' *Journal of Mammalogy*, 90: 6: 1341-1349
- Baerwald, E. And Barclay, R. (2009) 'Geographic variation in activity and fatality of migratory bats at wind energy facilities' *Journal of Mammalogy*, 90: 6: 1341-1349
- Baerwald, E.F., D'Amours, G.H., Klug, B.J. and Barclay, R.M. (2008) 'Barotrauma is a significant cause of bat fatalities at wind turbines' *Current Biology* 18: 18: 695-696
- Baker-Gabb, D. (2011) *National Recovery Plan for Superb Parrot *Polytelis swainsonii**, [online] Victorian Government Department of Sustainability and Environment, Melbourne. Accessed at: <http://www.environment.gov.au/biodiversity/threatened/publications/recovery/pubs/polytelis-swainsonii-recovery-plan.pdf> [accessed 19 October 2012]
- Barclay, R., Baerwald, E, Gruver, J. (2007) 'Variation in bird and bat fatalities at wind energy facilities: assessing the effects of rotor size and tower height' *Canadian Journal of Zoology*, 85: 381-387
- Barrett, G.W., Ford, H.A. and Recher, H.F. (1994) 'Conservation of woodland birds in a fragmented rural landscape' *Pacific Conservation Biology*, 1: 245-256
- Bean, J.M. (1999) '*Bothriochloa biloba* (Poaceae) in natural grasslands on slopes of the Liverpool Plains, New South Wales' *Cunninghamia*, 6(2):383 –388.
- Berry, L. (2001) 'Edge effects on the distribution and abundance of birds in a southern Victorian forest', *Wildlife Research*, 28: 239 – 245
- Benson, J.S. (2006) New South Wales Vegetation Classification and Assessment: Introduction - the classification, database, assessment of protected areas and threat status of plant communities. *Cunninghamia* 9(3): 331-382.
- Benson, J.S., Richards, P.G, Waller, S. & C.B. Allen (2010) 'New South Wales Vegetation classification and Assessment: Part 3 Plant communities of the NSW Brigalow Belt South, Nandewar and west New England Bioregions and update of NSW Western Plains and South-western Slopes plant communities, Version 3 of the NSWVCA database.' *Cunninghamia*, 11(4): 457 – 579.

- Binns, D.L. (1997) 'Floristics and vegetation patterns of Coolah Tops, New South Wales' *Cunninghamia*, 5(1): 233 – 274.
- Biosis Research (2005) *Bird and Bat Collision Risk Assessment for proposed Butoni Wind Farm, Sigatoka, Fiji* [online], report prepared for Sinclair Knight Mertz. Accessed at: http://www.skmconsulting.com/Site-Documents/Migration-General/NR_rdonlyres_C151177A-C523-4A16-AAC7-55419D15665D_0_AppendixCBirdandBatCollisionRiskAssessmentReport.pdf [accessed 10 August 2012]
- Biosis Research (2006) *Wind farm collision risk for birds: cumulative risks for threatened and migratory species* [online], report prepared for Department of Environment and Heritage, Australia. Accessed at: <http://www.environment.gov.au/epbc/publications/wind-farm-bird-risk.html> [accessed 28 October 2012]
- Biosis Research (2009) *Wedge-tailed Eagle Collision Risk Assessment*, report prepared for Pacific Hydro [online]. [accessed 8 July 2010].
- Birds Australia (2005-2007) Birddata: Important Bird Areas. Accessed at: <http://www.birddata.com.au/iba.vm> in December 2011.
- Braun-Blanquet, J. (1932) (Translated, revised and edited by Fuller, G.D. & Conrad, H.S. in 1983) *Plant sociology: the study of plant communities* (Koeltz Scientific Books: Germany).
- Brett Lane and Associates. (2009). Summary of investigation of Wedge-tailed Eagle breeding: Challicum Hills Wind Farm. Ecological Research and Management.
- Brooker, M.I.H. & Kleinig, D.A. (2006) *Field guide to Eucalypts vol. 1: south-eastern Australia*. Bloomings Books Pty Ltd.
- Burrows, G.E. (2004) 'The importance of seasonality in the timing of flora surveys in the South and Central Western Slopes of New South Wales' *Cunninghamia*, 8(4): 514 – 520.
- Churchill, S. (2008) *Australian Bats*, second edition, Allen & Unwin, NSW
- CMA (2012) Catchment Management Authorities – Hunter, Central Rivers, Namoi CMAs [online], Catchment Management Authority, NSW Government. Accessed at: <http://www.cma.nsw.gov.au/> [accessed 27 October 2012].
- Cropper, S.C. (1993) *Management of Endangered Plants*. CSIRO, East Melbourne, Victoria.
- Cryan, P. and Barclay, R. (2009) 'Causes of bat fatalities at wind turbines: hypotheses and predictions', *Journal of Mammalogy*, 90: 6: 1330-1340
- DEH (2005) *Threat abatement plan for beak and feather disease affecting endangered passerine species* [online], Department of Environment and Heritage, Commonwealth of Australia. Accessed at: <http://www.environment.gov.au/biodiversity/threatened/publications/tap/pubs/beak-feather-tap.pdf> [accessed 26 October 2012]
- Department of Environment and Conservation (NSW) (2004), Threatened Species Survey and Assessment: Guidelines for developments and activities (working draft), New South Wales Department of Environment and Conservation, Hurstville, NSW.

- Department of Environment and Conservation (NSW) (2006). NSW Recovery Plan for the Large Forest Owls: Powerful Owl (*Ninox strenua*), Sooty Owl (*Tyto tenebricosa*) and Masked Owl (*Tyto novaehollandiae*) DEC, Sydney.
- Department of Environment and Climate Change 2007. Human-caused climate change - key threatening process listing. Last updated June 2007. Accessed Nov 2007 from: <http://www.nationalparks.nsw.gov.au/npws.nsf/content/human+caused+climate+change+key+threatening+process+declaration>
- DEWHA (2008) *Energy markets – renewable power stations: operating plants* [online interactive map], Department of Environment, Water, Heritage and the Arts. Accessed at: <http://www.ga.gov.au/renewable/map.php?type=operating> [accessed 2 November 2012]
- DEWHA (2009a) *Significant Impact Guidelines for the critically endangered Golden Sun Moth (*Synemon plana*)* [online], Department of Environment, Water, Heritage and the Arts. Accessed at: <http://www.environment.gov.au/epbc/publications/pubs/golden-sun-moth.pdf> [accessed 10 October 2012]
- DEWHA (2009b) *Background Paper to EPBC Act Policy Statement 3.12 - Significant Impact Guidelines for the critically endangered Golden Sun Moth (*Synemon plana*)* [online], Department of Environment, Water, Heritage and the Arts. Available from http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=25234 [accessed 26 October 2012]
- Drewitt A and Langston R (2006) Assessing the impacts of wind farms on birds, *Ibis* 148:29–42.
- DSEWPAC (2009) *Biodiversity Assessment – South East Highlands*. Accessed at: <http://www.anra.gov.au/topics/vegetation/assessment/vic/ibra-south-eastern-highlands.html>
- EBS Ecology (2012) *Proposed Keyneton Wind Farm: Avifauna and Raptor Nest Assessment*, [online] report prepared for Pacific Hydro. Accessed at: <http://www.pacifichydro.com.au/files/2012/06/App-C-Avi-Raptor-.pdf> [accessed 10 October 2012]
- ELA (2010). Biodiversity Strategy: Liverpool Plains Local Government Area. EcoLogical Australia Pty Ltd, Sydney.
- Elmoby Ecology (2012) Hepburn wind Farm: Bird and Bat Mortality Survey Interim Report 11th January 2011 – 9th January 2012
- Entura (2011) *Cattle Hill Wind Farm DPEMP: Eagle Supplement – Addendum* [online], report prepared for NP Power. Accessed at: <http://epa.tas.gov.au/Documents/NP%20Power%20Cattle%20Hill%20Wind%20Farm%20DPEMP%20Supplement%20Eagles%20Additional%20Information.pdf> [accessed 10 October 2012]
- Environment Australia (2000) *Revision of the interim biogeographic regionalisation for Australia (IBRA) and development of version 5.1: Summary Report*, [online]. Accessed at: http://live.greeningaustralia.org.au/nativevegetation/pages/pdf/Authors%20E/4_Environment_Australia_2000.pdf [accessed 3 October 2012]
- Erickson, W., Johnson, J., Strickland, D., Young, D.Jnr., Sernka, K. And Good, R. (2001) *Avian collisions with wind turbines: a summary of existing studies and comparisons to other sources of avian collision mortality in the United States*, National Wind Co-ordinating Committee Resource Document, Washington DC

- Greg Richards and Associates Pty Ltd (2005) Cadia East Study Area Bat Fauna Assessment. Report prepared for Cadia Holdings Pty Ltd, January 2005.
- Harden, G. (Ed). 1992-2002. *Flora of New South Wales*. Vols 1,2,3 and 4. NSW University Press, Kensington, NSW.
- Herr, A. (1998) *Aspects of the ecology of insectivorous forest-dwelling bats (Microchiroptera) in the western slopes of the Australian alps*, Thesis submitted to Charles Sturt University for the degree of Doctor of Philosophy [online]. Accessed at: <http://csusap.csu.edu.au/~aherr/thesis/thesis.pdf> [accessed 19 August 2012]
- Hollands, D. (2008) 'Three Great Forest Owls' *Wingspan* 18: 3: 34-37
- Horn, J.W., Arnett, E.B. and Kunz, T.H. (2008) Behavioural responses of bats to operating wind turbines. *J. Wildl. Mgmt.* 72: 123-132.
- Howe, R. (1984) 'Local Dynamics of Bird Assemblages in Small Forest Habitat Islands in Australia and North America' *Ecology*, 65: 5 1585-1601. Accessed at: <http://www.environment.nsw.gov.au/bioregions/Bioregions.htm> [accessed 2 October 2012]
- Hydro Tasmania Consulting (2010) *Cattle Hill Wind Farm: Eagle Utilisation Assessment* [online], report prepared for NP Power. Accessed at: http://epa.tas.gov.au/Documents/Cattle_Hill_DPMP_Appendices_H1_H2.pdf [accessed 10 October 2012]
- Hydro Tasmania Consulting (2012) Bluff Point Wind Farm and Studland Bay Wind Farm Annual Environmental Performance Report 2012, report prepared for Woolnorth Wind Farm Holding Pty Ltd
- ISSC (2005) *ISSC 3 Guidelines for managing vegetation near power lines* [online], Industry Safety Steering Community, Department of Energy, Utilities and Sustainability, NSW. Accessed at: http://www.trade.nsw.gov.au/energy/electricity/networks/safety/electricity_network_safety_issc_3_guideline_for_managing_vegetation_nea_power_lines.pdf [accessed 29 October 2012]
- Kavanagh, R. (1995). Nocturnal forest birds and arboreal marsupials of Coolah Tops, Warung Management Area, Western Region. Research Division, State Forests of NSW.
- Kavanagh, R.P. (1997). Ecology and Management of Large Forest Owls in South-eastern Australia. PhD thesis, University of Sydney, Sydney.
- Lang, R.D. (2008) 'Defining the original extent and floristic composition of the naturally treeless grasslands of the Liverpool Plains, North Western Slopes, New South Wales' *Cunninghamia*, 10(3): 407 – 422.
- Langston, R.H.W. & Pullan, J.D. (2003) Wind farms and birds: an analysis of the effects of wind farms on birds, and guidance on environmental assessment criteria and site selection issues, Birdlife International report to the Bern Convention: Convention on the Conservation of European Wildlife and Natural habitats, Strasbourg, France
- Lindenmayer, D., and Fischer, J. (2006). Habitat fragmentation and landscape change – an ecological and conservation synthesis. CSIRO Publishing, Australia.

- Lloyd, A., Law, B. and Goldingay, R. (2006) 'Bat activity on riparian zones and upper slopes in Australian timber production forests and the effectiveness of riparian buffers' *Biological Conservation*, 129: 207-220
- Macintosh, A. and Downie, C. (2006) *Wind Farms: the facts and the fallacies*, Discussion Paper Number 91, The Australian Institute
- MacMahon, A. (2010) *Expert Witness Statement: Yaloak South Wind Farm: Review of Wedge-tailed Eagle Assessment* [online]. Accessed at: [http://www.moorabool.vic.gov.au/CA257489001FD37D/Lookup/YaloakWindfarmApplication/\\$file/Ecology%20Australia%20Expert%20Witness%20Statement.pdf](http://www.moorabool.vic.gov.au/CA257489001FD37D/Lookup/YaloakWindfarmApplication/$file/Ecology%20Australia%20Expert%20Witness%20Statement.pdf) [accessed 10 August 2012]
- Madders, M., and Whitfield, D. (2006). Upland raptors and the assessment of wind farm impacts. *Ibis*, 148:43-56.
- McKenzie, N., Start, A. and Bullen, R. (2002) 'Foraging ecology and organisation of a desert bat fauna', *Australian Journal of Zoology*, 50: 529-548
- McRae, R.H.D. & M.G. Cooper (1985) 'Vegetation of the Merriwa area, New South Wales' *Cunninghamia*, 1(3): 351 – 370.
- Morgan (2001) Delineation and description of the Eastern Environmental Subregions (provinces) in New South Wales Study, [online] NPWS, Hurstville. Available from:
- Mueller-Dombois, D. and Ellenberg, H (1974) *Aims and methods of vegetation ecology*. John Wiley & Sons, New York.
- ngnenvironmental (2012b) *Bird and Bat Adaptive Management Plan: Gullen Range Wind Farm* [online], report prepared for Goldwind. Accessed at: http://www.gullenrangewindfarm.com/wp-content/uploads/2011/08/GUL_BBMP_Final-V4-1.pdf [accessed 28 October 2012]
- Noske, R.A. (1991) 'A demographic comparison of cooperatively breeding and non-cooperative treecreepers (Climacteridae)' *Emu* 91, 73-86
- NRE (1998) *Victoria's Biodiversity Strategy*, [online]. Accessed at: <http://www.nre.vic.gov.au/plntanml/biodiversity/index.htm> [accessed 3 October 2012]
- NSW National Parks and Wildlife Service (2002) Coolah Tops National Park, Plan of Management, November 2002
- NSW Scientific Committee (2008) *Brown Treecreeper – vulnerable species listing*. Accessed at: <http://www.environment.nsw.gov.au/determinations/BrownTreecreeperVulSpListing.htm>
- NSW Scientific Committee (2010) *Flame Robin – vulnerable species listing – final determination*, <http://www.environment.nsw.gov.au/determinations/flamerobinFD.htm>
- NPWS (2002) Coolah Tops National Park Plan of Management.
- NPWS (2003) Draft Recovery Plan for the Barking Owl.

- OEH (2012) *Threatened Species Profile Search* [online], NSW Office of Environment and Heritage. Accessed at: <http://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10519> [accessed between 2 October and 18 November 2012].
- Pizzey, G.; Knight, F. (2012) *The field guide to the birds of Australia* 9th Ed (Editor S. Pizzey). HarperCollins Publishers (Australia) Pty Ltd.
- Popa-Lisseanu, A.G. & Voight, C.C. (2009) 'Bats on the move' *Journal of Mammalogy*, 90: 6: 1283-1289
- Rhodes, M. (2006) *The ecology and conservation of the White-striped Freetail Bat (Tadarida australis) in urban environments*, Doctor of Philosophy Thesis, Australian School of Environmental Studies. Griffith University
- Richards, G. (2005) *An Assessment of the bat fauna at the proposed Capital Wind Farm, NSW*, Greg Richards and Associates, report prepared for Connell Wagner Pty Ltd. Accessed at: <http://majorprojects.planning.nsw.gov.au/>
- Richards, G.C. (2001) *Ecological and Evolutionary Determinants of Bat Community Structure in South-east Australian Forests*. PhD Thesis, University of New South Wales.
- Richards, G., Hall, L. and Parish, S. (2012) *A Natural History of Australian Bat: Working the Night Shift*. CSIRO Publishing, Melbourne.
- Richardson, F. J.; Richardson, R. G.; Shepherd, R. C. H. (2011) *Weeds of the south-east: an identification guide for Australia* 2nd Ed. R.G. and F.J. Richardson, Meredith, Victoria.
- Roaring 40s Renewable Energy (2010) Bluff Point Wind Farm and Studland Bay Wind Farm Annual Environmental Performance Report 2010
- Roaring 40s Renewable Energy (2011) Bluff Point Wind Farm and Studland Bay Wind Farm Annual Environmental Performance Report 2009
- Robinson (1994). Research plan for threatened woodland birds of south-eastern Australia. *Arthur Rylah Institute for Environmental Research Tech Report Ser. 133*.
- Rowston, C., Catterall, C.P. and Hurst, C. (2002) Habitat preferences of Squirrel gliders, *Petaurus norfolcensis*, in the fragmented landscape of south east Queensland. Forest ecology and management.
- Schodde, R. and Tidemann, S. C., Eds. (2007) *Readers Digest Complete Book of Australian Birds*, Readers Digest Services, Sydney.
- Simberloff, D. & Cox, J. (1987) Consequences and costs of conservation corridors. *Conservation Biology* 1(1): 63-71.
- Sharp A. (2010) Briefing note on the effects of wind farms on bird and bat populations, Lower North Natural Resource Management Group, Department for Environment and Heritage, Government of South Australia.
- Smales, I. (2006) Impacts of avian collisions with wind power turbines: an overview of the modelling of cumulative risks posed by multiple wind farms, Biosis Research. Report prepared for Department of Environment & Heritage

- Smales, I. (2009) *Expert Witness Statement of Ian John Smales, Stockyard Hill Wind Farm* [online]. Accessed at: http://www.iberica2000.org/documents/EOLICA/REPORTS/Yaloak_Expert_witness_statement_of_f_%20Ian_Smales.pdf [accessed 10 August 2012]
- Smales, I. (2010) *Mortlake Wind Farm Planning Panel: Expert Witness Statement of Ian John Smales*, prepared for Acciona Energy Oceania by Biosis Research. Accessed at: <http://www.mortlakewindfarm.com.au/documents/ISmalesExpertWitnessStatementMortlake04032010.pdf>
- Soderquist, T. and Gibbons, D. (2007) 'Home-range of the Powerful Owl (*Ninox strenua*) in dry sclerophyll forest'. *Emu* 107, 177–184
- Sovacool, B.K. (2009) 'Contextualising avian mortality: a preliminary appraisal of bird and bat fatalities from wind, fossil-fuel, and nuclear electricity' *Energy Policy* 37: 6: 2241-2248
- Umwelt Environmental Consultants (2009) *Ecological Assessment: Ulan Coal – Continued Operations*.
- Willis, C.K., Barclay, R.M., Boyles, J.G., Brigham, R.M., Brack, V. Jr., Waldien, D.L. and Reichard, J. (2009) 'Bats are not birds and other problems with Sovacool's (2010) analysis of animal fatalities due to electricity generation' *Energy Policy* 38: 2067-2069.

APPENDICES

APPENDIX A	DIRECTOR GENERAL REQUIREMENTS	A-I
APPENDIX B	SPECIES LISTS AND HABITAT ASSESSMENT DATA	B-I
B.1	FLORA AND FAUNA FIELD DATA SHEETS.....	B-II
B.2	FLORA SPECIES LIST	B-III
B.3	VEGETATION DESCRIPTIONS (BENSON <i>ET AL.</i> 2010) AND PHOTOS.....	B-III
B.4	FAUNA SPECIES LIST	B-XXIII
B.5	SITE PHOTOS	B-XXVIII
B.6	FLORA PLOT AND INSPECTION POINT DATA – TRANSMISSION LINE STUDY AREA.....	B-XXX
B.7	FAUNA HABITAT ASSESSMENT DATA.....	B-XXXV
B.8	THREATENED SPECIES RECORDS IDENTIFIED DURING FIELD WORK 2012 & 2013	B-XXXIX
APPENDIX C	THREATENED SPECIES EVALUATIONS	C-I
C.1	FLORA.....	C-III
C.2	ENDANGERED ECOLOGICAL COMMUNITIES.....	C-XII
C.3	FAUNA.....	C-XVI
APPENDIX D	ASSESSMENT OF SIGNIFICANCE.....	D-I
D.1	NEW SOUTH WALES.....	D-I
D.2	COMMONWEALTH.....	D-XLI
APPENDIX E	MAPS.....	E-I
E.1	LOCATION OF PROJECT AREA.....	E-I
E.2	SURVEY EFFORT.....	E-II
E.3	SURVEY RESULTS	E-III
E.4	CONSTRAINT MAPS.....	E-IV
APPENDIX F	OFFSET STRATEGY	5
APPENDIX G	TEAM QUALIFICATIONS AND EXPERIENCE	G-I

APPENDIX A DIRECTOR GENERAL REQUIREMENTS



Contact: James Archdale
Phone: 9228-6236
Fax: (02) 9228 6455
Email: James.Archdale@planning.nsw.gov.au

Mr Andrew Durran
Executive Director
Epuron Pty Ltd
Level 11
75 Miller Street
NORTH SYDNEY NSW 2060

Our ref.: 10/23653

Dear Mr Durran

Subject: Director-General's Requirements for Liverpool Range Wind Farm (MP 10_0225)

The Department has received your application for the above project.

I have attached a copy of the Director-General's Requirements (DGRs) for the preparation of an Environmental Assessment for the project. These requirements have been prepared in consultation with relevant government authorities. I have also attached a copy of the government authorities' comments for your information.

The DGRs have been prepared based on the information you have provided to date. Please note that under section 75F(3) of the *Environmental Planning and Assessment Act 1979*, the Director-General may alter these requirements at any time. If you do not submit an Environmental Assessment for the project within 2 years, the DGRs will expire.

Prior to exhibiting the Environmental Assessment that you submit for the project, the Department will review the document to determine if it adequately addresses the DGRs. The Department may consult with other relevant government authorities in making this decision. Please provide 6 hard copies and 6 electronic copies¹ of the Environmental Assessment to assist this review.

If the Director-General considers that the Environmental Assessment does not adequately address the DGRs, the Director-General may require you to revise the Environmental Assessment. Once the Director-General is satisfied that the DGRs have been adequately addressed, the Environmental Assessment will be made publicly available for at least 30 days.

If your project is likely to have a significant impact on matters of National Environmental Significance, it will require an approval under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). This approval would be in addition to any approvals required under NSW legislation and it is your responsibility to contact the Department of Sustainability, Environment, Water, Population and Communities to determine

¹ File parts must be no greater than 5Mb each. File parts should be logically named and divided.

if an approval under the EPBC Act is required for your project (<http://www.environment.gov.au> or 6274 1111).

Your contact officer for this proposal, James Archdale, can be contacted on 9228-6236 or via email at James.Archdale@planning.nsw.gov.au. Please mark all correspondence regarding the proposal to the attention of the contact officer.

Yours sincerely,



Sam Haddad
Director-General
Department of Planning

31/3/2011

ATTACHMENT 1
Director-General's Requirements
Section 75F of the *Environmental Planning and Assessment Act 1979*

Director-General's Requirements

Section 75F of the Environmental Planning and Assessment Act 1979

Project	Construction and operation of a new wind farm and associated infrastructure located across 4 shires on the New England Tableland region of New South Wales. The project is proposed to comprise approximately 550 turbines and a new transmission line connecting the wind farm to Transgrid's 330kV Wollar to Wellington transmission line located 30-40 kilometres south of the site.
Site	A development area covering approximately 40km (east to west) by 50km (north to south) in the New England Tableland region of New South Wales. The site is primarily located in the Warrumbungle & Upper Hunter Shires, between the township of Coolah and Cassilis approximately 370km north of Sydney. Additional turbines would be located in the Liverpool Plains Shire, with transmission line connections south of the site located in the LGA of Mid Western Regional Council.
Proponent	Epuron Pty Ltd
Date of Issue	####
Date of Expiration	####
General Requirements	<p>The Environmental Assessment (EA) must include:</p> <ul style="list-style-type: none"> • an executive summary; • a detailed description of the project (both the wind farm and associated infrastructure) including: <ul style="list-style-type: none"> → construction, operation and decommissioning details; → the location and dimensions of all project components including the wind turbines (including map coordinates and AHD heights), underground/ overhead cabling between turbines, electrical substation and transmission line linking the wind farm to the grid, temporary concrete batching plant(s), construction compounds, access roads/road upgrades (including internal access tracks) and obstacle lighting; → a timeline identifying the proposed construction and operation of the project components including staging, their envisaged lifespan and arrangements for decommissioning; → supporting maps/plans clearly identifying existing environmental features (e.g. watercourses, vegetation), infrastructure and landuse (including nearby residences and approved residential developments or subdivisions, if any) and the location/ siting of the project including associated infrastructure in the context of this existing environment; and → resourcing requirements (including, but not limited to, water supply and gravel). • consideration of any relevant statutory provisions including the consistency of the project with the objects of the <i>Environmental Planning and Assessment Act 1979</i> (i.e. Section 5 of the Act) and any relevant development control plans; • an assessment of the key issues outlined below, during construction, operation and decommissioning (as relevant). The Environmental Assessment must assess the worst case as well as representative impact for all key issues; • consideration of any cumulative impacts as relevant, taking note of proposed wind farms in the locality; • demonstration that the wind farm will be capable of meeting relevant Building Code of Australia (BCA) standards and other relevant codes / manufacturers' specifications for the construction of wind farms; • a draft Statement of Commitments detailing measures for environmental mitigation, management and monitoring for the project; • a conclusion justifying the project taking into consideration the environmental, social and economic impacts of the project; the suitability of the site; and the public interest; and • certification by the author of the EA that the information contained in the Assessment is neither false nor misleading.

	<p>The EA should present, with respect to each relevant transmission line impact, a considered overview of potential impacts along the length of the line, to identify areas of potentially significant impact for further, more detailed assessment. In addition to detailed assessment of areas of potentially significant impact, other areas along the length of the line should be assessed in a more general manner, with a particular focus on the development of frameworks for the mitigation, management and monitoring of more minor and generic environmental issues.</p>
<p>Key Assessment Requirements</p>	<p>The EA must include assessment of the following key issues for both the wind farm and transmission line:</p> <ul style="list-style-type: none"> • Strategic Justification - the EA must: <ul style="list-style-type: none"> → include a strategic assessment of the need, scale, scope and location for the project in relation to predicted electricity demand, predicted transmission constraints and the strategic direction of the region and the State in relation to electricity supply, demand and electricity generation technologies, and its role within the Commonwealth's Renewable Energy Target Scheme. The EA must clearly demonstrate that the existing transmission infrastructure has sufficient capacity to accommodate the project; → include a clear demonstration of quantified and substantiated greenhouse gas benefits, taking into consideration sources of electricity that could realistically be replaced and the extent of their replacement, with reference to the Department of Environment, Climate Change and Water <i>NSW wind farm greenhouse gas savings tool</i> (http://www.environment.nsw.gov.au/climatechange/greenhousegassavingstool.htm); → include an analysis of the suitability of the project with respect to potential land use conflicts with existing and future surrounding land uses (including rural residential development, building entitlements and subdivision potential, land of significant scenic or visual value, land of high agricultural value, mineral reserves (particularly Petroleum Exploration Licence 433 held by Eastern Star, Petroleum Exploration Licence 456 held by Santos/ApolloGas/Dart, mining lease A286 held by Industry and Investment and Exploration Licence 7597 held by Australian Bauxite), forestry, Crown land and conservation areas including Coolah Tops and Goulburn River National Parks), taking into account local and strategic landuse objectives and the potential for social and economic impacts on the local community. In particular justification should be provided regarding the suitability of the transmission line route through Durrigere State Conservation Area. Consideration should be given to any potential conflicts with the proposed Coolah to Newcastle gas pipeline and any operating or proposed extractive industries. The analysis of site suitability shall consider any Environmentally Sensitive Area Mapping held by Liverpool Plains Shire Council, Warrumbungle Shire Council, Upper Hunter Shire Council and Mid-Western Regional Council; and → describe the alternatives considered (location and/or design) for all project components, and provide justification for the preferred project demonstrating its benefits on a local and strategic scale and how it achieves stated objectives and any measures to offset residual impacts (for example community enhancement programmes). • Visual Impacts - the EA must: <ul style="list-style-type: none"> → provide a comprehensive assessment of the landscape character and values and any scenic or significant vistas of the area potentially affected by the project, including an assessment of the significance of landscape values and character in a local and regional context. This should describe community and stakeholder values of the local and regional visual amenity and quality, and perceptions of the project based on surveys and consultation; → assess the impact of shadow "flicker", blade "glint" and night lighting from the wind farm; → identify the zone of visual influence of the wind farm including consideration to night lighting (no less than 10 kilometres) and assess the visual impact of all project components on this landscape; → include an assessment of any cumulative visual impacts from transmission line

infrastructure;

- include photomontages of the project taken from potentially affected residences (including approved but not yet developed dwellings or subdivisions with residential rights), settlements and significant public view points, and provide a clear description of proposed visual amenity mitigation and management measures for both the wind farm and the transmission line. The photomontages must include representative views of turbine night lighting if proposed; and
- provide an assessment of the feasibility, effectiveness and reliability of proposed mitigation measures and any residual impacts after these measures have been implemented.

- **Noise Impacts** - the EA must:

- include a comprehensive noise assessment of all phases and components of the project including: turbine operation, the operation of the electrical substation, corona and / or aeolian noise from the transmission line, construction noise (focusing on high noise-generating construction scenarios and works outside of standard construction hours), traffic noise during construction and operation, and vibration generating activities (including blasting) during construction and/ or operation. The assessment must identify noise/ vibration sensitive locations (including approved but not yet developed dwellings), baseline conditions based on monitoring results, the levels and character of noise (e.g. tonality, impulsiveness, low frequency etc) generated by noise sources, noise/ vibration criteria, modelling assumptions and worst case and representative noise/ vibration impacts;
- in relation to wind turbine operation, determine the noise impacts under operating meteorological conditions (i.e. wind speeds from cut in to rated power), including impacts under meteorological conditions that exacerbate impacts (including varying atmospheric stability classes and the van den Berg effect for wind turbines). The probability of such occurrences must be quantified;
- include monitoring to ensure that there is adequate wind speed/profile data and ambient background noise data that is representative for all sensitive receptors;
- provide justification for the nominated average background noise level used in the assessment process, considering any significant difference between daytime and night time background noise levels at background noise levels higher than 30 dB(A);
- identify any risks with respect to tonal, low frequency or infra-noise;
- clearly outline the noise mitigation, monitoring and management measures that would be applied to the project. This must include an assessment of the feasibility, effectiveness and reliability of proposed measures and any residual impacts after these measures have been incorporated;
- if any noise agreements with residents are proposed for areas where noise criteria cannot be met, provide sufficient information to enable a clear understanding of what has been agreed and what criteria have been used to frame any such agreements; and
- include a contingency strategy that provides for additional noise attenuation should higher noise levels than those predicted result following commissioning and/or noise agreements with landowners not eventuate.

The assessment must be undertaken consistent with the following guidelines:

- Wind Turbines - the South Australian Environment Protection Authority's *Wind Farms - Environmental Noise Guidelines* (2003);
- Substation - *NSW Industrial Noise Policy* (EPA, 2000);
- Site Establishment and Construction - *Interim Construction Noise Guidelines* (DECC, 2009);
- Traffic Noise - *Environmental Criteria for Road Traffic Noise* (NSW EPA, 1999); and
- Vibration - *Assessing Vibration: A Technical Guideline* (DECC, 2006).

- **Ecological Impacts** – the EA must include an ecological assessment considering terrestrial and aquatic ecosystems (as relevant), including groundwater dependent ecosystems, consistent with *Guidelines for Threatened Species Assessment* (DEC, 2005); The EA must:
 - identify threatened species, populations and communities listed under both State and Commonwealth legislation that have the potential to occur on site;
 - map existing vegetation by vegetation/ community type and include details on existing site conditions, including whether the vegetation comprises a highly modified or over-cleared landscape and the types and quality of habitat resources available. Vegetation mapping should consider any Environmentally Sensitive Area Mapping held by Liverpool Plains Shire Council, Warrumbungle Shire Council, Upper Hunter Shire Council and Mid-Western Regional Council.
 - provide details of the survey methodology employed including survey effort and representativeness for each species targeted and clear justification for species that were discounted from requiring field surveys or further assessment;
 - demonstrate a design philosophy of impact avoidance on ecological values, and in particular, ecological values of high significance;
 - provide a worst case estimate of vegetation to be cleared (in hectares), including quantifying impacts (in hectares) by vegetation type and threatened species habitat (as relevant);
 - assess the significance of impacts to native vegetation, listed threatened species, populations and communities and their habitats with consideration to local and region-based ecological implications, including habitat connectivity and distribution of species. The assessment must consider impacts to in-stream and riparian ecology from works close to waterways and/ or waterway crossings. In addition, impact of the project on birds and bats from blade strikes, low air pressure zones at the blade tips (barotrauma), and alteration to movement patterns resulting from the turbines must be assessed, including demonstration of how the project has been sited to avoid and/ or minimise such impacts;
 - include details of how flora and fauna impacts would be managed during construction and operation including adaptive management, rehabilitation/ regeneration measures and maintenance protocols;
 - demonstrate how the project (with the incorporation of all proposed measures to avoid, mitigate and/ or offset impacts) achieves a biodiversity outcome consistent with "maintain or improve" principles. Sufficient details must be provided to demonstrate the availability of viable and achievable options to offset the impacts of the project and to secure these measures in perpetuity; and
 - address the risk of weed spread and identify mitigation measures.

- **Heritage Impacts** – the EA must include an assessment of impacts on Aboriginal and historic heritage. The EA must:
 - include sufficient information to demonstrate the likely impacts of the project on Aboriginal heritage values/items (archaeological and cultural) and outline proposed mitigation measures (including consideration of the effectiveness and reliability of the measures) in accordance with the Draft *Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation* (DEC, 2005). The assessment must be undertaken by suitably qualified heritage consultants and demonstrate effective consultation with Aboriginal communities in determining and assessing impacts, developing options and selecting options and mitigation measures (including the final proposed measures); and
 - provide sufficient information to demonstrate the likely impacts of the project on historic heritage values (including heritage vistas) and, where impacts to State or local historic heritage items are proposed, outline proposed mitigation and management measures (including consideration of the effectiveness and reliability of the measures) generally consistent with the guidelines in the NSW Heritage Manual. Where impacts to State or local historic heritage items are

proposed, a statement of heritage significance must be included.

- **Traffic and Transport** – the EA must assess the construction and operational traffic impacts of the project including:
 - details of traffic volumes (both light and heavy vehicles) and transport routes during construction and operation;
 - assess the potential traffic impacts of the project on road network function (including intersection level of service) and safety;
 - assess the capacity of the existing road network to accommodate the type and volume of traffic generated by the project (including over-dimensional traffic) during construction and operation, including full details of any required upgrades to roads, bridges, site access provisions (for safe access to the public road network) or other road features;
 - details of measures to mitigate and/or manage potential impacts, including construction traffic control, road dilapidation surveys and measures to control soil erosion and dust generated by traffic volumes;
 - details of access roads within the site including how these would connect to the existing public road network (i.e. site access) and ongoing operational maintenance requirements for on-site roads; and
 - consideration of relevant Council traffic/road policies.
- **Hazard/Risks**– the EA must include an assessment of the potential impacts on aviation safety, including the need for aviation hazard lighting, considering nearby aerodromes and aircraft landing areas, defined air traffic routes, aircraft operating heights, approach/departure procedures, radar interference, communication systems, and navigation aids. Aerodromes within 30km of the turbines should be identified and impacts on obstacle limitation surfaces addressed. In addition, the EA must assess the impact of the turbines on the safe and efficient aerial application of agricultural fertilisers and pesticides in the vicinity of the turbines and transmission line. Possible effects on telecommunications systems must be identified. Potential hazards and risks associated with electric and magnetic fields and bushfires/use of bushfire prone land must also be assessed.
- **Water Supply, Water Quality and Hydrology** – The EA must:
 - identify water demands, and determine whether an adequate and secure water supply is available for the project;
 - identify water sources (surface and groundwater), water disposal methods and water storage structures in the form of a water balance;
 - include the statutory (licensing) context of the water supply sources;
 - assess potential environmental impacts associated with the use of the identified water sources including impacts on groundwater and implications for existing licensed users/basic landholder rights;
 - assess the potential to intercept groundwater, including predicted dewatering volumes, zone of drawdown and associated impact, water quality and disposal methods;
 - where the project involves crossing or works close to waterways, identify likely impacts to the waterways, how the waterways are proposed to be crossed and be designed in accordance with the NSW Office of Water Guidelines for Controlled Activities (August 2010);
 - describe the measures to minimise hydrological, water quality, aquatic and riparian impacts;
 - identify how works within steep gradient land or highly erosive soil types will be managed during construction and operation; and
 - consideration is to be given to water sharing plans and ground water and surface water access embargoes, as relevant.
- **Waste** – The EA must identify, quantify and classify the likely waste streams to be generated during construction and operation, and describe the measures to be implemented to manage, reuse, recycle and safely dispose of this waste.

	<ul style="list-style-type: none"> • General Environmental Risk Analysis – notwithstanding the above key assessment requirements, the EA must include an environmental risk analysis to identify potential environmental impacts associated with the project, proposed mitigation measures and potentially significant residual environmental impacts after the application of proposed mitigation measures. Where additional key environmental impacts are identified through this environmental risk analysis, an appropriately detailed impact assessment of the additional key environmental impact(s) must be included in the EA.
Consultation Requirements	<p>The Proponent must undertake a consultation programme as part of the environmental assessment process, including consultation with, but not necessarily limited to, the following parties:</p> <ul style="list-style-type: none"> • Liverpool Plains Shire Council; • Warrumbungle Shire Council; • Upper Hunter Shire Council; • Mid-Western Regional Council; • Department of Environment, Climate Change and Water; • NSW Office of Water; • Industry and Investment NSW; • NSW Roads and Traffic Authority; • NSW Rural Fire Service; • Land and Property Management Authority; • Central West Catchment Management Authority; • Hunter Central Rivers Catchment Management Authority; • Namoi Catchment Management Authority; • Commonwealth Department of Defence; • Civil Aviation Safety Authority; • Airservices Australia; • Aerial Agricultural Society of Australia; • relevant service providers; • relevant minerals stakeholders (including exploration and mining title holders); and • the local community and landowners (including “associated” and “non-associated” properties). <p>The consultation process shall include measures for disseminating information to increase awareness of the project as well as methods for actively engaging stakeholders on issues that would be of interest/concern to them. The EA must:</p> <ul style="list-style-type: none"> → demonstrate effective consultation with stakeholders, and that the level of consultation with each stakeholder is commensurate with their degree of interest/concern or likely impact; → clearly describe the consultation process undertaken for each stakeholder/group including details of the dates of consultation and copies of any information disseminated as part of the consultation process (subject to confidentiality); and → describe the issues raised during consultation and how and where these have been addressed in the EA.

Relevant Guidelines - For Reference

General

Wind Energy Facilities draft Environmental Impact Assessment Guidelines (Planning NSW, June 2002)

Draft EIS Guideline "Network Electricity Systems and Related Facilities" (Planning NSW, February, 2002)

Best Practice Guidelines for Implementation of Wind Energy Projects in Australia (Auswind, 2006)

Visual

Wind Farms and Landscape Values: National Assessment Framework (Australian Wind Energy Association and Australian Council of National Trust, June 2007).

Ecology

Cumulative Risk for Threatened and Migratory Species (Commonwealth Department of Environment and Heritage, March 2006).

Wind Farms and Birds: Interim Standards for Risk Assessment, (Auswind, July 2005).

Assessing the Impacts on Birds – Protocols and Data Set Standards (Australian Wind Energy Association).

Threatened Biodiversity Survey and Assessment – Guidelines for Developments and Activities (Working Document) (DEC, 2004).

Aviation Hazard

Advisory Circular 139-18(0) Obstacle Marking and Lighting of Wind Farms (Civil Aviation Safety Authority, July 2007). Note: this advisory is currently withdrawn however a replacement has to date not been issued.

Windfarm Policy (Aerial Agricultural Association of Australia, December 2009)

Powerlines Policy (Aerial Agricultural Association of Australia, December 2009)

Information Sheet – Airport Related Development (AirServices Australia)

Water Quality

National Water Quality Management Strategy: Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC 2000).

The NSW State Groundwater Quality Protection Policy (DLWC, 1998).

The NSW State Groundwater Dependent Ecosystems Policy (DLWC, 2002).

Department of Water and Energy's Guidelines for Controlled Activities (February 2008):

- Watercourse Crossings;
- Instream Works;
- Laying Pipes and Cables in Watercourses;
- Outlet Structures; and
- Riparian Corridors.

Managing Urban Stormwater: Soils and Construction, Volume 1, 4th edition (Landcom, 2004).

Managing Urban Stormwater: Soils and Construction, Volume 2C Unsealed roads (DECC).

APPENDIX B SPECIES LISTS AND HABITAT ASSESSMENT DATA

B.1 FLORA AND FAUNA FIELD DATA SHEETS

LIVERPOOL WIND FARM SURVEY OCTOBER 2013

FLORA SURVEY DATA SHEET

Project: Liverpool Wind Farm

Survey date: _____ **Personnel initials:** _____

Flora Survey ID: _____ **RM duration:** _____

GPS Location (GDA94): _____ E _____ N **WP:** _____

Location/Brief site description: (eg current landuse, soil, geology, slope, aspect, topographic position)

Structure and dominants (within representative patch) (refer to reference sheet)

Stratum	Height	Foliage cover (%)*	Dominant 1	Dominant 2	Dominant 3
Tree					
Small tree					
Shrub 1					
Shrub 2					
Groundcover					

Benson Vegetation Community (please tick)

Black Cypress Pine - ironbark +/- Narrow-leaved Wattle low open forest mainly on Narrabeen Sandstone (ID480);		Rough-barked Apple - Blakely's Red Gum - Narrow-leaved Stringybark +/- Grey Gum sandstone riparian grass fern open forest (ID481);	
Narrow-leaved Ironbark- Black Cypress Pine - stringybark +/- Grey Gum +/- Narrow-leaved Wattle shrubby open forest on sandstone hills (ID479);		Red Ironbark - Black Cypress Pine - stringybark +/- Narrow-leaved Wattle shrubby open forest on sandstone (ID478);	
Narrow-leaved Ironbark - Black Cypress Pine +/- Blakely's Red Gum shrubby open forest on sandstone low hills (ID468);		Grey Box x White Box grassy open woodland on basalt hills (ID483);	
Planted Vegetation (windbreaks)		Exotic Pasture and Crops	
Derived Speargrass – wallaby grass – wire grass mixed forb grassland (ID395)		Other: (specify)	

Age class, condition and disturbance (including average dbh, hollows, fire, grazing, introduced fauna, clearing/logging, soil disturbance/loss, salinity, weeds, dieback) Refer to condition classes ref sheet.

Exotic Poor Poor -Moderate Moderate Moderate-Good Good

Noxious weeds (note species and abundance) refer to list.

Threatened species and communities (if present, note pop. size/area, structure, reproductive status, habit, habitat, threats, photos, condition, native regen (refer to condition classes and note canopy cover)). Comments on whether further survey is required.

LIVERPOOL WIND FARM SURVEY OCTOBER 2013

FAUNA HABITAT ASSESSMENT LOCATION

Date & time		GPS location WP	
Personnel			
F.H.A.L. No. (eg: B3 FA, B4 FA etc)			
Correlates with veg No.			
Location description			
Habitat description			
Fauna Observed			

Quadrat size	20m x 20m			
Disturbances				
Grazing Pressure (circle)	Absent	Low	Medium	High
Waterbodies				
Tree height (average and tallest trees)				
Tree hollows (incl. no. of HBT and total no. of trees in quadrat eg. 2 of 7)				

Habitat features

	ABSENT	SCATTERED	COMMON	ABUNDANT
Small hollows				
Large hollows				
Mature trees				
Leaf litter				
Fallen trees & branches (<50cm diameter)				
Fallen trees & branches (>50cm diameter)				
Mistletoe				
Rock outcrop				
Small surface rock				
Large surface rock				
Cliffs and overhangs				
Tussock forming grasses				

Habitat quality for

	ABSENT	POOR	AVERAGE	GOOD	EXCELLENT	NOTES
Koala (presence of food trees)						
Small black ant tunnels?						
Log dependent fauna						
Small birds						
Waterbirds						
Glossy black-cockatoo feed trees						

B.2 FLORA SPECIES LIST

*Introduced species are preceded by an asterisk.

Where uncertainty exists, the taxon name is preceded by a question mark (?).

Species in **bold** are listed threatened species.

Relative abundance is given by a cover abundance scale (modified Braun-Blanquet):

- | | |
|---|--|
| 1 | 1 to a few individuals present, less than 5% cover |
| 2 | many individuals present, but still less than 5% cover |
| 3 | 5 - < 20% cover |
| 4 | 20 - < 50% cover |
| 5 | 50 - < 75% cover |
| 6 | 75 - 100% cover |

Species Name	Common Name	Family Name	Abundance Score
Native Species			
Trees			
<i>Acacia implexa</i>	Lightwood or Hickory	Fabaceae	0-2
<i>Acacia linearifolia</i>		Fabaceae	0-3
<i>Allocasuarina luehmannii</i>	Bulloak	Casuarinaceae	0-2
<i>Angophora floribunda</i>	Rough-barked Apple	Myrtaceae	0-3
<i>Callistemon sieberi</i>	River Bottlebrush	Myrtaceae	1
<i>Callitris endlicheri</i>	Black Cypress Pine	Cupressaceae	0-4
<i>Casuarina cunninghamiana</i>	River Oak	Casuarinaceae	0-3
<i>Corymbia maculata</i>	Spotted Gum	Myrtaceae	0-3
<i>Corymbia trachyphloia</i> ssp. <i>amphistomatica</i>	White Bloodwood	Myrtaceae	1
<i>Eucalyptus bridgesiana</i>	Apple Box	Myrtaceae	1
<i>Eucalyptus blakelyi</i>	Blakely's Red Gum	Myrtaceae	0-3
<i>Eucalyptus crebra</i>	Narrow-leaf Ironbark	Myrtaceae	0-3
<i>Eucalyptus fibrosa</i>	Red Ironbark	Myrtaceae	0-3
<i>Eucalyptus macrorhyncha</i>	Red Stringybark	Myrtaceae	0-3
<i>Eucalyptus melliodora</i>	Yellow Box	Myrtaceae	0-3
<i>Eucalyptus microcarpa</i>	Inland Grey Box	Myrtaceae	0-3
<i>Eucalyptus moluccana</i>		Myrtaceae	1
<i>Eucalyptus nubila</i>	Blue-leaved Ironbark	Myrtaceae	1
<i>Eucalyptus punctata</i>	Grey Gum	Myrtaceae	0-3
<i>Eucalyptus rossii</i>	Scribbly Gum	Myrtaceae	0-3
<i>Eucalyptus sparsifolia</i>	Narrow-leaved Stringybark	Myrtaceae	0-3
<i>Eucalyptus X albens</i>	White Box hybrids	Myrtaceae	0-3
<i>Exocarpos cupressiformis</i>	Native Cherry	Santalaceae	1
<i>Santalum lanceolatum</i>	Sandalwood	Santalaceae	1
Shrubs			
<i>Acacia amoena</i>		Fabaceae	1
<i>Acacia ausfeldii</i>	Ausfeld's Wattle	Fabaceae	1
<i>Acacia buxifolia</i> ssp. <i>buxifolia</i>		Fabaceae	1
<i>Acacia dawsonii</i>	Poverty Wattle	Fabaceae	1

Species Name	Common Name	Family Name	Abundance Score
<i>Acacia decora</i>		Fabaceae	0-2
<i>Acacia difformis</i>		Fabaceae	1
<i>Acacia gladiiformis</i>		Fabaceae	0-2
<i>Acacia leucolobia</i>		Fabaceae	1
<i>Acacia paradoxa</i>	Kangaroo Thorn	Fabaceae	0-3
<i>Acacia penninervis</i> var. <i>penninervis</i>		Fabaceae	1
<i>Acacia piligera</i>		Fabaceae	0-2
<i>Acacia ulicifolia</i>	Prickly Moses	Fabaceae	0-2
<i>Acacia ?verniciiflua</i>	Varnish Wattle	Fabaceae	1
<i>Acrotriche rigida</i>		Ericaceae	0-3
<i>Allocasuarina diminuta</i> ssp. <i>diminuta</i>		Casuarinaceae	1
<i>Allocasuarina gymnanthera</i>		Casuarinaceae	0-3
<i>Amyema pendulum</i>	a mistletoe	Loranthaceae	0-2
<i>Amyema quandang</i>	Wattle Mistletoe	Loranthaceae	0-2
<i>Aotus subglauca</i>		Fabaceae	1
<i>Astroloma humifusum</i>		Ericaceae	0-2
<i>Astrotricha longifolia</i>		Araliaceae	0-2
<i>Banksia marginata</i>	Silver Banksia	Proteaceae	1
<i>Bossiaea buxifolia</i>		Fabaceae	1
<i>Bossiaea rhombifolia</i> ssp. <i>concolor</i>		Fabaceae	1
<i>Bossiaea rhombifolia</i> ssp. <i>rhombifolia</i>		Fabaceae	1
<i>Brachyloma daphnoides</i>	Daphne Heath	Ericaceae	0-2
<i>Bursaria spinosa</i> ssp. <i>spinosa</i>	Blackthorn	Pittosporaceae	0-2
<i>Calytrix tetragona</i>		Myrtaceae	1
<i>Cassinia arcuata</i>	Sifton Bush	Asteraceae	0-5
<i>Cassinia cunninghamii</i>		Asteraceae	1
<i>Cassinia laevis</i>		Asteraceae	0-2
<i>Correa reflexa</i>	Common Correa	Rutaceae	1
<i>Cryptandra amara</i> var. <i>amara</i>		Rhamnaceae	0-2
<i>Cryptandra spinescens</i>		Rhamnaceae	0-2
<i>Daviesia acicularis</i>		Fabaceae	1
<i>Daviesia genistifolia</i>	Broom Bitter Pea	Fabaceae	0-2
<i>Daviesia mimosoides</i> ssp. <i>mimosoides</i>		Fabaceae	0-2
<i>Daviesia latifolia</i>		Fabaceae	0-2
<i>Daviesia ulicifolia</i>	Gorse Bitter Pea	Fabaceae	1
<i>Dillwynia elegans</i>		Fabaceae	1
<i>Dillwynia sericea</i>		Fabaceae	0-2
<i>Dodonaea viscosa</i> ssp. <i>cuneata</i>	Hop Bush	Sapindaceae	0-3
<i>Eremophila debilis</i>		Myoporaceae	1
<i>Exocarpus strictus</i>	Pale-fruited Ballart	Santalaceae	1
<i>Grevillea ramosissima</i> ssp. <i>ramosissima</i>		Proteaceae	1
<i>Grevillea sericea</i> ssp. <i>sericea</i>		Proteaceae	0-2
<i>Grevillea triternata</i>		Proteaceae	1
<i>Hakea dactyloides</i>	Finger Hakea	Proteaceae	1
<i>Hibbertia acicularis</i>		Dilleniaceae	1
<i>Hibbertia circumdans</i>		Dilleniaceae	0-2
<i>Hibbertia empetrifolia</i>		Dilleniaceae	1

Species Name	Common Name	Family Name	Abundance Score
<i>Hibbertia obtusifolia</i>	Guineaflower	Dilleniaceae	1
<i>Hibbertia riparia</i>		Dilleniaceae	1
<i>Hovea heterophylla</i>		Fabaceae	1
<i>Hovea rosmarinifolia</i>		Fabaceae	1
<i>Indigofera adesmiifolia</i>		Fabaceae	1
<i>Indigofera australis</i>		Fabaceae	1
<i>Isopogon</i> sp.		Proteaceae	1
<i>Kunzea parvifolia</i>		Myrtaceae	1
<i>Leptospermum parvifolium</i>		Myrtaceae	0-2
<i>Leptospermum polygalifolium</i> ssp. <i>transmontanum</i>		Myrtaceae	0-2
<i>Leucopogon attenuatus</i>		Ericaceae	1
<i>Leucopogon muticus</i>		Ericaceae	0-3
<i>Lissanthe strigosa</i> ssp. <i>strigosa</i>	Peach Heath	Ericaceae	0-2
<i>Macrozamia ?secunda</i>		Zamiaceae	1
<i>Macrozamia spiralis</i>		Zamiaceae	1
<i>Maireana microphylla</i>	Eastern Cottonbush	Chenopodiaceae	1
<i>Melaleuca erubescens</i>		Myrtaceae	1
<i>Melaleuca thymifolia</i>		Myrtaceae	1
<i>Melichrus erubescens</i>		Ericaceae	0-2
<i>Melichrus urceolatus</i>	Urn Heath	Ericaceae	0-2
<i>Melicytus dentatus</i> (<i>Hymenanthera dentata</i>)	Tree Violet	Violaceae	1
<i>Monotoca scoparia</i>	Prickly Broom Heath	Epacridaceae	1
<i>Muellerina eucalyptoides</i>	a mistletoe	Loranthaceae	1
<i>Notelaea microcarpa</i> ssp. <i>microcarpa</i>		Oleaceae	1
<i>Olox stricta</i>		Olacaceae	1
<i>Persoonia curvifolia</i>		Proteaceae	0-2
<i>Persoonia linearis</i>		Proteaceae	0-2
<i>Persoonia myrtilloides</i> ssp. <i>cunninghamii</i>		Proteaceae	1
<i>Persoonia rigida</i>		Proteaceae	1
<i>Phebalium squamulosum</i> ssp. <i>lineare</i>		Rutaceae	1
<i>Pimelea curviflora</i> var. <i>gracilis</i>		Thymeleaceae	1
<i>Pimelea linifolia</i> ssp. <i>caesia</i>		Thymeleaceae	1
<i>Pimelea linifolia</i> ssp. <i>linifolia</i>		Thymeleaceae	1
<i>Platysace ericoides</i>		Apiaceae	0-3
<i>Podolobium ilicifolium</i>		Fabaceae	0-3
<i>Pomaderris ?intermedia</i>		Rhamnaceae	1
<i>Pultenaea cinerascens</i>		Fabaceae	1
<i>Pultenaea foliolosa</i>		Fabaceae	1
<i>Pultenaea microphylla</i>		Fabaceae	1
<i>Rubus parvifolius</i>	Small-leaved Bramble	Rosaceae	1
<i>Sannantha cunninghamii</i>		Myrtaceae	0-3
<i>Styphelia triflora</i>		Ericaceae	0-3
<i>Templetonia stenophylla</i>	Leafy Templetonia	Fabaceae	1
Ferns			
<i>Adiantum aethiopicum</i>	Common Maidenhair	Adiantaceae	1
<i>Asplenium flabellifolium</i>	Necklace Fern	Aspleniaceae	1

Species Name	Common Name	Family Name	Abundance Score
<i>Cheilanthes austrotenuifolia</i>		Sinopteridaceae	1
<i>Cheilanthes distans</i>	Bristly Cloak Fern	Sinopteridaceae	1
<i>Cheilanthes sieberi ssp sieberi</i>	Rock or Mulga Fern	Sinopteridaceae	1
<i>Pleurosorus rutifolius</i>		Aspleniaceae	1
<i>Pteridium esculentum</i>	Bracken	Dennstaedtiaceae	1
<i>Pyrrhosia rupestris</i>	Rock Felt Fern		1
Vines & Twiners			
<i>Billardiera scandens</i>	Apple Berry	Pittosporaceae	1
<i>Cassytha glabella</i>	Devil's Twine	Lauraceae	1
<i>Cassytha pubescens</i>	Devil's Twine	Lauraceae	1
<i>Clematis glycinoides var. glycinoides</i>	Old Man's Beard	Ranunculaceae	1
<i>Convolvulus sp.</i>		Convolvulaceae	1
<i>Glycine ?clandestina</i>	Twining Glycine	Fabaceae	1
<i>Glycine tabacina</i>		Fabaceae	1
<i>Hardenbergia violacea</i>	Native Sarsaparilla	Fabaceae	1
<i>Parsonsia eucalyptophylla</i>	Gargaloo	Apocyanaceae	1
<i>Thysanotus patersonii</i>	Twining Fringe-lily	Anthericaceae	1
Forbs			
<i>Acaena novae-zelandiae</i>		Rosaceae	1
<i>Acaena ovina</i>		Rosaceae	1
<i>Acaena sp.</i>		Rosaceae	1
<i>Ajuga australis</i>	Austral Bugle	Lamiaceae	0-2
<i>Alternanthera sp. A</i>			1
<i>Arthropodium milleflorum</i>	Pale Vanilla Lily	Anthericaceae	1
<i>Arthropodium minus</i>		Anthericaceae	1
<i>Asperula conferta</i>	Common Woodruff	Rubiaceae	0-2
<i>Atriplex suberecta</i>		Chenopodiaceae	1
<i>Bidens pilosa</i>	Cobbler's Peg	Asteraceae	0-2
<i>Brachyscome ciliaris var. subintegrifolia</i>		Asteraceae	1
<i>?Brachyscome formosa</i>		Asteraceae	1
<i>Brunoniella pumilio</i>	Blue Trumpet	Acanthaceae	1
<i>Bulbine bulbosa</i>	Bulbine Lily	Asphodelaceae	1
<i>Calandrinia eremaea</i>		Portulacaceae	1
<i>Calocephalus citreus</i>	Lemon Beautyheads	Asteraceae	1
<i>Calotis cuneifolia</i>	Purple Burr-daisy	Asteraceae	0-2
<i>Calotis lappulacea</i>	Yellow Burr-daisy	Asteraceae	0-2
<i>Centella asiatica</i>		Apiaceae	1
<i>Chamaesyce sp.</i>	Causticweed	Euphorbiaceae	1
<i>Chenopodium ?curvispicatum</i>		Chenopodiaceae	1
<i>Chrysocephalum apiculatum</i>	Yellow Buttons	Asteraceae	1
<i>Cotula australis</i>	Carrot Weed	Apiaceae	1
<i>Crassula sieberiana</i>	Australian Stonecrop	Crassulaceae	1
<i>Cymbonotus sp.</i>	Bear's Ear	Asteraceae	1
<i>Cynoglossum australe</i>	Hound's Tongue	Boraginaceae	1
<i>Daucus glochidiatus</i>		Apiaceae	0-2
<i>Desmodium brachypodium</i>	Large Tick Trefoil	Fabaceae	1

Species Name	Common Name	Family Name	Abundance Score
<i>Desmodium varians</i>	Slender Tick Trefoil	Fabaceae	1
<i>Dianella longifolia</i>	Blue Flax Lily	Phormiaceae	1
<i>Dianella revoluta</i> ssp. <i>revoluta</i>	Black-anther Flax Lily	Phormiaceae	0-3
<i>Dichondra repens</i>	Kidney Weed	Convolvulaceae	0-2
<i>Dichondra</i> sp A		Convolvulaceae	0-2
<i>Dichopogon strictus</i>	Chocolate Lily	Anthericaceae	1
<i>Diuris sulphurea</i>	Tiger Orchid	Orchidaceae	1
<i>Drosera peltata</i> ssp. <i>auriculata</i>	Sundew	Droseraceae	1
<i>Einadia hastata</i>	Berry Saltbush	Chenopodiaceae	0-2
<i>Einadia nutans</i> ssp. <i>nutans</i>		Chenopodiaceae	0-2
<i>Einadia trigonos</i>	Fishweed	Chenopodiaceae	1
<i>Epilobium billardioreanum</i> ssp. <i>cinereum</i>	Willow Herb	Onagraceae	1
<i>Erodium crinitum</i>	Blue Storksbill	Geraniaceae	1
<i>Euchiton gymnocephalus</i>	Slender Cudweed	Asteraceae	1
<i>Galium</i> sp.	Bedstraw	Rubiaceae	1
<i>Geranium solanderi</i> var. <i>solanderi</i>		Geraniaceae	0-2
<i>Geranium</i> sp.		Geraniaceae	1
<i>Gonocarpus elatus</i>		Haloragaceae	1
<i>Gonocarpus tetragynus</i>		Haloragaceae	1
<i>Goodenia pinnatifida</i>		Goodeniaceae	1
<i>Goodenia hederacea</i> ssp. <i>hederacea</i>		Goodeniaceae	0-2
<i>Gratiola</i> ? <i>pedunculata</i>		Scrophulariaceae	1
<i>Haloragis heterophylla</i>		Haloragaceae	1
<i>Hybanthus monopetalus</i>	Lady's Slipper	Violaceae	1
<i>Hydrocotyle</i> ? <i>sibthorpioides</i>		Apiaceae	0-2
<i>Hydrocotyle laxiflora</i>	Stinking Pennywort	Apiaceae	0-2
<i>Hydrocotyle tripartita</i>		Apiaceae	0-2
<i>Hypericum gramineum</i>	Native St John's Wort	Clusiaceae	1
<i>Hypoxis</i> sp.	Weathergrass	Hypoxidaceae	1
<i>Isotoma axillaris</i>	Showy Isotome	Lobeliaceae	1
<i>Isotoma fluviatilis</i>		Lobeliaceae	1
<i>Lagenifera stipitata</i>	Blue Bottle Daisy	Asteraceae	1
<i>Laxmannia gracilis</i>		Anthericaceae	1
<i>Lepidium</i> ? <i>pseudotasmanicum</i>	Peppergrass	Brassicaceae	1
<i>Leptorhynchus squamatus</i> ssp. <i>squamatus</i>	Scaly Buttons	Asteraceae	1
<i>Leucochrysum</i> ? <i>molle</i>	Hoary Sunray	Asteraceae	0-3
<i>Lotus australis</i>		Fabaceae	1
<i>Maireana enchylaenoides</i>		Chenopodiaceae	1
<i>Mentha</i> ? <i>satureoides</i>	Native Mint	Lamiaceae	0-2
<i>Opercularia</i> ? <i>varia</i>	Twiggy Stinkweed	Rubiaceae	1
<i>Opercularia</i> sp.		Rubiaceae	1
<i>Oxalis</i> sp.		Oxalidaceae	1
<i>Patersonia sericea</i>		Iridaceae	1
<i>Philydrum lanuginosum</i>	Frogsmouth	Philydraceae	1
<i>Phyllanthus hirtellus</i>		Phyllanthaceae	1
<i>Pimelea curviflora</i> var. <i>sericea</i>		Thymeleaceae	1
<i>Plantago hispida</i>		Plantaginaceae	1

Species Name	Common Name	Family Name	Abundance Score
<i>Plantago varia</i>		Plantaginaceae	1
<i>Podolepis hieracioides</i>		Asteraceae	1
<i>Podolepis jaceoides</i>	Showy Copper-wire Daisy	Asteraceae	0-2
<i>Pomax umbellata</i>		Rubiaceae	0-2
<i>Poranthera microphylla</i>		Euphorbiaceae	0-2
<i>Pseudognaphalium luteo-album</i>	Jersey Cudweed	Asteraceae	1
<i>Pterostylis bicolor</i>		Orchidaceae	1
<i>Ranunculus sessiliflorus</i> var. <i>sessiliflorus</i>		Ranunculaceae	1
<i>Rhytidosporum procumbens</i>		Pittosporaceae	1
<i>Rumex brownii</i>	Native Dock	Polygonaceae	1
<i>Scutellaria humilis</i>	Dwarf Skullcap	Scrophulariaceae	1
<i>Senecio quadridentatus</i>	Cotton Fireweed	Asteraceae	1
<i>Sida corrugata</i>		Malvaceae	1
<i>Sida petrophila</i>		Malvaceae	0-2
<i>Sigesbeckia australiensis</i>		Asteraceae	1
<i>Solanum cinereum</i>	Narrawa Burr	Solanaceae	1
<i>Solanum prinophyllum</i>		Solanaceae	1
<i>Solanum</i> sp.		Solanaceae	1
<i>Solenogyne gunnii</i>		Asteraceae	0-2
<i>Stackhousia monogyna</i>	Creamy Candles	Stackhousiaceae	0-2
<i>Stackhousia muricata</i>		Stackhousiaceae	1
<i>Stackhousia viminea</i>		Stackhousiaceae	1
<i>Stackhousia</i> sp.		Stackhousiaceae	1
<i>Stellaria pungens</i>	Prickly Starwort	Caryophyllaceae	1
<i>Stuartina muelleri</i>	Spoon Cudweed	Asteraceae	1
<i>Stylidium laricifolium</i>	Trigger Plant	Stylidiaceae	1
<i>Styandra glauca</i>	Nodding Blue Lily	Anthericaceae	0-2
<i>Swainsona queenslandica</i>		Fabaceae	0-2
<i>Swainsona reticulata</i>		Fabaceae	1
<i>Swainsona sericea</i>	Silky Swainson-pea	Fabaceae	1
<i>Thelymitra pauciflora</i>	Sun Orchid	Orchidaceae	1
<i>Triptilodiscus pygmaeus</i>	Austral Sunray	Asteraceae	1
<i>Urtica incisa</i>	Stinging Nettle	Urticaceae	0-2
<i>Veronica plebeia</i>	Common Speedwell	Scrophulariaceae	1
<i>Vittadinia ?pustulata</i>	Fuzzweed	Asteraceae	0-2
<i>Vittadinia ?sulcata</i>	Fuzzweed	Asteraceae	1
<i>Vittadinia muelleri</i>		Asteraceae	1
<i>Vittadinia</i> sp.	Fuzzweed	Asteraceae	0-2
<i>Wahlenbergia communis</i>	Tufted Bluebell	Campanulaceae	0-2
<i>Wahlenbergia gracilis</i>	Sprawling Bluebell	Campanulaceae	1
<i>Wahlenbergia luteola</i>		Campanulaceae	1
<i>Wahlenbergia planiflora</i>		Campanulaceae	1
<i>Wahlenbergia stricta</i>	Tall Bluebell	Campanulaceae	1
<i>Wurmbea biglandulosa</i>	Early Nancy	Colchicaceae	1
<i>Wurmbea latifolia</i>	Early Nancy	Colchicaceae	0-2
<i>Wurmbea</i> sp.	Early Nancy	Colchicaceae	1
<i>Xerochrysum viscosum</i>	Sticky Everlasting	Asteraceae	0-2

Species Name	Common Name	Family Name	Abundance Score
<i>Zornia dyctiocarpa</i>		Fabaceae	1
Grasses			
<i>Aristida ramosa</i> var. <i>ramosa</i>	Wire Grass	Poaceae	0-4
<i>Arundinella nepalensis</i>	Reedgrass	Poaceae	0-4
<i>Austrodanthonia ?monticola</i>	Wallaby Grass	Poaceae	1
<i>Austrodanthonia ?racemosa</i> var. <i>racemosa</i>	Wallaby Grass	Poaceae	1
<i>Austrodanthonia ?pilosa</i>	Wallaby Grass	Poaceae	1
<i>Austrostipa ?rudis</i>		Poaceae	1
<i>Austrostipa aristiglumis</i>	Plains Grass	Poaceae	0-5
<i>Austrostipa scabra</i> ssp <i>falcata</i>	Corkscrew Grass	Poaceae	0-4
<i>Austrostipa verticillata</i>	Bamboo Grass	Poaceae	0-3
<i>Bothriochloa ?macra</i>	Red-stem Grass	Poaceae	0-4
<i>Chloris truncata</i>	Windmill Grass	Poaceae	0-2
<i>Chloris ventricosa</i>	Tall Windmill Grass	Poaceae	0-2
<i>Cleistochloa</i> sp.		Poaceae	0-4
<i>Cymbopogon refractus</i>	Barbed Wire Grass	Poaceae	1
<i>Dichanthium sericeum</i>	Queensland Bluegrass	Poaceae	1
<i>Dichelachne ?sieberiana</i>		Poaceae	0-4
<i>Dichelachne micrantha</i>	Common Plume Grass	Poaceae	1
<i>Digitaria ramularis</i>		Poaceae	1
<i>Digitaria ?parviflora</i>	Small Finger Grass	Poaceae	1
<i>Echinopogon ovatus</i>	Hedgehog Grass	Poaceae	0-2
<i>Elymus scaber</i>	Common Wheat Grass	Poaceae	1
<i>Entolasia stricta</i>		Poaceae	0-2
<i>Eragrostis leptostachya</i>	Paddock Lovegrass	Poaceae	1
<i>Eragrostis</i> sp.		Poaceae	0-3
<i>?Hemarthria uncinata</i>	Matgrass	Poaceae	1
<i>Joycea pallida</i>	Robust Wallaby Grass	Poaceae	0-4
<i>Microlaena stipoides</i>	Weeping Grass	Poaceae	0-4
<i>Panicum effusum</i>	Hairy Panic	Poaceae	1
<i>Phragmites australis</i>	Common Reed	Poaceae	1
<i>Poa ?sieberiana</i> var. <i>sieberiana</i>		Poaceae	0-3
<i>Poa labillardierei</i>	Silver or Poa Tussock	Poaceae	1
<i>Sporobolus creber</i>	Slender Rat's Tail Grass	Poaceae	1
<i>Themeda australis</i>	Kangaroo Grass	Poaceae	0-4
Graminoids			
<i>Carex appressa</i>	Tall Sedge	Cyperaceae	1
<i>Carex breviculmis</i>		Cyperaceae	1
<i>Carex inomitata</i>		Cyperaceae	0-2
<i>Carex inversa</i>		Cyperaceae	1
<i>Centrolepis strigosa</i>		Centrolepidaceae	1
<i>Cyperus vaginatus</i>		Cyperaceae	1
<i>Eleocharis sphacelata</i>	Tall Spike-rush	Cyperaceae	1
<i>Gahnia aspera</i>		Cyperaceae	0-2
<i>Isolepis</i> sp.		Cyperaceae	1
<i>Juncus ?planiflora</i>		Juncaceae	1

Species Name	Common Name	Family Name	Abundance Score
<i>Juncus</i> sp.		Juncaceae	1
<i>Lepidosperma gunnii</i>		Cyperaceae	1
<i>Lepidosperma laterale</i>	Variable Sword-sedge	Cyperaceae	1
<i>Lomandra confertifolia</i> ssp. <i>pallida</i>		Lomandraceae	0-4
<i>Lomandra filiformis</i> ssp. <i>coriacea</i>		Lomandraceae	0-3
<i>Lomandra filiformis</i> ssp. <i>filiformis</i>		Lomandraceae	0-3
<i>Lomandra glauca</i>		Lomandraceae	1
<i>Lomandra leucocephala</i> ssp. <i>leucocephala</i>		Lomandraceae	1
<i>Lomandra longifolia</i> ssp. <i>exilis</i>	Spiny Matrush (narrow leaf form)	Lomandraceae	1
<i>Lomandra longifolia</i> ssp. <i>longifolia</i>	Spiny Matrush	Lomandraceae	0-2
<i>Lomandra multiflora</i> ssp. <i>multiflora</i>		Lomandraceae	1
<i>Luzula meridionalis</i> var. <i>flaccida</i>		Juncaceae	1
<i>Schoenus apogon</i>	Common Bog-rush	Cyperaceae	1
<i>Schoenus ericitorum</i>		Cyperaceae	0-2
<i>Schoenus kennyi</i>		Cyperaceae	1
<i>Typha orientalis</i>	Cumbungi	Typhaceae	1
<i>Xanthorrhoea</i> ? <i>johnsonii</i>	Grass Tree	Xanthorrhoeaceae	1
<i>Xanthorrhoea</i> sp.	Grass Tree	Xanthorrhoeaceae	1
Exotic Species			
Forbs			
* <i>Acetosella vulgaris</i>	Sheep Sorrel	Polygonaceae	1
* <i>Anagallis arvensis</i>	Scarlet Pimpernel	Primulaceae	1
* <i>Arctotheca calendulacea</i>	Capeweed	Asteraceae	0-4
* <i>Arenaria leptoclados</i>		Caryophyllaceae	1
* <i>Argemone ochroleuca</i>	Mexican Poppy	Papaveraceae	1
* <i>Capsella bursa-pastoris</i>	Shepherd's Purse	Brassicaceae	1
* <i>Carduus nutans</i>	Nodding Thistle	Asteraceae	1
* <i>Carduus pycnocephalus</i>	Slender Thistle	Asteraceae	1
* <i>Carduus tenuiflorus</i>	Winged Slender Thistle	Asteraceae	1
* <i>Carthamus lanatus</i>	Saffron Thistle	Asteraceae	1
* <i>Centaurea</i> sp.		Asteraceae	1
* <i>Centaureum</i> sp.	Centaury	Gentianaceae	1
* <i>Cerastium</i> sp.	Chickweed	Caryophyllaceae	1
* <i>Chondrilla juncea</i>	Skeleton Weed	Asteraceae	0-2
* <i>Cirsium vulgare</i>	Black or Spear Thistle	Asteraceae	0-2
* <i>Conyza</i> sp.	Fleabane	Asteraceae	0-2
* <i>Echium plantagineum</i>	Paterson's Curse	Boraginaceae	1
* <i>Erodium cicutarium</i>	Common Storksbill	Geraniaceae	1
* <i>Galenia pubescens</i>	Galenia	Aizoaceae	0-3
* <i>Geranium molle</i>		Geraniaceae	1
* <i>Gomochaeta</i> sp.	Cudweed	Asteraceae	1
* <i>Gomphocarpus fruticosus</i>	Narrow-leaved Cotton-bush	Euphorbiaceae	1
* <i>Hypericum perforatum</i>	St John's Wort	Clusiaceae	0-2
* <i>Hypochaeris glabra</i>		Asteraceae	0-2
* <i>Hypochaeris radicata</i>	Cat's Ear, Flatweed	Asteraceae	0-2
* <i>Lactuca</i> sp.	Prickly Lettuce	Asteraceae	1

Species Name	Common Name	Family Name	Abundance Score
* <i>Lepidium africanum</i>	Peppergrass	Brassicaceae	1
* <i>Lepidium bonariense</i>	Peppergrass	Brassicaceae	1
* <i>Linum trigynum</i>		Linaceae	1
* <i>Malva parviflora</i>	Small-flowered Mallow	Malvaceae	1
* <i>Marrubium vulgare</i>	Horehound	Lamiaceae	0-2
* <i>Medicago arabica</i>	Black Medic	Fabaceae	1
* <i>Medicago</i> sp.	Black Medic	Fabaceae	0-2
* <i>Modiola caroliniana</i>	Orange Flowered Mallow	Malvaceae	1
* <i>Paronychia brasiliiana</i>	Brazilian Whitlow	Caryophyllaceae	1
* <i>Petrohragia nanteuillii</i>	Proliferous Pink	Caryophyllaceae	1
* <i>Plantago lanceolata</i>	Ribbed Plantain	Plantaginaceae	0-2
* <i>Polycarpon tetraphyllum</i>	Four-leaved Allseed	Caryophyllaceae	1
* <i>Richardia stellaris</i>		Rubiaceae	1
* <i>Sanguisorba minor</i> ssp. <i>muricata</i>	Sheep's Burnet	Rosaceae	1
* <i>Salvia verbenaca</i>	Wild Sage	Lamiaceae	0-3
* <i>Senecio madagascariensis</i>	Fireweed	Asteraceae	1
* <i>Sida rhombifolia</i>	Paddy's Lucerne	Malvaceae	1
* <i>Silybum marianum</i>	Variegated Thistle	Asteraceae	1
* <i>Sisymbrium officinale</i>	Hedge Mustard	Brassicaceae	0-2
* <i>Soliva sessilis</i>	Bindyi	Asteraceae	1
* <i>Sonchus asper</i>	Prickly Sow Thistle	Asteraceae	1
* <i>Sonchus oleraceus</i>	Sow Thistle	Asteraceae	1
* <i>Stachys arvensis</i>	Stagger Weed	Lamiaceae	1
* <i>Stellaria media</i>	Common Chickweed	Caryophyllaceae	1
* <i>Taraxacum officinale</i>	Dandelion	Asteraceae	0-2
* <i>Trifolium arvense</i>	Hare's Foot Clover	Fabaceae	1
* <i>Trifolium campestre</i>	Hop Clover	Fabaceae	0-2
* <i>Trifolium dubium</i>	Suckling Clover	Fabaceae	1
* <i>Trifolium repens</i>	White Clover	Fabaceae	0-4
* <i>Trifolium subterraneum</i>	Sub Clover	Fabaceae	0-4
* <i>Urtica urens</i>	Stinging Nettle	Urticaceae	1
* <i>Verbascum virgatum</i>	Twiggy Mullein	Scrophulariaceae	1
* <i>Verbena bonariensis</i>	Purpletop	Verbenaceae	1
* <i>Verbena rigida</i>	Veined Verbena	Verbenaceae	1
* <i>Vicia sativa</i>	Vetch	Fabaceae	1
* <i>Vicia</i> sp.	Vetch	Fabaceae	0-2
* <i>Vinca major</i>	Periwinkle	Acanthaceae	1
* <i>Xanthium spinosum</i>	Bathurst Burr	Asteraceae	1
Vines and Twiners			
* <i>Asparagus asparagoides</i>	Bridal Creeper	Asparagaceae	1
Grasses			
* <i>Aira</i> sp.	Hair Grass	Poaceae	1
* <i>Andropogon virginicus</i>	Whisky Grass	Poaceae	1
* <i>Briza minor</i>	Shivery Grass	Poaceae	1
* <i>Briza</i> sp.	Quaking Grass	Poaceae	1
* <i>Bromus ?molliformis</i>	Soft Brome	Poaceae	0-3

Species Name	Common Name	Family Name	Abundance Score
* <i>Bromus catharticus</i>	Prairie Grass	Poaceae	1
* <i>Bromus diandrus</i>	Giant Brome	Poaceae	0-2
* <i>Bromus inermis</i>		Poaceae	1
* <i>Chloris gayana</i>	Rhodes Grass	Poaceae	0-3
* <i>Dactylis glomerata</i>	Cocksfoot	Poaceae	1
* <i>Eragrostis curvula</i>	African Lovegrass	Poaceae	1
* <i>Holcus lanatus</i>	Yorkshire Fog	Poaceae	1
* <i>Hordeum</i> sp.	Barley Grass	Poaceae	0-4
* <i>Hyparrhenia hirta</i>	Coolatai Grass	Poaceae	1
* <i>Lolium perenne</i>	Perennial Ryegrass	Poaceae	0-4
* <i>Paspalum dilatatum</i>	Paspalum	Poaceae	0-2
* <i>Paspalum urvillei</i>	Vasey Grass	Poaceae	1
* <i>Phalaris aquatica</i>	Phalaris	Poaceae	1
* <i>Poa annua</i>	Winter Grass	Poaceae	1
* <i>Setaria</i> sp.	Pigeon Grass	Poaceae	1
* <i>Vulpia</i> sp.	Rat's Tail Fescue	Poaceae	1
Shrubs			
* <i>Lycium ferocissimum</i>	African Boxthorn	Solanaceae	1
* <i>Opuntia</i> sp.	Prickly Pear	Cactaceae	0-2
* <i>Prunus cerasifera?</i>	Plum	Amygdalaceae	1
* <i>Pyracantha angustifolia</i>	Firethorn	Rosaceae	1
* <i>Rosa rubiginosa</i>	Sweet Briar	Rosaceae	1
* <i>Rubus fruticosus</i> spp. agg.	Blackberry	Rosaceae	1
Trees			
* <i>Ailanthus altissima</i>	Tree of Heaven	Simaroubaceae	0-3
* <i>Eucalyptus nichollii</i>	Willow Peppermint	Myrtaceae	1
* <i>Pinus</i> sp.	Pine	Pinaceae	1
* <i>Robinia pseudoacacia</i>	Black Locust	Fabaceae	1
* <i>Schinus areira</i>	Pepper Tree	Anacardiaceae	1

B.3 VEGETATION DESCRIPTIONS (BENSON *et al.* 2010) AND PHOTOS

Common Name: Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley

Scientific Name: *Eucalyptus albens* <-> *moluccana intermedia* - *Eucalyptus moluccana* - *Eucalyptus albens* / *Sida trichopoda* - *Sclerolaena muricata* s.l. - *Pimelea curviflora* var. *curviflora* / *Austrostipa bigeniculata* - *Bothriochloa macra* - *Boerhavia dominii* - *Oxalis perennans*

Veg. Comm. ID.: 483

Characteristic Trees: *Eucalyptus albens* <-> *moluccana intermedia*; *Eucalyptus moluccana*; *Eucalyptus albens*; *Angophora floribunda*; *Eucalyptus melliodora*.

Shrubs/Vines/Epiphytes: *Sclerolaena muricata* s.l.; *Sida trichopoda*; *Pimelea curviflora* var. *curviflora*.

Groundcover: *Austrostipa bigeniculata*; *Bothriochloa macra*; *Boerhavia dominii*; *Oxalis perennans*; *Elymus scaber* var. *scaber*; *Cynodon dactylon*; *Chamaesyce drummondii*; *Hibiscus trionum*; *Einadia nutans* subsp. *nutans*; *Austrostipa aristiglumis*; *Aristida personata*; *Asperula conferta*; *Rumex brownii*; *Mentha diemenica*; *Cyperus gracilis*; *Panicum queenslandicum* var. *queenslandicum*; *Geranium solanderi* var. *solanderi*; *Austrostipa nodosa*; *Calotis lappulacea*; *Convolvulus graminetinus*; *Glycine latifolia*; *Chloris truncata*.

Vegetation Description: Mid-high to tall open woodland or woodland dominated by a Grey Box (*Eucalyptus moluccana*) x White Box (*Eucalyptus albens*) hybrid forming an *Eucalyptus albens* - *moluccana* intermediate taxon. The trees tend to be closer to Grey Box than White Box over most of this region. Few other tree species occur with Rough-barked Apple (*Angophora floribunda*) and Yellow Box (*Eucalyptus melliodora*) occurring on footslopes and valley flats. Shrubs are absent or very sparse and include *Sclerolaena muricata*, *Sida trichopoda* and *Pimelea curviflora* var. *curviflora*. The ground cover is dense after rain but mid-dense to sparse in dry times. Grass species include *Austrostipa bigeniculata*, *Bothriochloa macra*, *Austrostipa aristiglumis*, *Elymus scaber* var. *scaber*, *Cynodon dactylon* and *Panicum queenslandicum* var. *queenslandicum*. The sedge *Cyperus gracilis* may be present. Forb species include *Boerhavia dominii*, *Oxalis perennans*, *Chamaesyce drummondii*, *Hibiscus trionum*, *Einadia nutans* subsp. *nutans*, *Asperula conferta*, *Rumex brownii*, *Mentha diemenica*, *Geranium solanderi* var. *solanderi* and *Calotis lappulacea*. Occurs on brown to black earth, chocolate loam to clay soils derived from basalt on hillslopes, hillcrests, footslopes and valley flats on rolling hills and low hills on the Merriwa Plain and lower southern slopes of the Liverpool Range in the upper Hunter Valley in the far south-eastern corner of the Brigalow Belt South Bioregion. Mainly cleared. Listed as part of the grassy box-gum woodland EEC in both the EPBC and NSW TSC Acts. Threatened by fragmentation, weed invasion, tree dieback and intensive agricultural development of ground cover. Very poorly or not represented in protected areas as of 2009.

Threat Category: Critically Endangered.



Photo: White Box grassy woodland recorded at Flora plot A25_FL Condition Class: Poor-moderate

Hybrid White Box trees are the common dominant on lower slopes. These are less grey-foliaged and have smaller buds and fruits than typical White Box which was seen on the nearby Liverpool Plains. The White Box on the site all appeared to be this hybrid form and hence all White Box-dominated vegetation has been placed into this vegetation community (483) although there are several similar White Box communities described by Benson *et al.*

This community is part of the Box-Gum Woodland EEC.

Common Name: Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSWWS and BBS Bioregions

Scientific Name: *Angophora floribunda* - *Eucalyptus blakelyi* - *Eucalyptus melliodora* / *Acacia implexa* - *Dodonaea viscosa* subsp. *angustifolia* - *Bursaria spinosa* subsp. *spinosa* - *Hibbertia obtusifolia* / *Austrostipa verticillata* - *Aristida ramosa* -

Calotis lappulacea - *Arundinella nepalensis*

Veg. Comm. ID.: 281

Characteristic Trees: *Angophora floribunda*; *Eucalyptus blakelyi*; *Eucalyptus melliodora*; *Callitris endlicheri*; *Callitris glaucophylla*; *Eucalyptus camaldulensis*; *Casuarina cunninghamiana* subsp. *cunninghamiana*; *Eucalyptus albens*; *Brachychiton populneus* subsp. *populneus*.

Shrubs/Vines/Epiphytes: *Acacia implexa*; *Dodonaea viscosa* subsp. *angustifolia*; *Bursaria spinosa* subsp. *spinosa*; *Hibbertia obtusifolia*; *Acacia penninervis* var. *penninervis*; *Acacia gladiiformis*; *Acacia uncinata*; *Acacia leiocalyx*; *Acacia decora*; *Olearia elliptica* subsp. *elliptica*; *Brachyloma daphnoides* subsp. *daphnoides*; *Acacia sertiformis*; *Persoonia cuspidifera*; *Beyeria viscosa*; *Cassinia quinquefaria*; *Notelaea microcarpa* var. *microcarpa*; *Melichrus urceolatus*; *Pimelea curviflora* var. *curviflora*; *Phyllanthus subcrenulatus*; *Acacia deanei* subsp. *deanei*; *Geijera parviflora*; *Brachyloma daphnoides* subsp. *daphnoides*; *Ozothamnus diosmifolius*; *Acacia ulicifolia*; *Acacia leiocalyx*; *Macrozamia diplomera*; *Macrozamia heteromera*; *Persoonia cuspidifera*; *Grevillea floribunda*; *Exocarpos cupressiformis*; *Cassytha pubescens*; *Indigofera linnaei*; *Cassinia quinquefaria*.

Groundcover: *Austrostipa verticillata*; *Aristida ramosa*; *Calotis lappulacea*; *Arundinella nepalensis*; *Aristida calycina* var. *praealta*; *Lomandra longifolia*; *Lomandra confertifolia*; *Swainsona galegifolia*; *Haloragis heterophylla*; *Themeda australis*; *Einadia nutans*; *Juncus continuus*; *Juncus ochrocoleus*; *Juncus usitatus*; *Eragrostis brownii*; *Dianella revoluta* var. *revoluta*; *Ranunculus sessiliflorus* var. *sessiliflorus*; *Epaltes australis*; *Dichondra repens*; *Scutellaria humilis*; *Hydrocotyle laxiflora*; *Desmodium brachypodium*; *Desmodium varians*; *Austroanthonia racemosa* var. *obtusata*; *Poa labillardierei* var. *labillardierei*; *Bothriochloa decipiens*; *Carex appressa*; *Carex incommutata*; *Oncinocalyx betchei*; *Wahlenbergia luteola*; *Wahlenbergia stricta*; *Senecio queenslandicus*; *Microlaena stipoides* var. *stipoides*; *Dichelachne micrantha*; *Dichopogon fimbriatus*; *Daucus glochidiatus* s.l.; *Cheilanthes sieberi* subsp. *sieberi*; *Urtica incisa*; *Plantago hispida*; *Geranium solanderi* var. *solanderi*; *Podolepis neglecta*; *Rubus parvifolius*; *Glycine clandestina*; *Clematis glycinoides* var. *glycinoides*; *Commelina cyanea*; *Echinopogon intermedium*; *Echinopogon caespitosus* var. *caespitosus*; *Elymus scaber* var. *scaber*; *Echinopogon ovatus*; *Aristida vagans*; *Einadia hastata*; *Oxalis perennans*; *Cymbonotus lawsonianus*; *Cynoglossum australe*; *Lomandra bracteata*; *Sigesbeckia australiensis*; *Galium migrans*; *Vittadinia dissecta* var. *dissecta*; *Calotis cuneifolia*; *Ajuga australis*; *Galium gaudichaudii*; *Aristida jerichoensis* var. *jerichoensis*; *Wahlenbergia graniticola*; *Vittadinia cuneata* var. *hirsuta*; *Vittadinia tenuissima*.

Vegetation Description: Tall open forest or woodland with trees up to 30 m high dominated by Rough-barked Apple (*Angophora floribunda*) usually with *Eucalyptus blakelyi* or *Eucalyptus melliodora*. Other tree species may include *Callitris glaucophylla*, *Brachychiton populneus* and various red gum intergrades. River Oak (*Casuarina cunninghamiana* subsp. *cunninghamiana*) may be present but often forms its own riparian community in nearby river banks. The shrub layer is sparse or absent in heavily grazed locations. Shrub species may include wattles such as *Acacia implexa*, *Acacia decora*, *Acacia penninervis* var. *penninervis* and *Acacia deanei*. Other shrub species may include *Dodonaea viscosa* subsp. *angustifolia*, *Bursaria spinosa*, *Olearia elliptica* subsp. *elliptica* and *Hibbertia obtusifolia*. The ground cover is usually dense to mid-dense. It includes grass species such as *Austrostipa verticillata*, *Austrostipa scabra*, *Arundinella nepalensis*, *Digitaria breviglumis*, *Echinopogon* spp., *Dichelachne micrantha*, *Poa labillardierei* var. *labillardierei* and *Themeda australis*. The mat-rush *Lomandra longifolia* may be common. Rush (*Juncus* spp.) occur along creeks and in depressions along with sedges such as *Carex incommutata*. Forb species include *Swainsona galegifolia*, *Haloragis heterophylla*, *Dianella revoluta* var. *revoluta*, *Ranunculus sessiliflorus* var. *sessiliflorus*, *Dichondra repens*, *Epaltes australis*, *Haloragis heterophylla*, *Epaltes australis*, *Calotis cuneifolia*, *Ajuga australis*, *Dichondra repens*, *Scutellaria humilis* and *Hydrocotyle laxiflora*. Scramblers include *Desmodium brachypodium*, *Desmodium repens* and *Glycine clandestina*. A widespread community that occurs on black, brown and grey alluvial and colluvial clay loam, loam or sandy loam soils derived from a range of substrates on valley flats and footslopes in valleys in hill landform patterns mainly in the Brigalow Belt South Bioregion. Some areas also occur north of Mudgee in the Gulgong-Dunedoo area in the NSW South-western Slopes Bioregion. Most of its original extent has been cleared and weeds have invaded many remnants but some stands remain.

Threat Category: Vulnerable.



Photo: Yellow Box/Blakley's Red Gum/Rough-barked Apple woodland recorded at Flora plot A9_FL, Condition class: Good.

This community is essentially the same as ID481, but includes Yellow Box (*E. melliodora*) as a dominant tree species and is typically found on larger creek flats and adjacent lower slopes within sandstone areas

It is part of the Box-Gum Woodland EEC.

Common Name: Derived speargrass - wallaby grass - wire grass mixed forb grassland mainly in the Coonabarabran - Pilliga - Coolah region

Scientific Name: *Acacia deanei* subsp. *deanei* - *Acacia salicina* - *Senna aciphylla* - *Dodonaea viscosa* subsp. *angustifolia* / *Austrostipa scabra* subsp. *falcata* - *Austrostipa verticillata* - *Dichanthium sericeum* subsp. *sericeum* - *Panicum queenslandicum* var. *queenslandicum* / *Calotis lappulacea* - *Sida corrugata* - *Wahlenbergia stricta* subsp. *stricta* - *Vittadinia cuneata*

Veg. Comm. ID.: 395

Characteristic Trees: Generally cleared but tree species may have included: *Callitris glaucophylla*; *Atalaya hemiglauca*; *Alstonia constricta*; *Geijera parviflora*; *Alectryon oleifolius* subsp. *canescens*; *Eucalyptus albens*; *Eucalyptus crebra*; *Eucalyptus melliodora*.

Shrubs/Vines/Epiphytes: *Acacia deanei* subsp. *deanei*; *Acacia decora*; *Senna aciphylla*; *Dodonaea viscosa* subsp. *angustifolia*; *Acacia salicina*; *Notelaea microcarpa* var. *microcarpa*.

Groundcover: *Austrostipa scabra* subsp. *falcata*; *Austrostipa verticillata*; *Dichanthium sericeum* subsp. *sericeum*; *Calotis lappulacea*; *Vittadinia dissecta*; *Austrodanthonia bipartita*; *Austrodanthonia caespitosa*; *Bothriochloa decipiens*; *Themeda australis*; *Enteropogon acicularis*; *Aristida vagans*; *Boerhavia dominii*; *Oxalis perennans*; *Dichondra* sp. *A sensu Harden (1992)*; *Cyperus gracilis*; *Wahlenbergia stricta* subsp. *stricta*; *Einadia hastata*; *Xerochrysum bracteata*; *Sida corrugata*; *Cheilanthes sieberi* subsp. *sieberi*; *Rumex brownii*; *Podolepis neglecta*; *Carex inversa*; *Cymbopogon refractus*; *Panicum queenslandicum* var. *queenslandicum*; *Austrodanthonia racemosa* var. *obtusata*; *Aristida caput-medusae*; *Chloris truncata*; *Sporobolus elongatus*; *Chloris ventricosa*; *Bothriochloa macra*; *Eragrostis elongata*; *Vittadinia cuneata*; *Vittadinia muelleri*; *Swainsona galegifolia*; *Cymbonotus lawsonianus*; *Solanum ferocissimum*; *Hydrocotyle laxiflora*; *Cynoglossum australe*; *Acaena novae-zelandiae*; *Geranium solanderi* var. *solanderi*; *Geranium retrorsum*.

Vegetation Description: Mid-high to tall grassland or open grassland derived from the clearing of grassy woodlands. Original tree species may have included *Callitris glaucophylla*, *Atalaya hemiglauca*, *Alstonia constricta*, *Geijera parviflora*, *Alectryon oleifolius* subsp. *canescens* or *Eucalyptus albens*. Re-generating shrub species include *Notelaea microcarpa* var. *microcarpa*, *Dodonaea viscosa* subsp. *angustifolia*, *Acacia salicina*, *Acacia deanei* subsp. *deanei*, *Acacia decora* and *Senna aciphylla*. The ground cover is dense to mid-dense or sparse in dry times. It is dominated by a range of grass and forb species including a high number of exotic species. Native grasses include *Austrostipa scabra*, *Austrostipa verticillata*, *Dichanthium sericeum* subsp. *sericeum*, *Austrodanthonia racemosa*, *Austrodanthonia bipartita*, *Austrodanthonia caespitosa*, *Aristida caput-medusae*, *Chloris truncata*, *Sporobolus elongatus*, *Bothriochloa decipiens*, *Themeda australis*, *Enteropogon acicularis* and *Aristida vagans*. Native forb species include *Calotis lappulacea*, *Vittadinia dissecta*, *Wahlenbergia stricta* subsp. *stricta*, *Einadia hastata*, *Xerochrysum bracteata*, *Sida corrugata*, *Cheilanthes sieberi* subsp. *sieberi*, *Rumex brownii*, *Podolepis neglecta*, *Carex inversa*, *Cymbopogon refractus*, *Panicum queenslandicum* var. *queenslandicum*, *Austrodanthonia racemosa* var. *obtusata*, *Vittadinia cuneata*, *Vittadinia muelleri*, *Cymbonotus lawsonianus*, *Hydrocotyle laxiflora* and *Cynoglossum australe*. Occurs on a range of soils including clay to sandy loams on a range of landscapes including hills, low hills, rises and outwash plains across a large geographical area from the Pilliga Scrub and Warrumbungle Range region in the north to Coolah in the south where woodland has been cleared for grazing. While being a derived vegetation type, this community may contain threatened species and form a native ground cover matrix between bushland areas.

Threat Category: Least Concern.



Photo: Native pasture with scattered Inland Grey Box, recorded at Flora plot A5FL (2012 survey) condition class: Moderate.

Native pasture is most common in the north-eastern part of the Transmission Line Study Area. Shrubs are absent, but there may be scattered eucalypts. Groundcover is generally near-continuous and typically has low diversity of native grasses and forbs due to grazing history.

Benson *et al.* 2010 regard this community as being of “least concern” as it is very extensive in the region. However, where this community is contiguous with stands of Box-Gum Woodland EEC, it has been regarded as part of that EEC in this assessment.

Common Name: Narrow-leaved Ironbark - Black Cypress Pine +/- Blakely's Red Gum shrubby open forest on sandstone low hills in the southern BBS Bioregion (including Goonoo)

Scientific Name: *Eucalyptus crebra* - *Callitris endlicheri* - *Eucalyptus blakelyi* - *Eucalyptus sideroxylon* / *Calytrix tetragona* – *Melichrus urceolatus* - *Acacia triptera* - *Acacia hakeoides* / *Austrodanthonia monticola* - *Goodenia hederacea* subsp.

Veg. Comm. ID.: 468

Characteristic Trees: *Eucalyptus crebra*; *Callitris endlicheri*; *Eucalyptus blakelyi*; *Allocasuarina luehmannii*; *Eucalyptus sideroxylon*; *Eucalyptus microcarpa*; *Eucalyptus macrorhyncha*; *Eucalyptus fibrosa*; *Eucalyptus pilligaensis*.

Shrubs/Vines/Epiphytes: *Calytrix tetragona*; *Melichrus urceolatus*; *Daviesia acicularis*; *Acacia triptera*; *Acrotriche rigida*; *Pultenaea boormanii*; *Acacia spectabilis*; *Dillwynia sieberi*; *Acacia hakeoides*; *Melaleuca erubescens*; *Kunzea parvifolia*; *Grevillea arenaria* subsp. *arenaria*; *Pultenaea laxiflora*; *Conospermum taxifolium*; *Notelaea longifolia* forma *intermedia*; *Acacia acinacea*; *Dodonaea peduncularis*; *Cryptandra amara* var. *floribunda*; *Hibbertia obtusifolia*; *Brachyloma daphnoides* subsp. *daphnoides*; *Macrozamia secunda*; *Persoonia cuspidifera*; *Acacia gladiiformis*; *Acacia buxifolia* subsp. *buxifolia*; *Acacia sertiformis*; *Melaleuca uncinata*; *Aotus subglauca* var. *filiformis*.

Groundcover: *Austrodanthonia monticola*; *Goodenia hederacea* subsp. *hederacea*; *Gonocarpus tetragynus*; *Astroloma humifusum*; *Platysace ericoides*; *Lomandra filiformis* subsp. *coriacea*; *Aristida vagans*; *Dianella revoluta* var. *revoluta*; *Austrostipa scabra* subsp. *scabra*; *Laxmannia gracilis*; *Calotis cuneifolia*; *Gahnia aspera*; *Platysace ericoides*; *Xerochrysum viscosa*; *Aristida ramosa*; *Juncus remotiflorus*; *Brachyscome multifida* var. *multifida*; *Juncus flavidus*; *Sporobolus mitchellii*; *Bulbine semibarbata*; *Brachyscome multifida* var. *multifida*; *Cheilanthes sieberi* subsp. *sieberi*; *Veronica plebeia*; *Microtis unifolia*; *Juncus subsecundus*.

Vegetation Description: Tall to mid-high woodland or open forest dominated by Narrow-leaved Ironbark (*Eucalyptus crebra*) with Black Cypress Pine (*Callitris endlicheri*) and often Blakely's Red Gum (*Eucalyptus blakelyi*). Other tree species include Buloke (*Allocasuarina luehmannii*) and Mugga Ironbark (*Eucalyptus sideroxylon*). The shrub layer is sparse to mid-dense depending on time since fire, grazing history and soil depth. Shrub species include *Calytrix tetragona*, *Melichrus urceolatus*, *Acacia triptera*, *Pultenaea boormanii*, *Dillwynia sieberi*, *Daviesia acicularis*, *Acacia hakeoides*, *Melaleuca erubescens*, *Kunzea parvifolia*, *Dillwynia sieberi*, *Grevillea arenaria*, *Acacia sertiformis* and *Acacia spectabilis*. The ground cover is sparse and includes the low shrubs *Astroloma humifusum* and *Platysace ericoides* along with grasses such as *Austrodanthonia monticola*, *Aristida vagans*, *Aristida ramosa* and *Austrostipa scabra*. The mat-rush *Lomandra filiformis* subsp. *coriacea* is common. Forb species include *Goodenia hederacea* subsp. *hederacea*, *Gonocarpus tetragynus*, *Dianella revoluta* var. *revoluta*, *Xerochrysum viscosa* and *Laxmannia gracilis*. Occurs on brown to yellow loamy sand or sandy loam soils derived from sandstone on hillslopes, hill crests and footslopes in low hill landforms mainly in the Goonoo forest and reserves north of Dubbo in the far south-western part of the Brigalow Belt South Bioregion. Grades into Blue-leaved Ironbark shrubby open forest (ID467) and other ironbark types in the Goonoo forests. Partly cleared.

Threat Category: Least Concern.



Photo: Narrow-leaved Ironbark/Blakely's Red Gum open forest recorded at Flora plot ID B27_FL Condition class: Good.

This community was recorded in various states of condition from good condition patches on private land (as at left) to disturbed stands and scattered paddock trees over native pasture.

Inland Grey Box (*E. microcarpa*) is considered a characteristic tree for this community and was noted in various locations, often as remnants in farming land. As these occurrences most commonly occur in the sandstone flora in the study area and is not found on the more fertile soils of the wind farm site, we have taken the view that Inland Grey Box EEC and CEEC are not present.

Common Name: Inland Scribbly Gum - Red Stringybark - Black Cypress Pine - Red Ironbark open forest on sandstone hills in the southern Brigalow Belt South Bioregion and northern NSW South Western Slopes Bioregion

Scientific Name: *Eucalyptus rossii* (Inland Scribbly Gum), *Eucalyptus macrorhyncha* (Red Stringybark), *Callitris endlicheri* (Black Cypress Pine), *Eucalyptus fibrosa* (Red Ironbark) / *Phyllanthus hirtellus* (Thyme Spurge), *Cassinia laevis* (Cough Bush), *Pultanaea microphylla* (A Bush Pea), *Persoonia linearis* (Narrow-leaved Geebung) / *Joycea pallida* (Silvertop Wallaby Grass), *Lomandra filiformis* subsp. *coriacea* (Wattle Matt-rush), *Pomax umbellata* (Pomax), *Chrysocephalum semipapposum* (Clustered Everlasting)

Veg. Comm. ID.: 477

Characteristic Trees: *Eucalyptus rossii*, *Eucalyptus macrorhyncha*, *Callitris endlicheri*, *Eucalyptus fibrosa*, *Eucalyptus polyanthemos* subsp. *polyanthemos*, *Acacia doratoxylon*

Shrubs/Vines/Epiphytes: *Phyllanthus hirtellus*, *Cassinia laevis*, *Persoonia linearis*, *Pultanaea microphylla*, *Dillwynia sieberi*, *Allocasuarina gymnanthera*, *Ozothamnus diosmifolius*, *Pultanaea cunninghamii*, *Hibbertia circumdans*, *Olearia microphylla*, *Lissanthe strigosa* subsp. *strigosa*, *Bursaria spinosa* subsp. *spinosa*, *Brachyloma daphnoides* subsp. *daphnoides*, *Hibbertia obtusifolia*, *Melichrus urceolatus*.

Groundcover: *Joycea pallida*, *Lomandra filiformis* subsp. *coriacea*, *Pomax umbellata*; *Chrysocephalum semipapposum*, *Lepidosperma laterale*, *Dichelachne rara*, *Goodenia hederacea* subsp. *hederacea*, *Platysace ericoides*, *Brachyscome melanocarpa*, *Cheilanthes sieberi* subsp. *sieberi*.

Vegetation Description: Mid-high open forest co-dominated by Inland Scribbly Gum (*Eucalyptus rossii*), Red Stringybark (*Eucalyptus macrorhyncha*) and Black Cypress Pine (*Callitris endlicheri*). Other common trees include Red Ironbark (*Eucalyptus fibrosa*) and Red Box (*Eucalyptus polyanthemos* subsp. *polyanthemos*) and rarely Currawang (*Acacia doratoxylon*). The shrub layer is sparse and includes *Phyllanthus hirtellus*, *Cassinia laevis*, *Allocasuarina gymnanthera*, *Persoonia linearis*, *Pultanaea microphylla*, *Dillwynia sieberi*, *Hibbertia circumdans*, *Olearia microphylla*, *Acacia uncinata*, *Indigofera australis*, *Lissanthe strigosa* subsp. *strigosa*, *Bursaria spinosa* subsp. *spinosa*, *Brachyloma daphnoides* subsp. *pubescens*, *Hibbertia obtusifolia*, *Melichrus urceolatus* and *Ozothamnus diosmifolius*. The ground cover is mid-dense to sparse often with large amounts of leaf litter. The small shrub *Platysace ericoides* is often present. Grasses include *Joycea pallida*, *Dichelachne rara* and *Notodanthonia semiannularis*. The mat-rushes *Lomandra filiformis*, *Lomandra confertifolia* and *Lomandra multiflora* are often present along with the sedges *Lepidosperma laterale* and *Gahnia aspera*. Forb species include *Pomax umbellata*, *Chrysocephalum semipapposum*, *Goodenia hederacea* subsp. *hederacea*, *Veronica plebeia*, *Stypantra glauca*, *Wahlenbergia luteola* and *Dianella revoluta* var. *revoluta*. Occurs on sandy loam to clayey sands soils derived from sandstone on hillcrests and hillslopes in hill landform patterns in the Dunedoo - Merriwa region of the extreme south BBS Bioregion overlapping into the NSW SWS Bioregion. Occurs in Dapper Nature Reserve. Grades into a similar community dominated by Red Ironbark (*Eucalyptus fibrosa*) (ID478) and also into the Dapper Mugga Ironbark community (ID403). Restricted in extent and partly cleared.

Threat Category: Near Threatened.



Photo: Black Cypress Pine/Inland Scribbly Gum recorded at Flora plot ID C20_FL, condition class Moderate-good

This community includes vegetated areas dominated by Inland Scribbly Gum and was most commonly recorded at the southern end of the Transmission Line, along the preferred route option west of Ulan Road. Inland Scribbly Gum was also a co-dominant or occasional canopy tree in the Ironbark dominant sandstone communities.

Common Name: Red Ironbark - Black Cypress Pine - stringybark +/- Narrow-leaved Wattle shrubby open forest on sandstone in the Gulgong - Mendooran region, southern BBS Bioregion

Scientific Name: *Eucalyptus fibrosa* - *Callitris endlicheri* - *Eucalyptus sparsifolia* - *Acacia linearifolia* / *Phyllanthus hirtellus* – *Brachyloma daphnoides* subsp. *pubescens* - *Hibbertia obtusifolia* - *Persoonia linearis* / *Astroloma humifusum* - *Joycea pallida* - *Austrodanthonia racemosa* var. *racemosa* - *Chrysocephalum semipapposum*

Veg. Comm. ID.: 478

Characteristic Trees: *Eucalyptus fibrosa*; *Callitris endlicheri*; *Eucalyptus crebra*; *Eucalyptus sparsifolia*; *Eucalyptus rossii*; *Acacia linearifolia*; *Eucalyptus blakelyi*; *Eucalyptus punctata*; *Eucalyptus dawsonii*.

Shrubs/Vines/Epiphytes: *Phyllanthus hirtellus*; *Brachyloma daphnoides* subsp. *daphnoides*; *Hibbertia obtusifolia*; *Melichrus urceolatus*; *Cassinia laevis*; *Persoonia linearis*; *Pultenaea microphylla*; *Dillwynia sieberi*; *Allocasuarina gymnanthera*; *Ozothamnus diosmifolius*; *Pultenaea cunninghamii*; *Hibbertia circumdans*; *Olearia microphylla*; *Acacia uncinata*; *Indigofera australis*; *Lissanthe strigosa* subsp. *strigosa*; *Bursaria spinosa* subsp. *spinosa*; *Dodonaea viscosa* subsp. *spatulata*; *Acacia spectabilis*; *Allocasuarina gymnanthera*; *Acacia gladiiformis*; *Acacia verniciflua*; *Leucopogon attenuatus*.

Groundcover: *Astroloma humifusum*; *Joycea pallida*; *Austrodanthonia racemosa* var. *racemosa*; *Chrysocephalum semipapposum*; *Lomandra filiformis* subsp. *coriacea*; *Lepidosperma laterale*; *Pomax umbellata*; *Dichelachne rara*; *Goodenia hederacea* subsp. *hederacea*; *Platysace ericoides*; *Brachyscome melanocarpa*; *Veronica plebeia*; *Lomandra confertifolia* subsp. *leptostachya*; *Gahnia aspera*; *Lomandra multiflora* subsp. *multiflora*; *Stypantra glauca*; *Wahlenbergia gracilis*; *Wahlenbergia luteola*; *Cheilanthes sieberi* subsp. *sieberi*; *Dianella revoluta* var. *revoluta*; *Cymbopogon refractus*; *Notodanthonia semiannularis*; *Goodenia stephensonii*

Vegetation Description: Mid-high to tall open forest co-dominated by Red Ironbark (*Eucalyptus fibrosa*), Black Cypress Pine (*Callitris endlicheri*), Red Stringybark (*Eucalyptus macrorhyncha*) and/or Narrow-leaved Stringybark (*Eucalyptus sparsifolia*) and the small tree *Acacia linearifolia*. Other trees may include Scribbly Gum (*Eucalyptus rossii*), Grey Gum (*Eucalyptus punctata*) and Slaty Gum (*Eucalyptus dawsonii*). The last two species are near their western limit. The shrub layer is sparse and includes *Phyllanthus hirtellus*, *Brachyloma daphnoides* subsp. *daphnoides*, *Hibbertia obtusifolia*, *Melichrus urceolatus*, *Cassinia laevis*, *Persoonia linearis*, *Pultenaea microphylla*, *Dillwynia sieberi*, *Hibbertia circumdans*, *Olearia microphylla*, *Acacia uncinata*, *Indigofera australis*, *Lissanthe strigosa* subsp. *strigosa*, *Bursaria spinosa* subsp. *spinosa* and *Ozothamnus diosmifolius*. The ground cover is mid-dense to sparse. The small shrubs *Platysace ericoides* and *Astroloma humifusa* are often present. Grasses include *Joycea pallida* and *Austrodanthonia racemosa*. The mat-rushes include *Lomandra filiformis*, *Lomandra confertifolia* and *Lomandra multiflora* along with the sedge *Lepidosperma laterale*. Forb species include *Pomax umbellata*, *Chrysocephalum semipapposum*, *Goodenia hederacea* subsp. *hederacea*, *Veronica plebeia*, and *Stypantra glauca*. Occurs on sandy loam to clayey sand soils derived from sandstone, siltstone, shale or slate on footslopes, hillcrests and hillslopes in hill and low hill landform patterns in the Dunedoo - Merriwa region of the extreme south BBS Bioregion overlapping into the NSW SWS Bioregion and upper Hunter Valley and Capertee Valley. Grades into a similar community dominated by Inland Scribbly Gum - Red Stringybark open forest (ID477), into the Dapper Mugga Ironbark community (ID403) and a Narrow-leaved Ironbark - Black Cypress Pine shrubby community (ID479) on sandstones. Partly cleared.

Threat Category: Near Threatened.



Photo: Red Ironbark dominant forest recorded at Flora plot ID C4_FL, Condition class: Moderate.

This community includes stands where Red Ironbark (*Eucalyptus fibrosa*) was dominant over Narrow-leaved Ironbark (*E. crebra*) and was predominately recorded within Durrigere SCA.

Benson *et al.* (2010) consider it near threatened, possibly because it includes Slaty Gum woodland which is listed as an EEC, although this species was not recorded within the Transmission Line Study Area.

Common Name: Narrow-leaved Ironbark- Black Cypress Pine - stringybark +- Grey Gum +- Narrow-leaved Wattle shrubby open forest on sandstone hills in the southern BBS - Sydney Basin Bioregions

Scientific Name: *Eucalyptus crebra* - *Callitris endlicheri* - *Eucalyptus punctata* - *Eucalyptus sparsifolia* / *Cassinia laevis* – *Hibbertia obtusifolia* - *Allocasuarina gymnanthera* - *Grevillea sericea* / *Pomax umbellata* - *Joycea pallida* - *Gahnia aspera* – *Stypantra glauca*

Veg. Comm. ID.: 479

Characteristic Trees: *Eucalyptus crebra*; *Callitris endlicheri*; *Eucalyptus punctata*; *Eucalyptus sparsifolia*; *Acacia linearifolia*; *Eucalyptus dwyeri*; *Eucalyptus nubila*; *Eucalyptus macrorhyncha*; *Eucalyptus fibrosa*; *Corymbia trachyphloia* subsp. *amphistomatica*; *Eucalyptus dealbata*; *Eucalyptus sideroxylon*; *Acacia crassa* subsp. *crassa*.

Shrubs/Vines/Epiphytes: *Cassinia arcuata*; *Hibbertia obtusifolia*; *Cassinia laevis*; *Grevillea sericea*; *Styphelia triflora*; *Dodonaea triangularis*; *Acacia buxifolia* subsp. *buxifolia*; *Kunzea parvifolia*; *Acrotriche rigida*; *Phyllanthus hirtellus*; *Sannantha cunninghamii*; *Macrozamia secunda*; *Melichrus urceolatus*; *Allocasuarina gymnanthera*; *Melichrus erubescens*; *Leucopogon muticus*; *Prostanthera howelliae*; *Exocarpos cupressiformis*; *Choretrum* sp. A; *Melaleuca thymifolia*; *Sannantha cunninghamii*; *Bursaria spinosa* subsp. *spinosa*; *Acacia piligera*; *Lissanthe strigosa* subsp. *strigosa*; *Leptospermum polygalifolium* subsp. *transmontanum*; *Acacia verniciflua*; *Acacia piligera*; *Oxylobium pulteneae*; *Acacia falcata*; *Gompholobium virgatum* var. *aspalathoides*.

Groundcover: *Pomax umbellata*; *Joycea pallida*; *Austrostipa densiflora*; *Gahnia aspera*; *Stypantra glauca*; *Goodenia hederacea* subsp. *hederacea*; *Digitaria ramularis*; *Aristida ramosa*; *Lepidosperma laterale*; *Cheilanthes sieberi* subsp. *sieberi*; *Lomandra glauca*; *Lomandra filiformis* subsp. *coriacea*; *Echinopogon caespitosus* var. *caespitosus*; *Astroloma humifusum*; *Gonocarpus elatus*; *Microlaena stipoides* var. *stipoides*; *Dianella revoluta* var. *revoluta*; *Xerochrysum viscosa*; *Echinopogon caespitosus* var. *caespitosus*; *Wahlenbergia gracilis*.

Threat Category: Near Threatened.



Photo: Black Cypress Pine/Grey Gum forest recorded at Flora ID plot C12_FL, Condition class Moderate.

This community is essentially the same as 468, but includes Grey Gum (*Eucalyptus punctata*) and the small tree *Acacia linearifolia*, which is not mentioned by Benson *et al.* 2010 as a component of 468. It was locally dominant in Durrigere SCA and on adjacent forested private property.

Common Name: Black Cypress Pine - ironbark +/- Narrow-leaved Wattle low open forest mainly on Narrabeen Sandstone in the Upper Hunter region of the Sydney Basin Bioregion

Scientific Name: *Callitris endlicheri* - *Eucalyptus fibrosa* - *Eucalyptus punctata* - *Acacia linearifolia* / *Leucopogon muticus* – *Persoonia linearis* - *Grevillea sericea* - *Allocasuarina gymnanthera* / *Lepidosperma laterale* - *Pomax umbellata* – *Astroloma humifusum* - *Lomandra glauca*

Veg. Comm. ID.: 480

Characteristic Trees: *Callitris endlicheri*; *Eucalyptus fibrosa*; *Eucalyptus crebra*; *Acacia linearifolia*; *Eucalyptus punctata*; *Corymbia trachyphloia* subsp. *amphistomatica*; *Eucalyptus tenella*.

Shrubs/Vines/Epiphytes: *Leucopogon muticus*; *Persoonia linearis*; *Grevillea sericea*; *Styphelia triflora*; *Hibbertia circumdans*; *Leptospermum parvifolium*; *Hibbertia acicularis*; *Allocasuarina gymnanthera*; *Leptospermum sphaerocarpum*; *Macrozamia spiralis*; *Boronia rubiginosa*; *Acrotriche rigida*.

Groundcover: *Lepidosperma laterale*; *Pomax umbellata*; *Astroloma humifusum*; *Lomandra glauca*; *Microlaena stipoides* var. *stipoides*; *Cheilanthes sieberi* subsp. *sieberi*; *Cleistochloa rigida*; *Eriochilus cucullatus*.

Vegetation Description: Low open forested dominated by Black Cypress Pine (*Callitris endlicheri*) with ironbarks such as *Eucalyptus crebra* or *Eucalyptus fibrosa*, Grey Gum (*Eucalyptus punctata*) and Narrow-leaved Wattle (*Acacia linearifolia*). Shrubs are sparse and include *Leucopogon muticus*, *Persoonia linearis*, *Grevillea sericea*, *Styphelia triflora*, *Hibbertia circumdans*, *Leptospermum parvifolium*, *Allocasuarina gymnanthera* and *Macrozamia spiralis*. The ground cover is very sparse and often covered with leaf litter. Species include the sedge *Lepidosperma laterale*, the forb *Pomax umbellata*, the rock fern *Cheilanthes sieberi* subsp. *sieberi*, the mat-rush *Lomandra glauca* and the grasses *Microlaena stipoides* and *Cleistochloa rigida*. Occurs on shallow loamy sands soils derived from sandstone on hillcrests in hill landscapes in the very southern most tip of the BBS bioregion but mainly in the Goulburn River/Wollemi National Parks in the Sydney Basin Bioregion in the upper Hunter region. Not threatened but restricted in total extent.

Threat Category: Least Concern.



Photo: Black cypress pine dominant forest. Flora plot ID C15_FL, Condition class Moderate.

This community was recorded mainly in Durrigere State Conservation Area, where past timber harvesting has left stands of dense Cypress Pine regrowth with occasional emergent eucalypts.

Common Name: Rough-barked Apple - Blakely's Red Gum - Narrow-leaved Stringybark +/- Grey Gum sandstone riparian grass fern open forest on in the southern BBS and Upper Hunter regions

Scientific Name: *Angophora floribunda* - *Eucalyptus blakelyi* - *Eucalyptus punctata* - *Eucalyptus crebra* / *Styphelia triflora* – *Cassinia arcuata* - *Xanthorrhoea johnsonii* - *Persoonia linearis* / *Lomandra longifolia* - *Pteridium esculentum* - *Microlaena stipoides* var. *stipoides* - *Hydrocotyle laxiflora*

Veg. Comm. ID.: 481

Characteristic Trees: *Angophora floribunda*; *Eucalyptus blakelyi*; *Eucalyptus punctata*; *Eucalyptus crebra*; *Eucalyptus sparsifolia*; *Acacia linearifolia*; *Callitris endlicheri*.

Shrubs/Vines/Epiphytes: *Styphelia triflora*; *Hibbertia obtusifolia*; *Cassinia arcuata*; *Persoonia linearis*; *Xanthorrhoea johnsonii*; *Bursaria spinosa* subsp. *spinosa*; *Dodonaea triangularis*; *Acrotriche rigida*; *Cassinia quinquefaria*; *Amyema quandang* var. *bancroftii*; *Persoonia linearis*; *Melicytus dentatus*; *Acacia piligera*; *Grevillea triternata*; *Pultenaea cunninghamii*; *Acacia penninervis* var. *penninervis*; *Acacia lanigera* var. *lanigera*; *Acacia doratoxylon*; *Clematis glycinoides* var. *glycinoides*; *Stephania japonica* var. *japonica*; *Acacia floribunda*;

Groundcover: *Phragmites australis*. *Lomandra longifolia*; *Microlaena stipoides* var. *stipoides*; *Hydrocotyle laxiflora*; *Geranium solanderi* var. *solanderi*; *Pteris tremula*; *Pteridium esculentum*; *Glycine clandestina*; *Gahnia aspera*; *Imperata cylindrica* var. *major*; *Arundinella nepalensis*; *Persicaria prostrata*; *Lomandra multiflora* subsp. *multiflora*; *Dichelachne micrantha*; *Cheilanthes distans*; *Cheilanthes sieberi* subsp. *sieberi*; *Calotis lappulacea*; *Poranthera microphylla*; *Rorippa laciniata*; *Echinopogon caespitosus*; *Rumex brownii*; *Swainsona reticulata*; *Calotis cuneifolia*; *Sigesbeckia australiensis*; *Veronica plebeia*; *Geranium potentilloides* var. *potentilloides*; *Cymbonotus lawsonianus*; *Xerochrysum bracteata*; *Crassula sieberiana* subsp. *sieberiana*; *Stellaria pungens*; *Galium liratium*; *Galium gaudichaudii*; *Urtica incisa*; *Einadia hastata*; *Calandrinia eremaea*; *Ajuga australis*; *Cyperus eragrostis*; *Adiantum atroviride*; *Pellaea falcata*; *Oxalis exilis*; *Vittadinia pustulata*; *Tricoryne elatior*; *Carex appressa*; *Juncus psammophilus*; *Alternanthera denticulata*; *Lachnagrostis filiformis*; *Commelina cyanea*; *Echinopogon ovatus*; *Desmodium varians*; *Gratiola pedunculata*; *Wahlenbergia gracilis*.

Vegetation Description: Tall open forest to woodland dominated by *Angophora floribunda*, *Eucalyptus blakelyi* with *Eucalyptus punctata* grading upslope into *Eucalyptus crebra*, *Eucalyptus sparsifolia*, *Acacia linearifolia* and *Callitris endlicheri*. Shrubs are sparse and include *Styphelia triflora*, *Hibbertia obtusifolia*, *Persoonia linearis* and *Xanthorrhoea johnsonii*. The ground cover is very sparse and bare in creek beds. Grasses include *Microlaena stipoides* var. *stipoides*, *Echinopogon caespitosus*, *Echinopogon ovatus*, *Imperata cylindrica* var. *major*, *Arundinella nepalensis* and *Lachnagrostis filiformis*. Forbs include *Dichondra repens*, *Persicaria prostrata*, *Hydrocotyle laxiflora*, *Geranium solanderi* var. *solanderi*, *Poranthera microphylla*, *Rorippa laciniata*, *Rumex brownii*, *Urtica incisa*, *Sigesbeckia australiensis*, *Veronica plebeia* and *Geranium potentilloides* var. *potentilloides*. The rock fern *Cheilanthes sieberi* subsp. *sieberi* and the tall ferns *Pteridium esculentum* or *Pteris tremula* also occur. The sedge *Carex appressa* and rush *Juncus psammophilus* may be present. Occurs on alluvial sands or loam soil derived mainly from sandstone in hill or low hill landforms in the upper Hunter Valley mainly in the Sydney Basin Bioregion with small areas in the BBS Bioregion. Partly cleared and sometimes weed infested due to position in valleys.

Threat Category: Near Threatened.



Photo: Rough-barked Apple and Blakely's Red Gum dominant woodland. Flora plot ID A33_FL (2012 survey), Condition Class Moderate-good

This community is common across the Transmission Line Study Area and occurs on creek flats on sandstone and often includes shrub and groundcover species which are typical of the sandstone flora, as well as a more or less continuous grassy groundcover. In some locations the groundcover was found to be quite species rich.

Community 481 is not regarded by Benson *et al.* (2010) as being part of the Box Gum Woodland EEC.

B.4 FAUNA SPECIES LIST

Species name	Common name	Trans Line/Offsite
Amphibians		
<i>Crinia signifera</i>	Common Eastern Froglet	x
<i>Limnodynastes tasmaniensis</i>	Spotted Marsh Frog	x
<i>Limnodynastes dumerillii</i>	Southern Banjo Frog	x
<i>Litoria peronii</i>	Peron's Tree Frog	x
<i>Litoria fallax</i>	Eastern Dwarf Tree Frog	x
<i>Litoria latopalmata</i>	Broad-palmed Frog	x
<i>Litoria wilcoxii</i>	Stoney Creek Frog	x
<i>Platyplectrum (=Opisthodon=Limnodynastes) ornatus</i>	Ornate Burrowing Frog	x
<i>Uperoleia laevigata</i>	Smooth Toadlet	x
Reptiles		
<i>Chelodina longicollis</i>	Eastern Snake-necked Turtle	x
<i>Amalosia (=Oedura) lesueurii</i>	Lesueur's Velvet Gecko	x
<i>Diplodactylus vittatus</i>	Wood Gecko	x
<i>Underwoodisaurus milii</i>	Barking Gecko	x
<i>Pogona barbata</i>	Bearded Dragon	x
<i>Varanus gouldii</i>	Gould's Goanna	x
<i>Varanus varius</i>	Lace Monitor	x
<i>Tiliqua scincoides</i>	Eastern Blue-tongued Lizard	Offsite
<i>Morethia boulengeri</i>	South-eastern Morethia Skink	x
<i>Lampropholis delicata</i>	Dark-flecked Garden Sunskink	x
<i>Anomalopus leuckartii</i>	Two-clawed Worm-skink	x
<i>Acritoscincus platynotum</i>	Red-throated skink	x
<i>Ctenotus taeniolatus</i>	Copper-tailed Skink	x
<i>Liopholis (=Egernia) whitii</i>	White's Skink	x
<i>Hemiergis talbingoensis (=decreiensis)</i>	Three-toed Earless Skink	x
<i>Lerista bougainvillii</i>	Bougainville's Skink	x
<i>Pseudechis porphyriacus</i>	Red-bellied Black Snake	x
Mammals		
<i>Tachyglossus aculeatus</i>	Short-beaked Echidna	x
<i>Sminthopsis murina</i>	Common Dunnart	x
<i>Vombatus ursinus</i>	Common Wombat	x
<i>Petaurus breviceps</i>	Sugar Glider	x
<i>Petaurus norfolcensis</i>	Squirrel Glider	x
<i>Pseudocheirus peregrinus</i>	Common Ringtail Possum	x
<i>Acrobates pygmaeus</i>	Feathertail Glider	x
<i>Trichosurus vulpecula</i>	Common Brushtail Possum	x
<i>Macropus giganteus giganteus</i>	Eastern Grey Kangaroo	x
<i>Macropus robustus</i>	Common Wallaroo	x
<i>Macropus rufogriseus</i>	Red-necked Wallaby	x
<i>Wallabia bicolor</i>	Swamp Wallaby	x
* <i>Vulpes vulpes</i>	Fox	x
* <i>Canis familiaris</i>	Dog	x
* <i>Felis catus</i>	Cat	x
* <i>Oryctolagus cuniculus</i>	Rabbit	x
* <i>Lepus capensis</i>	Brown Hare	x

Species name	Common name	Trans Line/Offsite
* <i>Sus scrofa</i>	Pig	x
* <i>Bos taurus</i>	European Cattle	x
* <i>Capra hircus</i>	Goat	x
* <i>Dama dama</i>	Fallow Deer	x
<i>Rhinolophus megaphyllus</i>	Eastern horseshoe-bat	x
<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheathtail-bat	x
<i>Mormopterus</i> sp. 4	Unnamed Freetail-bat	x
<i>Mormopterus ridei</i>	Little Northern Freetail-bat	x
<i>Miniopterus schreibersii</i>	Common Bentwing-bat	x
<i>Nyctophilus corbeni</i>	Northern Long-eared Bat	x
<i>Nyctophilus</i> sp.	Unidentified long-eared bat	x
<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	x
<i>Chalinolobus gouldii</i>	Gould's Wattled Bat	x
<i>Chalinolobus morio</i>	Chocolate Wattled Bat	x
<i>Scotorepens balstoni</i>	Inland Broad-nosed Bat	x
<i>Tadarida (=Nyctinomus=Austronomus) australis</i>	White-striped Freetail-bat	x
<i>Vespadelus darlingtoni</i>	Large Forest Bat	x
<i>Vespadelus regulus</i>	Southern Forest Bat	x
<i>Vespadelus troughtoni</i>	Eastern Cave Bat	x
<i>Vespadelus vulturnus</i>	Little Forest Bat	x
Birds		
<i>Dromaius novaehollandiae</i>	Emu	x
<i>Chenonetta jubata</i>	Australian Wood Duck	x
<i>Cygnus atratus</i>	Black Swan	x
<i>Anas superciliosa</i>	Pacific Black Duck	x
<i>Aythya australis</i>	Hardhead	x
<i>Tachybaptus novaehollandiae</i>	Australasian Grebe	x
<i>Pelecanus conspicillatus</i>	Australian Pelican	Offsite*
<i>Egretta novaehollandiae</i>	White-faced Heron	x
<i>Ardea pacifica</i>	White-necked Heron	Offsite
<i>Ardea alba</i>	Great Egret	x
<i>Threskiornis spinicollis</i>	Straw-necked Ibis	x
<i>Elanus axillaris</i>	Black-shouldered Kite	x
<i>Milvus migrans</i>	Black kite	Offsite
<i>Lophoictinia isura</i>	Square-tailed Kite	x
<i>Haliastur sphenurus</i>	Whistling Kite	x
<i>Aquila audax</i>	Wedge-tailed Eagle	x
<i>Haliaeetus leucogaster</i>	White-bellied Sea-eagle	Offsite *
<i>Falco longipennis</i>	Australian Hobby	x
<i>Fulica atra</i>	Eurasian Coot	Offsite *
<i>Porphyrio porphyrio</i>	Purple Swamphen	Offsite *
<i>Falco cenchroides</i>	Nankeen Kestrel	x
<i>Vanellus miles</i>	Masked Lapwing	x
<i>Elseyornis melanops</i>	Black-fronted Dotterel	Offsite *
<i>Vanellus tricolor</i>	Banded Lapwing	x
<i>Columba livia</i>	Rock Dove	Offsite
<i>Phaps chalcoptera</i>	Common Bronzewing	x

Species name	Common name	Trans Line/Offsite
<i>Geopelia placida</i>	Peaceful Dove	x
<i>Ocyphaps lophotes</i>	Crested Pigeon	x
<i>Calyptorhynchus lathami</i>	Glossy Black-cockatoo	x
<i>Eolophus roseicapillus</i>	Galah	x
<i>Cacatua galerita</i>	Sulphur-crested Cockatoo	x
<i>Glossopsitta concinna</i>	Musk Lorikeet	x
<i>Glossopsitta pusilla</i>	Little Lorikeet	Offsite
<i>Trichoglossus haematodus</i>	Rainbow Lorikeet	x
<i>Alisterus scapularis</i>	Australian King-Parrot	x
<i>Aprosmictus erythropterus</i>	Red-winged Parrot	x
<i>Platycercus elegans</i>	Crimson Rosella	x
<i>Platycercus eximius</i>	Eastern Rosella	x
<i>Psephotus haematonotus</i>	Red-rumped Parrot	x
<i>Cacomantis variolosus</i>	Brush Cuckoo	x
<i>Cuculus pallidus</i>	Pallid Cuckoo	x
<i>Cacomantis flabelliformis</i>	Fan-tailed Cuckoo	x
<i>Chalcites basalis</i>	Horsfield's Bronze-Cuckoo	x
<i>Chalcites lucidus</i>	Shining Bronze-Cuckoo	x
<i>Ninox boobook</i>	Southern Boobook	x
<i>Ninox strenua</i>	Powerful Owl	x
<i>Tyto alba</i>	Barn Owl	x
<i>Podargus strigoides</i>	Tawny Frogmouth	x
<i>Aegotheles cristatus</i>	Australian Owlet-nightjar	x
<i>Eurostopodus mystacalis</i>	White-throated Nightjar	x
<i>Dacelo novaeguineae</i>	Laughing Kookaburra	x
<i>Todiramphus sanctus</i>	Sacred Kingfisher	x
<i>Merops ornatus</i>	Rainbow Bee-eater	x
<i>Eurystomus orientalis</i>	Dollarbird	x
<i>Cormobates leucophaeus</i>	White-throated Treecreeper	x
<i>Climacteris picumnus</i>	Brown Treecreeper	x
<i>Malurus lamberti</i>	Variegated Fairy-wren	x
<i>Malurus cyaneus</i>	Superb Fairy-wren	x
<i>Pardalotus punctatus</i>	Spotted Pardalote	x
<i>Pardalotus striatus</i>	Striated Pardalote	x
<i>Origma solitaria</i>	Rockwarbler	x
<i>Sericornis frontalis</i>	White-browed Scrubwren	x
<i>Smicrornis brevirostris</i>	Weebill	x
<i>Chthonicola sagittata</i>	Speckled Warbler	x
<i>Gerygone olivacea</i>	White-throated Gerygone	x
<i>Acanthiza pusilla</i>	Brown Thornbill	x
<i>Acanthiza nana</i>	Yellow Thornbill	x
<i>Acanthiza lineata</i>	Striated Thornbill	x
<i>Acanthiza chrysorrhoa</i>	Yellow-rumped Thornbill	x
<i>Acanthiza reguloides</i>	Buff-rumped Thornbill	x
<i>Anthochaera carunculata</i>	Red Wattlebird	x
<i>Plectorhyncha lanceolata</i>	Striped Honeyeater	x
<i>Philemon citreogularis</i>	Little Friarbird	x

Species name	Common name	Trans Line/Offsite
<i>Philemon corniculatus</i>	Noisy Friarbird	x
<i>Acanthagenys rufogularis</i>	Spiny-cheeked Honeyeater	x
<i>Entomyzon cyanotis</i>	Blue-faced Honeyeater	x
<i>Melithreptus brevirostris</i>	Brown-headed Honeyeater	x
<i>Manorina melanocephala</i>	Noisy Miner	x
<i>Lichenostomus chrysops</i>	Yellow-faced Honeyeater	x
<i>Lichenostomus leucotis</i>	White-eared Honeyeater	x
<i>Lichenostomus penicillatus</i>	White-plumed Honeyeater	x
Melithreptus gularis	Black-chinned Honeyeater	x
<i>Melithreptus lunatus</i>	White-naped Honeyeater	x
Grantiella picta	Painted Honeyeater	x
<i>Acanthorhynchus tenuirostris</i>	Eastern Spinebill	x
<i>Microeca fascians</i>	Jacky Winter	x
<i>Petroica goodenovii</i>	Red-capped Robin	x
<i>Eopsaltria australis</i>	Eastern Yellow Robin	x
Pomatostomus temporalis	Grey-crowned Babbler	x
<i>Pomatostomus superciliosus</i>	White-browed Babbler	x
<i>Cinlosoma punctatum</i>	Spotted Quail-thrush	x
Daphoenositta chrysoptera	Varied Sittella	x
<i>Pachycephala pectoralis</i>	Golden Whistler	x
<i>Pachycephala rufiventris</i>	Rufous Whistler	x
<i>Colluricincla harmonica</i>	Grey Shrike-thrush	x
<i>Myiagra rubecula</i>	Leaden Flycatcher	x
<i>Myiagra inquieta</i>	Restless Flycatcher	x
<i>Grallina cyanoleuca</i>	Magpie-lark	x
<i>Rhipidura fuliginosa</i>	Grey Fantail	x
<i>Rhipidura leucophrys</i>	Willie Wagtail	x
<i>Lalage sueurii</i>	White-winged triller	x
<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike	x
<i>Coracina tenuirostris</i>	Cicadabird	x
<i>Coracina papuensis</i>	White-bellied Cuckoo-shrike	x
<i>Oriolus sagittatus</i>	Olive-backed Oriole	x
<i>Cracticus torquatus</i>	Grey Butcherbird	x
<i>Cracticus nigrogularis</i>	Pied Butcherbird	x
<i>Gymnorhina tibicen</i>	Australian Magpie	x
<i>Strepera graculina</i>	Pied Currawong	x
<i>Artamus personatus</i>	Masked Woodswallow	x
<i>Artamus superciliosus</i>	White-browed Woodswallow	x
<i>Artamus cyanopterus</i>	Dusky Woodswallow	x
<i>Corvus coronoides</i>	Australian Raven	x
<i>Corvus mellori</i>	Little Raven	x
<i>Corcorax melanorhamphos</i>	White-winged Chough	x
Stagonopleura guttata	Diamond Firetail	x
<i>Neochmia temporalis</i>	Red-browed Finch	x
<i>Taeniopygia bichenovii</i>	Double-barred Finch	x
<i>Dicaeum hirundinaceum</i>	Mistletoebird	x
<i>Hirundo neoxena</i>	Welcome Swallow	x

Species name	Common name	Trans Line/Offsite
<i>Hirundo ariel</i>	Fairy Martin	x
<i>Hirundo nigricans</i>	Tree Martin	x
<i>Acrocephalus australis</i>	Australian Reed-Warbler	Offsite *
<i>Cincloramphus mathewsi</i>	Rufous Songlark	x
<i>Megalurus gramineus</i>	Little Grassbird	x
<i>Zosterops lateralis</i>	Silvereye	x
<i>Sturnus vulgaris</i>	Common Starling	x

*Recorded at Ulan Mine dam

B.5 SITE PHOTOS

TRANSMISSION LINE



Typical rocky drainage line



Typical woodland patch



Typical dry forest / paddock edge



Farm dam with fringing vegetation



Typical area of Sifton bush shrubland



Typical woodland/open forest



Typical grazing pasture with scattered trees



Good quality roadside vegetation



Typical large sandstone rocky outcrop



Large rocky features



Area of scribbly gum and Callitris forest within Sandstone Forest

B.6 FLORA PLOT AND INSPECTION POINT DATA – TRANSMISSION LINE STUDY AREA

DATA			LOCATION				VEGETATION COMMUNITY & CONDITION				STATUS		
Survey	Date	Personnel/Team	GPS location	Easting	Northing	Elevation	Flora Survey ID (plots only)	Veg community type	Condition	Benson ID	NSW EEC?	EPBC CEEC?	Threatened species
Flora plot	8/10/12	JM	A1	773080	6444331	508	A1FL	Exotic pasture	Exotic	Exotic	No	No	
Flora plot	8/10/12	JM	A5	774550	6445637	508	A5FL	Inland Grey Box Woodland/grassland matrix	Moderate	395	No	No	
Flora plot	8/10/12	JM	A12	774598	6444977	498	A12FL	Planted	Moderate	Planted	No	No	
Flora plot	8/10/12	JM	A14	772540	6442635	518	A14FL	E.fibrosa + E.punctata + E macrorhyncha sandstone forest	Good	478	No	No	
Flora plot	8/10/12	KS	B1	776808	6449431	484	B1FL	E.crebra + E.blakelyi/E.moluccana open grassy forest	Good	468	No	No	
Flora plot	8/10/12	KS	B2	776919	6449340	469	B2FL	Native pasture with scattered Grey box	Poor	395	No	No	
Flora plot	8/10/12	KS	B4	776799	6446220	520	B3FL	Exotic pasture with scattered White Box	Exotic	483	Yes	No	
Flora plot	8/10/12	KS	B6	776518	6447813	476	B4FL	A. floribunda + E. macrocarpa + C.tracufora sst forest	Moderate	481	No	No	Yes. Swainsonia sericea
Flora plot	8/10/12	KS	B7	776126	6448633	495	B5FL	Native pasture with scattered Grey box	Mod-poor	395	No	No	
Flora plot	8/10/12	KS	B8	776782	6449226	487	B6FL	White box open grassy woodland	Mod-good	483	Yes	Yes	
Flora plot	8/10/12	KS	B10	772759	6444205	507	B7FL	E crebra dom sandstone forest	good	479	No	No	
Flora plot	8/10/12	KS	B12	772837	6444012	515	B8FL	Ironbark open forest	Good	468	No	No	
Flora plot	9/10/12	JM	A15	771671	6442092	504	A15FL	E.crebra + E.punctata sandstone forest	Good	479	No	No	
Flora plot	9/10/12	JM	A16	770425	6441354	480	A16FL	Callitris-dense regen etc	Moderate	480	No	No	
Flora plot	9/10/12	JM	A17	769636	6440936	456	A17FL	E.moluccana + E.crebra sandstone forest	Good	468	No	No	
Flora plot	9/10/12	JM	A18	770042	6441818	466	A18FL	E.crebra + A.linearifolia sandstone forest	Good	479	No	No	
Flora plot	9/10/12	JM	A19	767915	6441778	417	A19FL	E.blakelyi riparian forest	Good	481	No	No	
Flora plot	9/10/12	JM	A22	778271	6450704	452	A22FL	Ironbark Dry sclerophyll forest on sandstone	Good	468	No	No	
Flora plot	9/10/12	Jm	A24	778888	6451952	419	A24FL	Riparian forest w E.melliodora and E.crebra ecotone	Good	281	Yes	Yes	
Flora plot	9/10/12	JM	A26	778977	6452158	405	A26FL	Riparian forest w E.melliodora	Good	281	Yes	Yes	
Flora plot	9/10/12	JM	A27	778695	6453362	465	A27FL	BGW EEC	Mod-good	483	Yes	Yes	
Flora plot	9/10/12	KS	B14	766883	6438506	465	B9FL	E.crebra + E.microcarpa	Good	468	No	No	
Flora plot	9/10/12	KS	B15	767062	6438934	431	B10FL	Cassinia open scrub w emergent scattered trees	poor-mod	468	No	No	
Flora plot	9/10/12	KS	B18	767530	6439640	418	B11FL	E.blakelyi riparian vegetation	poor-mod	481	No	No	
Flora plot	9/10/12	KS	B23	767874	6439998	411	B12FL	E.blakelyi + A.floribunda riparian forest	mod-good	481	No	No	
Flora plot	9/10/12	KS	B27	768186	6440129	415	B13FL	E.crebra sandstone forest	Good	479	No	No	
Flora plot	9/10/12	KS	B29	768198	6440298	430	B14FL	E.crebra sandstone forest	moderate	479	No	No	
Flora plot	9/10/12	KS	B31	766662	6438092	454	B15FL	Grey Box grassy woodland	Moderate	468	No	No	
Flora plot	9/10/12	KS	B34	765689	6436780	491	B16FL	Native grassland	Poor	395	No	No	
Flora plot	10/10/12	KS	B36	772752	6450386	524	B17FL	Native pasture	Poor	395	No	No	
Flora plot	10/10/12	KS	B38	772773	6450462	529	B18FL	E.crebra open woodland	poor-mod	468	No	No	
Flora plot	10/10/12	KS	B40	773920	6451198	523	B19FL	White box woodland	moderate	483	Yes	No	
Flora plot	10/10/12	KS	B43	767941	6442305	428	B20FL	E blakelyi + E crebra regrowth	moderate	481/468	No	No	
Flora plot	10/10/12	KS	B47	768658	6446305	446	B21FL	A. floribunda/ E.blakelyi woodland - open forest	poor-mod	481	No	No	
Flora plot	19/10/12	JM	A28	769155	6449818		A28FL	1. Native pasture with scattered Angophora To N 2. Ironbark/cassonia arcuata forest to S	Poor	481/468	No	No	
Flora plot	19/10/12	JM	A29	768399	6448768	477	A29FL	Riparian forest w E melliodora	Moderate	281	Yes	No	
Flora plot	19/10/12	JM	A30	767379	6447866	512	A30FL	Spotted gum forest	Moderate	??	No	No	
Flora plot	19/10/12	JM	A32	762531	6432790	413	A32FL	Inland scribbly gum	Good	477	No	No	
Flora plot	19/10/12	JM	A33	762403	6432780	405	A33FL	Riparian E. blakelyi/Angoph forest	Moderate	481	No	No	
Flora plot	19/10/12	JM	A34	761732	6430452	403	A34FL	Riparian E. blakelyi/Angoph forest	Good	481	No	No	
Flora plot	19/10/12	JM	A35	761438	6430217	415	A35FL	Riparian/ ck flat E. blake etc..	Good	481	No	No	

DATA			LOCATION				VEGETATION COMMUNITY & CONDITION					STATUS		
Survey	Date	Personnel/Team	GPS location	Easting	Northing	Elevation	Flora Survey ID (plots only)	Veg community type	Condition	Benson ID	NSW EEC?	EPBC CEEC?	Threatened species	
Flora plot	1/10/13	A	1	775238	6451557	446	A1_FL	Angophora floribunda dom	Moderate	481	No	No		
Flora plot	1/10/13	A	2	775404	6451799	453	A2_FL	E.blakelyi + A.floribunda dominant	Mod-good	481	No	No		
Flora plot	1/10/13	A	5	775704	6452306	447	A3_FL	E.crebra + E.blakelyi dominant	Mod-good	468	No	No		
Flora plot	1/10/13	A	6	776052	6452542	459	A4_FL	E.crebra dominant	Moderate	468	No	No		
Flora plot	1/10/13	A	7	776267	6452631	462	A5_FL	E. macrorhyncha + E. crebra	Moderate	468	No	No		
Flora plot	1/10/13	A	10	776147	6452980	418	A6_FL	C.cunninghamiana + A.floribunda + E.bridgesiana	Moderate	481	No	No		
Flora plot	1/10/13	C	1	771687	6442334	520	C1_FL	E. fibrosa	Moderate	478	No	No		
Flora plot	1/10/13	C	5	771920	6442469	516	C2_FL	E. fibrosa + E.macrorhyncha	Moderate	478	No	No		
Flora plot	1/10/13	C	8	772179	6443153	521	C3_FL	E.fibrosa + A.gymnanthera	Moderate	478	No	No		
Flora plot	1/10/13	C	9	772348	6443618	507	C4_FL	E.fibrosa	Moderate	478	No	No		
Flora plot	1/10/13	C	12	772509	6444069	512	C5_FL	A.gymnanthera + E.fibrosa	Moderate	478	No	No		
Flora plot	1/10/13	C	13	767029	6442862	446	C6_FL	C.endlicheri + E.fibrosa	Moderate	480	No	No		
Flora plot	1/10/13	B	1	773782	6449409	504	B1_FL	E. crebra	Mod-good	IB dom	No	No		
Flora plot	2/10/13	A	16	773832	6451709	478	A10_FL	E.blakelyi + E.melliodora + B.populneus	Mod-good	281	Yes	Yes		
Flora plot	2/10/13	A	17	773337	6451724	477	A11_FL	E.crebra + E.albens x moluccana	Mod-good	483/468	No	No		
Flora plot	2/10/13	A	11	776099	6452908	441	A7_FL	E.crebra dominant	Moderate	479	No	No		
Flora plot	2/10/13	A	13	774993	6451529	433	A8_FL	E.bridgesiana + A.floribunda + E.melliodora	Mod-good	281	No	No		
Flora plot	2/10/13	A	15	774370	6451617	446	A9_FL	E.melliodora + E.blakelyi + A.floribunda	Good	281	Yes	Yes		
Flora plot	2/10/13	B	20	766199	6447220	500	B10_FL	E.crebra + A.floribunda + E.blakelyi	Good	468/481	No	No		
Flora plot	2/10/13	B	19	766213	6446599	502	B9_FL	A.floribunda + E.macrorhyncha + E.blakelyi	Good	481	No	No		
Flora plot	2/10/13	C	19	763133	6436114	447	C10_FL	E.microcarpa + E.blakelyi	Mod-good	468	No	No		
Flora plot	2/10/13	C	14	761941	6435626	459	C7_FL	E.crebra + C.endlicheri	Moderate	468	No	No		
Flora plot	2/10/13	C	15	762921	6434397	436	C8_FL	C.endlicheri + E.crebra	Moderate	468	No	No		
Flora plot	2/10/13	C	17	763013	6435010	446	C9_FL	E.crebra	Moderate	468	No	No		
Flora plot	2/10/13	B	3	770217	6451510	544	B2_FL	E.crebra + A. floribunda	Moderate	IB dom	No	No		
Flora plot	2/10/13	B	4	771686	6451637	556	B3_FL	E.albens hybrid; native grassland N of WP w scattered white box hybrid	Poor	483	Yes	No		
Flora plot	2/10/13	B	5	772942	6451346	493	B4_FL	E.blakelyi + A. floribunda	Poor-moderate	481	No	No		
Flora plot	2/10/13	B	7	772858	6451705	504	B5_FL	E.blakelyi + E. melliodora	Moderate	281	Yes	No		
Flora plot	2/10/13	B	13	768110	6449930	526	B6_FL	E.blakelyi + A. floribunda + E.crebra	Poor-moderate	468	No	No		
Flora plot	2/10/13	B	16	766140	6445498	497	B7_FL	E.crebra + A.floribunda + B.populneus	Poor	468/481	No	No		
Flora plot	2/10/13	B	17	766192	6446345	499	B8_FL	A. floribunda + E.macrorhyncha + A.linearifolia	Good	481	No	No		
Flora plot	3/10/13	A	24	767057	6442918	441	A12_FL	E.crebra + C.endlicheri + E.fibrosa	Moderate	468	No	No		
Flora plot	3/10/13	A	25	767956	6440056	414	A13_FL	E.blakelyi + E.macrorhyncha	Moderate	481	No	No		
Flora plot	3/10/13	A	26	767867	6439586	433	A14_FL	E.crebra	Moderate	468	No	No		
Flora plot	3/10/13	A	29	767766	6439075	466	A15_FL	E.crebra + C.endlicheri	Moderate	468	No	No		
Flora plot	3/10/13	A	31	767370	6440288	424	A16_FL	E.blakelyi + E. moluccana	Moderate	468	No	No		
Flora plot	3/10/13	A	33	766812	6437247	455	A17_FL	E.microcarpa + E.blakelyi + E.crebra	Moderate	468	No	No		
Flora plot	3/10/13	C	24	771216	6442066	502	C11_FL	E.fibrosa + E.punctata + E.macrorhyncha	Moderate	478	No	No		
Flora plot	3/10/13	C	29	770616	6441680	499	C12_FL	C.endlicheri + E.punctata	Moderate	479	No	No		
Flora plot	3/10/13	C	31	770128	6441367	489	C13_FL	E.rossii + C.endlicheri + E.fibrosa	Moderate	477	No	No		
Flora plot	3/10/13	C	34	769481	6440965	462	C14_FL	E.nubila + C.endlicheri	Moderate	479	No	No		
Flora plot	3/10/13	C	37	768997	6440683	441	C15_FL	C.endlicheri + E.fibrosa	Moderate	480	No	No		
Flora plot	3/10/13	C	39	768497	6440383	410	C16_FL	E.fibrosa + A.floribunda + E.macrorhyncha	Moderate	478	No	No		
Flora plot	3/10/13	C	41	768181	6440115	410	C17_FL	E.punctata + E.fibrosa + E.macrorhyncha	Moderate	478	No	No		
Flora plot	3/10/13	B	22	762058	6435686	456	B11_FL	E.microcarpa + E.crebra	Mod-good	468	No	No		
Flora plot	3/10/13	B	23	762492	6435875	446	B12_FL	E.melliodora + E.blakelyi	Moderate	281	Yes	No		

DATA			LOCATION				VEGETATION COMMUNITY & CONDITION					STATUS		
Survey	Date	Personnel/Team	GPS location	Easting	Northing	Elevation	Flora Survey ID (plots only)	Veg community type	Condition	Benson ID	NSW EEC?	EPBC CEEC?	Threatened species	
Flora plot	3/10/13	B	26	762864	6436046	443	B13_FL	A.floribunda + E.melliodora + E.blakelyi	Mod-good	281	Yes	Yes		
Flora plot	3/10/13	B	28	763099	6436165	442	B14_FL	E.crebra + E.blakelyi + E.melliodora	Mod-good	468/281	Yes	Yes		
Flora plot	4/10/13	A	40	767105	6437633	445	A18_FL	E.crebra + E.macrorhyncha + C.endlicheri	Mod-good	468	No	No		
Flora plot	4/10/13	A	42	767497	6438108	457	A19_FL	E.fibrosa + C.endlicheri	Moderate	478	No	No		
Flora plot	4/10/13	A	45	766469	6436887	454	A20_FL	E.microcarpa + C.endlicheri + E.blakelyi	Moderate	468/481	No	No		
Flora plot	4/10/13	A	47	766133	6436522	463	A21_FL	E.crebra + A.floribunda	Mod-good	468/481	No	No		
Flora plot	4/10/13	A	48	765100	6436692	513	A22_FL	E.blakelyi + E.crebra	?	468	No	No		
Flora plot	4/10/13	A	50	773436	6449626	504	A23_FL	E.albens x moluccana	Good	483	Yes	Yes		
Flora plot	4/10/13	B	35	775967	6449043	490	B15_FL	E.crebra dominant	Poor-mod	468	No	No		
Flora plot	4/10/13	B	39	767537	6441827	426	B16_FL	E.macrorhyncha + E. crebra + E.blakelyi	Moderate	468	No	No		
Flora plot	4/10/13	B	42	767450	6441512	417	B17_FL	E.blakelyi + E. macrorhyncha	Mod-good	481	No	No		
Flora plot	4/10/13	B	46	767321	6441227	422	B18_FL	E.blakelyi + A.floribunda + E.crebra	Mod-good	481/468	No	No		
Flora plot	4/10/13	C	43	761257	6427964	420	C18_FL	A. floribunda	Poor	481	No	No		
Flora plot	4/10/13	C	44	762615	6433793	421	C19_FL	E.blakelyi + E.rossii + A.floribunda	Moderate	477	No	No		
Flora plot	4/10/13	C	47	762512	6433173	421	C20_FL	C.endlicheri + E.rossii	Moderate-good	477	No	No		
Flora plot	4/10/13	C	48	762555	6433616	425	C21_FL	E.rossii + C.endlicheri + A.floribunda	Moderate-good	477	No	No		
Flora plot	4/10/13	C	49	761149	6429851	405	C22_FL	E.blakelyi + A.floribunda	Mod-Good	481	No	No		
Flora plot	4/10/13	C	50	761510	6430175	412	C23_FL	E.blakelyi + A.floribunda	Good	481	No	No		
Flora plot	5/10/13	A	52	766139	6445263	494	A24_FL	E blakelyi + A floribunda riparian forest	?	481	No	No		
Flora plot	5/10/13	A	56	765992	6444584	467	A25_FL	E.albens x moluccana	Poor-moderate	483	Yes	No		
Flora plot	5/10/13	A	59	766790	6444450	460	A26_FL	E.?moluccana + E.melliodora + A.floribunda + E.blakelyi	Mod-good	483/281	Yes	Yes		
Flora plot	5/10/13	A	60	766991	6444319	472	A27_FL	E.crebra + C.endlicheri + E.macrorhyncha	Mod-good	468	No	No	Acacia ausfeldii	
Flora plot	5/10/13	A	61	766935	6443993	473	A28_FL	E.crebra + E.?moluccana	Poor-moderate	468	No	No		
Flora plot	5/10/13	A	62	766876	6443498	448	A29_FL	E.crebra + E.?moluccana + E.melliodora	Mod-good	468/281	Yes	Yes		
Flora plot	5/10/13	A	66	767294	6441160	422	A30_FL	E.blakelyi + E.crebra + A.floribunda	Mod-good	481/468	No	No		
Flora plot	5/10/13	A	68	763891	6437217	460	A31_FL	A.floribunda + E.blakelyi + E.melliodora	Mod-good	481	No	No		
Flora plot	5/10/13	C	55	761600	6430641	408	C24_FL	A. floribunda + E.blakelyi	Moderate	481	No	No		
Flora plot	5/10/13	C	58	761573	6431227	440	C25_FL	E.rossii + C.endlicheri	Moderate	477	No	No		
Flora plot	5/10/13	C	60	761868	6431691	443	C26_FL	E.rossii + E.fibrosa +C.endlicheri	Moderate	477	No	No		
Flora plot	5/10/13	C	62	762169	6432197	417	C27_FL	A.floribunda + E.rossii + E.fibrosa	Moderate	477	No	No		
Flora plot	5/10/13	C	65	762412	6432638	425	C28_FL	C.endlicheri + E.fibrosa + E.rossii	Moderate	477	No	No		
Flora plot	6/10/13	A	69	773453	6449516	500	A32_FL	E.crebra + E.blakelyi + A.floribunda	Mod-good	481/468	No	No		
Flora plot	6/10/13	A	70	773913	6449354	500	A33_FL	E.crebra + E.macrorhyncha	Mod-good	468	No	No		
Flora plot	6/10/13	A	72	774388	6449278	472	A34_FL	E.macrorhyncha + E.blakelyi + E.crebra	Mod-good	468	No	No		
Flora plot	6/10/13	A	73	774868	6449245	444	A35_FL	E.blakelyi + A. floribunda + E.melliodora	Good	281	Yes	Yes		
Flora plot	6/10/13	A	76	775579	6449036	473	A36_FL	E. crebra dom w occ E.melliodora	Mod-good	IB dom	No	No		
Flora plot	6/10/13	A	77	775954	6449053	492	A37_FL	E.crebra + E.melliodora + E.blakelyi	Good	IB dom	No	No		
Flora plot	6/10/13	B	71	767709	6442383	426	B24_FL	E.blakelyi	Poor-mod	481	No	No		
Flora plot	6/10/13	B	74	767459	6442556	424	B25_FL	E.blakelyi + A.floribunda	Moderate	481	No	No		
Flora plot	6/10/13	C	66	762465	6432819	413	C29_FL	A.floribunda + E.punctata	Moderate	481	No	No		
Flora plot	6/10/13	C	70	763005	6435625	457	C30_FL	C.endlicheri + E.blakelyi + E.?crebra	Poor-mod	468	No	No		
Flora plot	6/10/13	C	72	763381	6436937	463	C31_FL	E.albens + E.blakelyi + E.melliodora	Poor-mod	483	Yes	No		
Flora plot	8/10/13	B	79	766484	6448313	530	B26_FL	A. floribunda + E.macrorhyncha	Moderate	481	No	No		
Flora plot	8/10/13	B	80	766366	6448109	514	B27_FL	E.blakelyi + E.crebra	Good	468	No	No		
Inspection point	8/10/12	JM	A10	775242	6445392	484		Exotic w scattered Grey Box	Exotic	Exotic	No	No		
Inspection point	8/10/12	JM	A11	774860	6445206	494		Cropped paddock both sides of fence	Exotic	Exotic	No	No		

DATA			LOCATION				VEGETATION COMMUNITY & CONDITION				STATUS		
Survey	Date	Personnel/Team	GPS location	Easting	Northing	Elevation	Flora Survey ID (plots only)	Veg community type	Condition	Benson ID	NSW EEC?	EPBC CEEC?	Threatened species
Inspection point	8/10/12	JM	A13	773791	6444550	492		Native pasture w scattered E crebra	Poor	395	No	No	
Inspection point	8/10/12	JM	A2	773547	6444694	508		Exotic pasture as per A1	Exotic	Exotic	No	No	
Inspection point	8/10/12	JM	A3	773817	6444979	500		Native pasture	Poor	395	No	No	
Inspection point	8/10/12	JM	A4	774093	6445299	492		Exotic	Exotic	Exotic	No	No	
Inspection point	8/10/12	JM	A6	774977	6445953	513		Native pasture w scattered Grey Box	Poor	395	No	No	
Inspection point	8/10/12	JM	A7	776775	6446211	523		Native pasture w scattered Grey Box	Poor	395	No	No	
Inspection point	8/10/12	JM	A8	776390	6445975	519		Lane below native pasture & crop/improved pasture	Poor - lacking trees	Exotic/395	No	No	
Inspection point	8/10/12	JM	A9	775772	6445609	512		Exotic w scattered Grey Box	Poor, heavily grazed	Exotic	No	No	
Inspection point	9/10/12	JM	A20	767754	6442540	420		ecotone E crebra and native pasture	mod	468/395	No	No	
Inspection point	9/10/12	JM	A21	778304	6450754	457		Native pasture w scattered E crebra	Mod	395	No	No	
Inspection point	9/10/12	JM	A23	778617	6451516	433		Native pasture w scattered E crebra	Poor	395	No	No	
Inspection point	9/10/12	KS	B16	767179	6439194	427		Riparian forest on sandstone	Good to west of easement	481	No	No	
Inspection point	9/10/12	KS	B20	767532	6440058	414		Native pasture w Cassinia shrubland	Poor-mod	395	No	No	
Inspection point	9/10/12	KS	B21	767279	6440209	416		E. microcarpa open woodland, grassy groundcover	Moderate	468	No	No	
Inspection point	9/10/12	KS	B22	767215	6440271	418		Sporobolus grassland up to 1m	Poor	395	No	No	
Inspection point	9/10/12	KS	B28	768200	6440241	436		Large sandstone outcrop, Black cypress pine, E. sparsifolia dominated canopy	Good	480	No	No	
Inspection point	9/10/12	KS	B31	766662	6438092	454		Grey box woodland, grassy/shrubby with scattered Callitris	Moderate	468	No	No	
Inspection point	9/10/12	KS	B32	766705	6437343	454		Blakely's woodland to west, Grey box to East	Moderate	481/468	No	No	
Inspection point	9/10/12	KS	B33	766388	6437219	457		Grey box woodland with Callitris dominant in some areas, grassy g'cover	Moderate	468/480	No	No	
Inspection point	10/10/12	KS	B37	772788	6450318	524		E. crebra with Blakelys woodland, grassy g' cover > 50% native	Moderate	468	No	No	
Inspection point	10/10/12	KS	B39	773217	6450659	538		Native grassland with scattered trees A floribunda + Grey Box	Poor	481	No	No	
Inspection point	10/10/12	KS	B41	773451	6449713	508		White box grassy woodland >50% native g'cover, < 12 native nongrass sp.	Mod	483	Yes	No	
Inspection point	10/10/12	KS	B42	767987	6442461	427		Native pasture w scattered trees Blakelys, Crebra, Callitris, Stringybark, Angophora	Poor	468	No	No	
Inspection point	10/10/12	KS	B44	767972	6442517	433		Native grassland with isolated paddock trees E.crebra	Poor	468	No	No	
Inspection point	10/10/12	KS	B45	768237	6443599	437		Roadside veg. Mature & regenerating. Angophora, Acacia, Cassinia u/s, grassy g/c	Poor	481	No	No	
Inspection point	10/10/12	KS	B46	768093	6445120	462		Degraded creekline, scattered trees Angophora, exotic/native grassy g/c	Poor	481	No	No	
Inspection point	10/10/12	KS	B48	768253	6444315	423		Creekline (Rd crossing) Typha & phragmites dense in ck, scattered Yellow Box along ck	Poor	281	Yes	No	
Inspection point	10/10/12	KS	B50	769051	6444383	442		Blakelys regen along drainage channel 4m tall, one mature tree	Poor	481	No	No	
Inspection point	1/10/13	A	8	776689	6452771	424		trans from ironbark/red stringy regrowth to blakelys grassy woodland on flats		468/481	No	No	
Inspection point	1/10/13	C	7	772037	6442769	524		E. fibrosa + E.macrorhyncha	Moderate	478	No	No	
Inspection point	1/10/13	C	10	772383	6443724	518		E.fibrosa	Moderate	478	No	No	
Inspection point	2/10/13	A	18	773466	6451805	477		E.melliodora + E.blakelyi + A.floribunda	Good	281	Yes	Yes	
Inspection point	2/10/13	C	18	763048	6434869	438		E.microcarpa + A.floribunda	Moderate	468/481	No	No	
Inspection point	2/10/13	B	2	769675	6451332	522		Exotic pasture w scattered E.crebra N of hwy, exotic to S	Exotic	Exotic	No	No	
Inspection point	2/10/13	B	6	772649	6450785	516		E. melliodora + E.microcarpa grassy woodland	Poor-moderate	281	Yes	No	
Inspection point	2/10/13	B	9	772491	6451526	515		E.blakelyi + E.microcarpa grassy woodland	Poor-mod	483	Yes	No	
Inspection point	2/10/13	B	12	769044	6450904	514		E.blakelyi + E.melliodora along drainage line	Poor	281	Yes	No	
Inspection point	2/10/13	B	14	767926	6449771	542		Heavily grazed paddocks (exotic dom) w patches E.crebra	Poor	Exotic	No	No	
Inspection point	2/10/13	B	15	767722	6449482	540		A.floribunda + E.crebra	Poor-moderate	468	No	No	
Inspection point	2/10/13	B	18	766191	6446126	493		E blakelyi + A floribunda riparian forest	Mod-good	481	No	No	
Inspection point	3/10/13	A	22	774001	6449991	507		BGW on basalt	Mod-good	483	Yes	Yes	
Inspection point	3/10/13	C	23	771436	6442197	501		E.punctata + E.fibrosa + E.macrorhyncha	Moderate	478	No	No	
Inspection point	3/10/13	C	25	771155	6441937	511		E.rossii + E.macrorhyncha + E.fibrosa	Moderate	477	No	No	
Inspection point	3/10/13	C	26	771002	6441916	514		E.fibrosa + E.macrorhyncha + E.rossii	Moderate	477	No	No	
Inspection point	3/10/13	C	30	770390	6441544	489		C.endlicheri + E.punctata	Poor-moderate	479	No	No	

DATA			LOCATION				VEGETATION COMMUNITY & CONDITION				STATUS		
Survey	Date	Personnel/Team	GPS location	Easting	Northing	Elevation	Flora Survey ID (plots only)	Veg community type	Condition	Benson ID	NSW EEC?	EPBC CEEC?	Threatened species
Inspection point	3/10/13	C	32	769855	6441209	488		E.fibrosa + C.endlicheri	Poor-mod	478	No	No	
Inspection point	3/10/13	C	35	769163	6440778	444		C.endlicheri + E.fibrosa	Moderate	480	No	No	
Inspection point	3/10/13	C	38	768715	6440502	412		A.floribunda	Poor-mod	481	No	No	
Inspection point	3/10/13	C	40	768430	6440244	398		A.floribunda + A.linearifolia + E.macrorhyncha + E.fibrosa + E.punctata	Mod-good	478	No	No	
Inspection point	3/10/13	B	25	762682	6435960	444		E.melliodora + E.blakelyi	Mod-good	281	Yes	Yes	
Inspection point	4/10/13	A	41	767292	6437869	434		E. blakelyi + E. microcarpa + Angophora woodland in flat drainage line		481	no	no	
Inspection point	4/10/13	A	44	766673	6437079	464		E.blakelyi head of drainage line		481	no	no	
Inspection point	4/10/13	A	49	765502	6436586	496		E. microcarpa open woodland (large trees, no HBT, grazed, regen evident)		468	no	no	
Inspection point	4/10/13	B	34	776824	6449307	474		E.crebra + E.blakelyi	Poor-mod	468	No	No	
Inspection point	4/10/13	B	43	767400	6441391	422		E.blakelyi + A.floribunda	Good	481	No	No	
Inspection point	4/10/13	B	44	767399	6441348	422		E.blakelyi + A.floribunda	Good	481	No	No	
Inspection point	4/10/13	B	45	767290	6441245	420		E.blakelyi + A.floribunda	Good	481	No	No	
Inspection point	4/10/13	B	48	767442	6441579	423		E.crebra + E.blakelyi (W side) creek veg (E side)	Mod-good	468	No	No	
Inspection point	5/10/13	A	53	766071	6444998	496		ridgetop, E. crebra + A. linearifolia (sst outcrop)		479	No	No	
Inspection point	5/10/13	A	54	766046	6444904	485		E. blakelyi + Angophora + native pasture (on sst)		481	No	No	
Inspection point	5/10/13	A	55	766017	6444782	484		start of basalt, E. blakelyi + Angophora, low hill		481	No	No	
Inspection point	5/10/13	A	57	766073	6444369	461		white box woodland on basalt	Poor-mod	483	Yes	No	
Inspection point	5/10/13	A	58	766732	6444447	455		E. blakelyi, drainage line crossing on sst		481	No	No	
Inspection point	5/10/13	A	63	766613	6443558	435		E. melliodora + E. blakelyi + Angophora (good quality, Lots mature trees)	Good	281	yes	Yes	
Inspection point	5/10/13	A	65	767150	6440738	429		Native pasture derived from cleared ironbark forest		395	No	No	
Inspection point	5/10/13	A	67	767038	6443018	426		E. blakelyi + Angophora on creek (youngish regrowth, mostly cleared)		481	No	No	
Inspection point	5/10/13	C	57	761562	6430916	441		E.rossii + C.endlicheri	Moderate	477	No	No	
Inspection point	5/10/13	C	59	761733	6431485	444		E.rossii + C.endlicheri + E.fibrosa	Moderate	477	No	No	
Inspection point	5/10/13	C	61	762020	6431977	433		E.rossii + C.endlicheri + E.fibrosa	Poor-mod	477	No	No	
Inspection point	5/10/13	C	63	762311	6432413	421		E.rossii + C.endlicheri + E.fibrosa	Moderate	477	No	No	
Inspection point	6/10/13	A	75	775199	6449174	459		Native pasture + regrowth belts ID481 to S and Ironbark to N		S(481) N(iron)	No	No	
Inspection point	6/10/13	B	67	767565	6441945	416		E.blakelyi	Moderate	481	No	No	
Inspection point	6/10/13	B	68	767579	6442000	417		Native grassland	Poor	395	No	No	
Inspection point	6/10/13	B	69	767600	6442063	422		E.blakelyi dom	Mod-good	481	No	No	
Inspection point	6/10/13	B	70	767640	6442155	422		Open grassland (native) patches E.blakelyi regrowth	Moderate	395/481	No	No	
Inspection point	6/10/13	B	72	767586	6442480	432		E.crebra open woodland	Poor-mod	468	No	No	
Inspection point	6/10/13	B	73	767493	6442570	426		E.crebra open woodland	Moderate	468	No	No	
Inspection point	6/10/13	B	75	767279	6442602	435		E.crebra open forest	Mod-good	468	No	No	
Inspection point	6/10/13	B	76	767147	6442771	443		E.crebra open forest	Mod-good	469	No	No	
Inspection point	6/10/13	C	67	761439	6427104	443		C.endlicheri + E.macrorhyncha	Moderate	480	No	No	
Inspection point	6/10/13	C	69	761149	6428477	415		A. floribunda	Poor-mod	481	No	No	
Inspection point	6/10/13	C	71	763226	6436459	456		C.endlicheri + E.blakelyi + E.?crebra	Moderate	468	No	No	
Inspection point	6/10/13	C	73	763644	6437225	466		E.albens + E.blakelyi + E.melliodora	Poor-mod	483	Yes	No	
Inspection point	8/10/13	B	83	771320	6451701	574		E.albens	poor-mod	483	Yes	No	
Inspection point	8/10/13	C	93	773436	6449703	509		E.albens	Good	483	yes	yes	Acacia ausfeldii
Inspection point	8/10/13	C	94	773490	6449859	516		E.albens	Good	483	yes	yes	Acacia ausfeldii
Inspection point	4/10/13	B	36	776680	6447861	473		native grassland	mod	395	no	no	Swainsona sericea x1
Inspection point	4/10/13	B	37	776657	6447851	475		native grassland	mod	395	no	no	Swainsona sericea x2

B.7 FAUNA HABITAT ASSESSMENT DATA

DATA				HABITAT FEATURES												HABITAT QUALITY						
Date	Easting	Northing	Site code (FHAL)	Tree hgt (m)	Hollows	Hollow No.	Mature trees	Leaf litter	Fallen <50cm	Fallen >50cm	Mistletoe	Rock outcrop	Small rock	Large rock	Cliffs	Hollow dep.	Rock dep.	Ant tunnels	Log fauna	Small birds	Waterbirds	Glossy Black-cockatoo
8/10/12	776125.55	6448633.5	B4FA		absent		absent	absent	absent	scattered	Absent	Absent	Absent	Absent	Absent	absent	Absent	Absent	poor	average	Absent	Absent
8/10/12	773817.42	6444979.4		1x7m	absent		scattered	absent	absent	absent	Absent	common	scattered	Absent	Absent	absent	average		absent	absent	Absent	Absent
8/10/12	775772.03	6445609		1x25m	absent		scattered	absent	absent	scattered	Absent	Absent	common	Absent	Absent	absent		average	absent	poor	Absent	Absent
8/10/12	774598.01	6444977		10	absent		absent	scattered	absent	Common	Absent	Absent	common	Absent	Absent	absent	poor	average	poor	average	Absent	Absent
8/10/12	774549.99	6445637.2		10	abundant	100%	Common	absent	scattered	Common	Absent	Absent	Absent	common	Absent	excellent	poor		poor	absent	Absent	Absent
8/10/12	775241.96	6445392		10	abundant	100%	abundant	absent	scattered	scattered	Absent	Absent	scattered	Absent	Absent	average	Absent	Absent	poor	poor	Absent	Absent
8/10/12	776808.06	6449430.7	1	18	Common	3 of 6	Common	Common	Common	Common	Absent	Absent	Absent	Absent	Absent	Good	Absent	Absent	Good	Excellent	Absent	Absent
8/10/12	776781.61	6449226.4	B5FA	22	Common	5 of 7	Common	scattered	Common	scattered	Absent	abundant	common	common	Absent	Good	excellent	good	average	average	Absent	Absent
8/10/12	772837.06	6444011.8	B7FA	18	Common	4 of 10	scattered	Common	abundant	Common	scattered	absent	Absent	Absent	Absent	Good	poor	Absent	excellent	Excellent	Absent	Absent
8/10/12	776518.45	6447812.9	B3-FA	av10 tallest 20	scattered	1 of 10	scattered	scattered	scattered	scattered	scattered	Absent	scattered	scattered	absent	poor	average	average	average	average	absent	Absent
8/10/12	776798.87	6446219.6	B2FA	14	scattered	1 of 4	Common	absent	scattered	absent	Absent	Absent	scattered	Absent	Absent	average	poor		poor	poor	Absent	Absent
8/10/12	772759.2	6444204.8	B6FA	av12 tallest 16	scattered		scattered	Common	Common	Common	scattered	Absent	Absent	Absent	Absent	average	poor	Absent	Good	good	Absent	Absent
8/10/12	773080	6444331		1x18m,2x6 m	scattered	1 of 2	scattered	absent	absent	scattered	Absent	Absent	scattered	Absent	Absent	absent	Absent	average	poor	poor	poor	Absent
8/10/12	774093.22	6445299.2		7	scattered	10%	scattered	absent	absent	scattered	Absent	Absent	Absent	Absent	Absent	poor	Absent	Absent	poor	average	Absent	Absent
8/10/12	772539.97	6442635		18	scattered	3, 40%	scattered	Common	Common	Common	Absent	Absent	s	Absent	Absent	average	Absent	Absent	average	good	Absent	Absent
9/10/12	767061.89	6438934.4	B9FA	shrub to 2m	absent		absent	absent	absent	absent	Absent	Absent	Absent	Absent	Absent	absent	Absent	Absent	absent	good	Absent	Absent
9/10/12	767530.17	6439639.8	B10FA	reeds to 1m	absent		absent	absent	absent	absent	Absent	Absent	Absent	Absent	Absent	absent	Absent	Absent	absent	average	good	Absent
9/10/12	778617.23	6451516.2		22, 25mtallest	abundant		abundant	scattered	scattered	scattered	abundant		scattered	Absent	Absent		average	Absent	poor	poor	poor	poor
9/10/12	778977.14	6452158.1		15-25	Common	80%	abundant	scattered	Common	Common	Absent	Absent	abundant	abundant	Absent	Good	Absent		average	poor	Absent	Absent
9/10/12	766882.84	6438505.5	B8FA	12	scattered	4 of 10	scattered	scattered	Common	Common	abundant	scattered	common	common	Absent	average	good	average	Good	average	Absent	Absent
9/10/12	767873.51	6439998.4	B11FA	16	scattered	3 of 12 inc stags	scattered	scattered	Common	Common	Absent	abundant	common	common	Absent	average	excellent	average	Good	good	poor	Absent
9/10/12	768186.01	6440129	B12FA	18	scattered	3 of 12	scattered	Common	Common	Common	Absent	common	common	common	Absent	average	good	average	Good	good	Absent	Absent
9/10/12	768197.54	6440297.5	B13FA	av14, tallest20	scattered	2 of 15	scattered	Common	Common	scattered	Absent	some to N+E	Absent	Absent	Absent	average	poor	Absent	average	average	Absent	Absent
9/10/12	766662.37	6438091.7	B14FA	16-18	scattered	2 of 14	scattered	Common	scattered	absent	common	Absent	scattered	Absent	Absent	average	poor	average	poor	average	Absent	Absent
9/10/12	765689.34	6436780	B15FA	12	scattered	1 in only tree	absent	absent	scattered	scattered	Absent	Absent	Absent	Absent	Absent	poor	Absent	Absent	poor	poor	Absent	Absent
9/10/12	771638.97	6442055		12-20	scattered	4,8%	scattered	abundant	Common	abundant	Absent	Absent	scattered	Absent	Absent	average	poor		Good	good	Absent	poor
9/10/12	770424.62	6441354.1		12-18	scattered	4,10%	scattered	abundant	scattered	Common	Absent	Absent	Absent	Absent	Absent	poor	Absent	Absent	average	average	Absent	Absent
9/10/12	769636.48	6440936.2		10-12-17tallest	scattered	3,3	scattered	Common	scattered	Common	abundant	abundant	abundant	abundant	Absent	poor	good		average	average	Absent	Absent
9/10/12	770041.64	6441818.2		10-12-30tallest	scattered	1,5%	scattered	abundant	scattered	Common	scattered	Absent	Absent	Absent	Absent	poor	Absent	Absent	average	good	Absent	Absent
9/10/12	767915.47	6441778.1		12-18	scattered	4,10%	Common	Common	Common	Common	scattered	common	Absent	Absent	common	average	average		average	good	poor	Absent
9/10/12	778270.67	6450703.6		12, 16mtallest	scattered	2	scattered	scattered	absent	Common	common	Absent	common	scattered	Absent	poor	poor	Absent	poor	average	Absent	casuarinas present
9/10/12	779064.52	6452293.2		16-20	scattered		scattered	Common	absent	scattered	common	common	common	common	Absent	average	average	average	poor	poor	Absent	Absent
10/10/12	767941.35	6442304.5	B18FA	6m-12m	absent		scattered	Common	scattered	abundant	common	Absent	Absent	Absent	Absent	absent	Absent	poor	poor	Excellent	Absent	Absent
10/10/12	772752.06	6450386.1	B16FA	15-18	scattered	2 of 20	scattered	scattered	Common	Common	scattered	Absent	Absent	Absent	Absent	poor	Absent	Absent	average	poor	poor	poor
10/10/12	773919.91	6451197.7	B17FA	10mto14m	scattered	2 of 20	Common	scattered	scattered	Common	Absent	Absent	scattered	scattered	Absent	poor	poor	excellent	average	poor	Absent	Absent
10/10/12	768236.67	6443599.2	B19FA	av10 tallest 20	scattered	3, 8%		Common	absent	abundant	common	Absent	Absent	Absent	Absent	poor	Absent	Absent	average	good	Absent	Absent
10/10/12	768657.64	6446304.6	B20FA	14-18	scattered	3, 8%	Common	scattered	absent	Common	common	Absent	abundant	scattered	common	poor	poor	poor	poor	average	poor	Absent
18/10/12	774585	6449241		18avg-25tallest	Common	4 of 10	abundant	abundant	Common	absent	Absent	Absent	Absent	Absent	Absent	Good	Absent	average	Good	poor	Absent	Absent
18/10/12	772468.01	6442873.6		12avg-18tallest	Common	4 of 20	abundant	abundant	Common	scattered	Absent	Absent	Absent	Absent	Absent	Good	Absent	average	Good	Excellent	Absent	excellent
18/10/12	769929.42	6441880		avg10-16	Common	4 of 20	abundant	abundant	abundant	scattered	scattered	Absent	Absent	Absent	Absent		Absent	good	Good	good	Absent	Absent
18/10/12	768843.49	6440376.4		20	scattered	3 of 30	abundant	Common	Common	absent	Absent	abundant	scattered	common	abundant	average	excellent	average	average	average	poor	poor

DATA				HABITAT FEATURES												HABITAT QUALITY						
Date	Easting	Northing	Site code (FHAL)	Tree hgt (m)	Hollows	Hollow No.	Mature trees	Leaf litter	Fallen <50cm	Fallen >50cm	Mistletoe	Rock outcrop	Small rock	Large rock	Cliffs	Hollow dep.	Rock dep.	Ant tunnels	Log fauna	Small birds	Waterbirds	Glossy Black-cockatoo
19/10/12	769131	6449790	CA28FA	av13m tallest 17	absent		Common	Common	Common	scattered	Absent	Absent	scattered	Absent	Absent	absent	Absent		average	good	Absent	poor
19/10/12	766454.85	6442587.1	B25FA	22	abundant	7 of 10	Common	abundant	abundant	abundant	Absent	Absent	Absent	Absent	Absent	excellent	Absent	poor	excellent	good	Absent	Absent
19/10/12	772024.1	6449164.1	B22FA	20	Common	3 of 12	Common	Common	scattered	absent	scattered	Absent	Absent	Absent	Absent	poor	Absent	poor	poor	poor	Absent	Absent
19/10/12	771880.14	6448374.2	B23FA	20	Common		Common									Good	poor	poor	average	average	average	Absent
19/10/12	772142.26	6447005.5	B24FA	19	Common		Common	scattered								average				average		
19/10/12	766814.06	6442466.4	B26FA	18-20	Common		Common		abundant	Common	Absent	Absent	Absent	Absent	Absent	Good	poor	good	excellent	good	Absent	good-check ID of casuarinas
19/10/12	767543.81	6441816.1	B27FA	18	Common	4 of 10	scattered	Common	Common	scattered	Absent	Absent	Absent	Absent	Absent	Good	poor	good	Good	good	Absent	Absent
19/10/12	767379	6447866	A30FA	av18, tallest 23	Common	3 of 25	abundant	abundant	Common	scattered	scattered	abundant	common	common	scattered	Good	good	average	average	Excellent	Absent	av-good
19/10/12	772164.58	6450240.4	B21FA	19	scattered	3 of 6	scattered	scattered	scattered	scattered	scattered	Absent	Absent	Absent	Absent	average	Absent	poor	poor	poor	Absent	Absent
19/10/12	770257.77	6445698.7	B27FA	15	scattered	2 of 12	scattered	scattered	scattered	scattered	scattered	Absent	Absent	Absent	Absent	average	poor	average	average	good	Absent	Absent
19/10/12	768399	6448768	A29FA	av15, tallest 25	scattered	2 of 18	Common	Common	Common	scattered	scattered	Absent	Absent	Absent	Absent	average	poor	poor	average	average	Absent	Absent
19/10/12	762530	6432791	A32FA	av9 tallest 18	scattered	3 of 20	Common	Common	Common	Common	scattered	Absent	common	common	Absent	Good	good	average	average	Excellent	Absent	good
19/10/12	762403	6432780	A33FA	av15 tallest 25	scattered	2 of 20	Common	Common	Common	Common	scattered	scattered	scattered	scattered	scattered	average	average		average	average	poor	poor
19/10/12	761732	6430452	A34FA	av10, tallest 20	scattered	3 of 20	Common	Common	Common	scattered	scattered	Absent	scattered			average	poor	good		Excellent	Absent	good
19/10/12	761438	6430217	A35FA	av15 tallest 20	scattered	2 of 20	Common	Common	Common	scattered	common	Absent	common	Absent	Absent	average	poor	good	poor	Excellent	Absent	Absent
1/10/13	776146.84	6452979.9	A6_FA		Common	2 of 12	common	scattered	abundant	scattered	absent	abundant	scattered	common	abundant				good	good	poor	absent
1/10/13	771686.98	6442334	C1_FA		Common	3 of 18	scattered	abundant	abundant	scattered	absent	absent	scattered	absent	absent			absent	average	good	absent	excellent
1/10/13	776266.83	6452631	A5_FA		Common	3 of 20	scattered	common	abundant	scattered	absent	abundant	common	abundant	absent				excellent	excellent	absent	absent
1/10/13	775238.25	6451557	A1_FA		scattered	3 of 15	common	common	common	scattered	common	common	common	abundant	common				good	good	absent	absent
1/10/13	775703.8	6452306.3	A3_FA		scattered	0 of 8	scattered	common	common	scattered	common	absent	scattered	absent	absent				average	average	absent	absent
1/10/13	772509.44	6444069.2	C5_FA		scattered	1 of 17	scattered	abundant	common	common	absent	absent	absent	absent	absent			absent	poor	average	absent	excellent
1/10/13	776051.88	6452542.4	A4_FA		scattered	2 of 15	scattered	common	abundant	scattered	scattered	scattered	scattered	scattered	absent				good	excellent	absent	absent
1/10/13	772178.87	6443153.4	C3_FA		scattered	3 of 27	scattered	common	common	abundant	absent	absent	scattered	absent	absent			absent	good	good	absent	average
1/10/13	775404.29	6451799.3	A2_FA		scattered	1 of 13	common	common	common	scattered	scattered	scattered	scattered	scattered	absent			absent	good	average	absent	absent
1/10/13	771920.4	6442469.4	C2_FA		scattered	3 of 26	scattered	abundant	common	common	absent	absent	scattered	scattered	absent			absent	good	good	absent	poor
1/10/13	772347.7	6443618	C4_FA		scattered	2 of 23	common	common	common	abundant	absent	absent	scattered	absent	absent			absent	average	good	absent	absent
1/10/13	767029.44	6442862	C6_FA		scattered	2 of 21	scattered	scattered	common	common	scattered	absent	scattered	scattered	absent			absent	poor	average	absent	excellent
1/10/13	773781.82	6449408.5	B1_FA		scattered	3 of 23	scattered	common	scattered	absent	absent	absent	scattered	absent	absent			average	poor	good	absent	absent
2/10/13	762921.48	6434397.4	C8_FA		abundant	9 of 37	abundant	abundant	abundant	abundant	scattered	absent	scattered	scattered	absent			absent	good	good	absent	poor
2/10/13	774369.65	6451617.2	A8_FA		Common	3 of 6	scattered	common	common	scattered	common	common	scattered	scattered	scattered				good	average	absent	absent
2/10/13	773831.74	6451708.9	A9_FA		Common	2 of 5	common	common	scattered	scattered	scattered	common	common	common	scattered				average	good	absent	absent
2/10/13	766199.11	6447220.1	B10_FA		Common	7 of 12	abundant	common	common	common	absent	absent	absent	absent	absent			absent	excellent	excellent	absent	average
2/10/13	766212.91	6446599.2	B9_FA		Common	7 of 20	common	common	abundant	common	absent	absent	absent	absent	absent			absent	excellent	excellent	absent	absent
2/10/13	773336.78	6451724.4	A10_FA		Common	1 of 5	common	common	common	scattered	scattered	common	common	common	scattered				average	good	absent	absent
2/10/13	774993.49	6451528.7	A7_FA		Common	2 of 10	abundant	scattered	common	scattered	absent	common	scattered	scattered	absent				good	average	absent	absent
2/10/13	763132.58	6436113.6	C10_FA		scattered	1 of 18	abundant	abundant	abundant	abundant	scattered	absent	scattered	absent	absent			absent	good	excellent	absent	poor
2/10/13	761941.27	6435625.7	C7_FA		scattered	1 of 27	common	abundant	abundant	common	common		absent	absent	absent			absent	average	average	absent	average
2/10/13	763012.54	6435010.2	C9_FA		scattered	3 of 36	common	abundant	abundant	abundant	absent	absent	common	common	absent			excellent	average	good	absent	poor
2/10/13	770216.97	6451509.5	B2_FA		scattered	1 of 10	scattered	common	scattered	scattered	absent	absent	absent	absent	absent			absent	poor	good	absent	absent
2/10/13	771686.38	6451636.7	B3_FA		scattered	3 of 4	common	absent	scattered	absent	scattered	absent	absent	absent	absent			poor	poor	poor	absent	absent
2/10/13	772941.96	6451345.7	B4_FA		Common	3 of 5	scattered	scattered	common	common	common	common	common	common	common			poor	excellent	average	poor	absent
2/10/13	772858.18	6451705	B5_FA		Common	3 of 5	common	scattered	scattered	scattered	scattered	absent	scattered	absent	absent			poor	poor	poor	absent	absent
2/10/13	768110.27	6449929.9	B6_FA		scattered	2 of 12	scattered	scattered	abundant	abundant	absent	scattered	scattered	common	absent			poor	excellent	average	poor	absent
2/10/13	766139.78	6445498.3	B7_FA		scattered	1 of 1	scattered	absent	scattered	common	absent	absent	scattered	absent	absent			poor	poor	poor	absent	absent
2/10/13	766192.07	6446344.7	B8_FA		Common	7 of 12	abundant	common	common	common	absent	absent	absent	absent	absent			absent	excellent	excellent	absent	absent
3/10/13	770616.02	6441680.2	C12_FA		absent	0 of 45	scattered	abundant	abundant	common	absent	absent	absent	absent	absent			absent	average	good	absent	absent
3/10/13	768181.18	6440115.4	C17_FA		absent	0 of 34	scattered	abundant	abundant	common	absent	common	scattered	scattered	scattered			poor	average	average	absent	poor

DATA				HABITAT FEATURES												HABITAT QUALITY							
Date	Easting	Northing	Site code (FHAL)	Tree hgt (m)	Hollows	Hollow No.	Mature trees	Leaf litter	Fallen <50cm	Fallen >50cm	Mistletoe	Rock outcrop	Small rock	Large rock	Cliffs	Hollow dep.	Rock dep.	Ant tunnels	Log fauna	Small birds	Waterbirds	Glossy Black-cockatoo	
3/10/13	771216.15	6442065.8	C11_FA		Common	4 of 40	common	abundant	abundant	abundant	absent	absent	absent	absent	absent			absent	good	good	absent	poor	
3/10/13	770127.54	6441366.7	C13_FA		Common	5 of 29	common	abundant	abundant	abundant	absent	absent	absent	absent	absent			absent	excellent	good	absent	poor	
3/10/13	767867.33	6439585.5	A13_FA		Common	3 of 11	scattered	common	abundant	scattered	common	common	scattered	common	scattered								
3/10/13	767766.44	6439075.5	A14_FA		Common	6 of 18	scattered	common	abundant	scattered	scattered	common	common	common	scattered			absent	good	average	absent	poor	
3/10/13	767056.58	6442918.3	A11_FA		scattered	0 of 11	scattered	common	common	scattered	scattered	scattered	common	common	absent			absent	good	good	absent	average	
3/10/13	767955.96	6440056.4	A12_FA		scattered	0 of 20	scattered	abundant	common	absent	absent	scattered	scattered	scattered	scattered				average	good	absent	absent	
3/10/13	767369.92	6440287.6	A15_FA		scattered	0 of 3	scattered	scattered	scattered	absent	absent	absent	absent	absent	absent			absent	poor	average	absent	absent	
3/10/13	769480.94	6440964.6	C14_FA		scattered	2 of 26	scattered	abundant	common	common	absent	scattered	abundant	common	absent			average	average	average	absent	absent	
3/10/13	768997.48	6440682.6	C15_FA		scattered	1 of 33	scattered	abundant	abundant	common	absent	absent	abundant	scattered	absent			poor	average	average	absent	poor	
3/10/13	768496.66	6440382.8	C16_FA		scattered	1 of 24	scattered	abundant	abundant	abundant	absent	abundant	abundant	abundant	absent			poor	good	good	absent	poor	
3/10/13	762057.94	6435685.6	B11_FA		scattered	4 of 8	common	common	common	common	absent	absent	absent	absent	absent			absent	excellent	good	absent	absent	
3/10/13	762491.88	6435875	B12_FA		Common	6 of 10	common	scattered	common	common	absent	absent	absent	absent	absent			poor	good	excellent	poor	absent	
3/10/13	762863.82	6436045.6	B13_FA		Common	4 of 6	abundant	common	common	common	scattered	abundant	scattered	common	absent			average	excellent	excellent	poor	absent	
3/10/13	763098.63	6436165.3	B14_FA		scattered	3 of 8	scattered	scattered	common	common	absent	absent	absent	absent	absent			average	good	excellent	absent	absent	
4/10/13	767450.03	6441511.5	B16_FA		absent	0 of 8	scattered	scattered	common	common	absent	absent	absent	absent	absent			average	good	good	absent	good	
4/10/13	761257.08	6427963.8	C18_FA		absent	0 of 2	scattered	scattered	scattered	absent	absent	absent	scattered	scattered	absent			absent	absent	average	absent	absent	
4/10/13	762614.56	6433793.4	C19_FA		absent	0 of 17	common	abundant	abundant	common	absent	abundant	scattered	scattered	absent			poor	good	good	absent	poor	
4/10/13	767290.13	6441245.2	B17_FA		Common	6 of 10	common	common	abundant	abundant	scattered	absent	absent	absent	absent			average	excellent	excellent	average	absent	
4/10/13	762555.39	6433616	C21_FA		Common	4 of 21	common	abundant	abundant	common		common	common	common	absent			poor	good	good	absent	poor	
4/10/13	761149.11	6429851.4	C22_FA		Common	2 of 27	scattered	common	abundant	scattered	common	absent	absent	absent	absent			absent	average	excellent	absent	poor	
4/10/13	766468.71	6436886.8	A18_FA		scattered	1 of 12	scattered	common	common	scattered	common	absent	scattered	absent	absent			absent	average	average	absent	poor	
4/10/13	765099.74	6436691.7	A20_FA		scattered	0 of 18	scattered	common	common	scattered	abundant	absent	absent	absent	absent			absent	average	average	absent	absent	
4/10/13	767104.65	6437632.9	A16_FA		scattered	1 of 11	scattered	common	abundant	common	scattered	scattered	common	common	scattered				excellent	good	absent	absent	
4/10/13	767496.97	6438108.5	A17_FA		scattered	3 of 20	scattered	scattered	common	scattered	absent	common	common	common	common			absent	good	good	absent	absent	
4/10/13	766132.52	6436521.7	A19_FA		scattered	2 of 21	scattered	common	common	scattered	common	absent	absent	absent	absent			absent	average	good	absent	average	
4/10/13	775966.53	6449043	B15_FA		scattered	2 of 5	common	scattered	abundant	abundant	absent	common	common	common	absent			good	excellent	good	absent	absent	
4/10/13	762511.69	6433173.2	C20_FA		scattered	2 of 27	scattered	abundant	abundant	scattered	absent	absent	scattered	scattered	absent			absent	poor	excellent	absent	average	
4/10/13	761509.64	6430175.3	C23_FA		scattered	2 of 26	common		abundant	abundant	scattered	absent	absent	absent	absent			absent	average	excellent	absent	poor	
5/10/13	766990.72	6444319.1	A24_FA		absent	0 of 22	scattered	common	common	scattered	common	scattered	scattered	scattered	scattered			absent	good	good	absent	absent	
5/10/13	766934.55	6443993.4	A25_FA		absent	0 of 5	scattered	scattered	scattered	absent	scattered	scattered	absent	absent	absent			absent	poor	poor	absent	absent	
5/10/13	761867.82	6431690.9	C26_FA		absent	0 of 16	common	abundant	abundant	absent	scattered	absent	scattered	scattered	absent			poor	poor	average	absent	good	
5/10/13	762412.39	6432638	C28_FA		absent	0 of 30	scattered	common	abundant	absent	absent	absent	abundant	common	absent			average	average	good	absent	excellent	
5/10/13	761599.73	6430640.9	C24_FA		Common	5 of 22	common	abundant	abundant	common	scattered	common	common	common	scattered			poor	good	excellent	average	poor	
5/10/13	762168.96	6432197.3	C27_FA		Common	5 of 17	abundant	abundant	abundant	common	absent	absent	absent	absent	absent			absent	good	good	absent	poor	
5/10/13	765992.28	6444583.7	A22_FA		Common	5 of 5	scattered	scattered	scattered	scattered	common	absent	scattered	absent	absent			absent	average	poor	absent	absent	
5/10/13	767294.13	6441160.2	A27_FA		scattered	2 of 17	scattered	common	common	absent	absent	scattered	scattered	scattered	absent			absent	average	good	absent	absent	
5/10/13	761573.06	6431227.4	C25_FA		scattered	1 of 16	scattered	abundant	abundant	common	scattered	absent	absent	absent	absent			absent	average	good	absent	excellent	
5/10/13	766139.21	6445263.4	A21_FA		scattered	0 of 0	scattered	scattered	scattered	scattered	scattered	absent	absent	absent	absent			absent	poor	poor	absent	absent	
5/10/13	766789.64	6444450.1	A23_FA		scattered	2 of 8		scattered	scattered	scattered	common	scattered	scattered	scattered	absent			absent	average	average	absent	absent	
5/10/13	766875.91	6443497.5	A26_FA		scattered	1 of 16	scattered	common	common	scattered	common	scattered	common	scattered	absent			absent	good	good	absent	absent	
5/10/13	763890.8	6437217.5	A28_FA		scattered	2 of 8	scattered	common	scattered	scattered	scattered	absent	absent	absent	absent			absent	average	average	absent	absent	
6/10/13	767709.3	6442383.4	B23_FA		absent	0 of 10	scattered	scattered	scattered	absent	absent	absent	absent	absent	absent			poor	poor	good	absent	absent	
6/10/13	763380.64	6436937.1	C31_FA		absent	0 of 8	abundant	scattered	common	common	abundant	absent	scattered	absent	absent			absent	poor	poor	absent	absent	
6/10/13	774867.56	6449244.8	A32_FA		Common	5 of 8	common	common	common	common	absent	scattered	scattered	scattered	scattered			absent	excellent	excellent	poor	absent	
6/10/13	773452.86	6449516.2	A29_FA		Common	3 of 18	common	common	common	scattered	scattered	absent	scattered	absent	absent			absent	good	excellent	absent	absent	
6/10/13	774388.31	6449277.7	A31_FA		Common	3 of 17	common	common	common	scattered	absent	scattered	scattered	scattered	absent			absent	good	excellent	absent	absent	
6/10/13	775579.21	6449036.4	A33_FA		Common	3 of 6	common	common	common	scattered	scattered	absent	scattered	absent	absent			absent	excellent	average	absent	absent	
6/10/13	775953.57	6449053.2	A34_FA		Common	1 of 4	common	common	common	common	scattered	scattered	common	scattered	absent			absent	excellent	good	absent		
6/10/13	762465.19	6432819.3	C29_FA		Common	4 of 45	abundant	abundant	abundant	abundant	scattered	common	scattered	scattered	scattered			poor	good	excellent	poor	poor	
6/10/13	773913.45	6449354.5	A30_FA		scattered	2 of 16	scattered	common	common	absent	absent	absent	absent	absent	absent			absent	average	good	absent	absent	
6/10/13	767459.02	6442555.5	B24_FA		scattered	2 of 9	common	scattered	scattered	absent	absent	abundant	scattered	absent	common			poor	poor	excellent	good	good	
6/10/13	763005.11	6435625.4	C30_FA		scattered	1 of 32	common	abundant	abundant	scattered	absent	absent	scattered	absent	absent			absent	average	good	absent	average	

DATA				HABITAT FEATURES											HABITAT QUALITY							
Date	Easting	Northing	Site code (FHAL)	Tree hgt (m)	Hollows	Hollow No.	Mature trees	Leaf litter	Fallen <50cm	Fallen >50cm	Mistletoe	Rock outcrop	Small rock	Large rock	Cliffs	Hollow dep.	Rock dep.	Ant tunnels	Log fauna	Small birds	Waterbirds	Glossy Black-cockatoo
8/10/13	766483.79	6448313.2	B25_FA		absent	0 of 8	common	common	scattered	scattered	absent	abundant	common	abundant	absent			good	good	good	absent	absent
8/10/13	766365.61	6448108.6	B26_FA		scattered	4 of 8	common	common	common	common	common	absent	absent	absent	absent			poor	excellent	excellent	absent	average

B.8 THREATENED SPECIES RECORDS IDENTIFIED DURING FIELD WORK 2012 & 2013

Name	Scientific name	Description	Map Reference/WP	Zone	x_proj	y_proj	Altitude	Surveyors
FLORA								
Silky Swainson-pea	<i>Swainsona sericea</i>	8 Oct 2012	TL1_J14	55H	776518	6447812	476 m	KS
Silky Swainson-pea	<i>Swainsona sericea</i>	4 Oct 2013	WP 36 (Team B)	55H	776680	6447861	473 m	KS
Silky Swainson-pea	<i>Swainsona sericea</i>	4 Oct 2013	WP 37 (Team B)	55H	776657	6447851	475 m	KS
Ausfeld's Wattle	<i>Acacia ausfeldii</i>	5 Oct 2013	WP 60 (Team A)	55H	766991	6444319	472 m	JM
Ausfeld's Wattle	<i>Acacia ausfeldii</i>	8 Oct 2013	WP 93 (Team C)	55H	773436	6449703	509 m	BvTD
Ausfeld's Wattle	<i>Acacia ausfeldii</i>	8 Oct 2013	WP 94 (Team C)	55H	773490	6449860	516 m	BvTD
FAUNA								
Brown Treecreeper	<i>Climacteris picumnus</i>	10 Oct 2012	TL1_E10	55H	773450	6449713	508 m	RG
Speckled Warbler	<i>Chthonicola sagittata</i>	19 Oct 2012	TL2_N16; TL2_C16	55H	766319	6442505	445 m	MF/DF
Speckled Warbler	<i>Chthonicola sagittata</i>	18 Oct 2012		55H	772468	6442874	531 m	FB
Painted Honeyeater	<i>Grantiella picta</i>	9 Oct 2012	TL3_G9	55H	766135	6438526	458 m	MF
Black-chinned Honeyeater	<i>Meliphreptus gularis</i>	9 Oct 2012	TL1_K11	55H	779065	6452293	381 m	RG
Glossy Black-cockatoo	<i>Calyptorhynchus lathami</i>	19 Oct 2012	TL2_D17	55H	767054	6442306	425 m	DF/MF
Grey-crowned Babbler	<i>Pomatostomus temporalis</i>	9 Oct 2012	TL2_M18; TL2_M19; TL3_F12	55H	765689	6436780	491 m	MF
Grey-crowned Babbler	<i>Pomatostomus temporalis</i>	9 Oct 2012		55H	767455	6439623	426 m	RG
Grey-crowned Babbler	<i>Pomatostomus temporalis</i>	18 Oct 2012		55H	771681	6440903	476 m	RG
Grey-crowned Babbler	<i>Pomatostomus temporalis</i>	18 Oct 2012		55H	771743	6441002	487 m	RG
Grey-crowned Babbler	<i>Pomatostomus temporalis</i>	9 Oct 2012		55H	771849	6441601	482 m	MF
Grey-crowned Babbler	<i>Pomatostomus temporalis</i>	8 Oct 2012		55H	772759	6444205	507 m	MF
Scarlet Robin	<i>Petroica multicolor</i>	19 Oct 2012		WF3_B7	55J	782099	6488706	1061 m
Squirrel Glider	<i>Petaurus norfolcensis</i>	16 Oct 2012, 9.30pm	WF6_B16	55J	779291	6473699	599 m	BvTD/MF
Varied Sittella	<i>Daphoenositta chrysoptera</i>	18 Oct 2012	TL2_J18; WF6_G9	55H	769929	6441880	457 m	FB
Varied Sittella	<i>Daphoenositta chrysoptera</i>	17 Oct 2012		55J	781572	6477356	880 m	GF

Name	Scientific name	Description	Map Reference/WP	Zone	x_proj	y_proj	Altitude	Surveyors
Yellow-bellied Sheath-tail-bat	<i>Saccolaimus flaviventris*</i>	17 Oct 2012	TL2_016 (Anabat locn)	55H	772789	6442578	511 m	Anabat
Yellow-bellied Sheath-tail-bat	<i>Saccolaimus flaviventris*</i>	5 Oct 2013			762130	6435695	460 m	Anabat
Common Bentwing-bat	<i>Miniopterus schreibersii</i>	VARIOUS RECORDS	Anabat locations – see survey effort maps (Appendix E.2)					Anabat
Corben’s Long-eared Bat	<i>Nyctophilus corbeni</i>	VARIOUS RECORDS	Anabat locations – see survey effort maps (Appendix E.2)					Anabat
Large-eared Pied Bat	<i>Chalinolobus dwyeri</i>	VARIOUS RECORDS	Anabat locations – see survey effort maps (Appendix E.2)					Anabat
Eastern Cave Bat	<i>Vespadelus troughtoni</i>	VARIOUS RECORDS	Anabat locations – see survey effort maps (Appendix E.2)					Anabat
Brown Treecreeper	<i>Climacteris picumnus</i>	3 Oct 2013	23	55H	773448	6449606	509 m	FG
Brown Treecreeper	<i>Climacteris picumnus</i>	5 Oct 2013	63	55H	766613	6443558	435 m	FG
Brown Treecreeper	<i>Climacteris picumnus</i>	2 Oct 2013	14	55H	761941	6435626	459 m	BvTD/GM
Brown Treecreeper	<i>Climacteris picumnus</i>	1 Oct 2013	8	55H	772179	6443153	521 m	BvTD/GM
Speckled Warbler	<i>Chthonicola sagittata</i>	1 Oct 2013	8	55H	772179	6443153	521 m	BvTD/GM
Brown Treecreeper	<i>Climacteris picumnus</i>	6 Oct 2013	69	55H	773453	6449516	500 m	FG
Brown Treecreeper	<i>Climacteris picumnus</i>	6 Oct 2013	74	55H	775136	6449311	454 m	FG
Brown Treecreeper	<i>Climacteris picumnus</i>	3 Oct 2013	33	55H	762507	6435906	439 m	MF
Brown Treecreeper	<i>Climacteris picumnus</i>	2 Oct 2013	19	55H	763133	6436114	447 m	GM
Diamond Firetail	<i>Stagonopleura guttata</i>	2 Oct 2013	20	55H	774001	6451671	456 m	FG
Diamond Firetail	<i>Stagonopleura guttata</i>		39	55H	765218	6437838	504 m	FG
Diamond Firetail	<i>Stagonopleura guttata</i>	3 Oct 2013	27	55H	762943	6436078	443 m	MF
Brown Treecreeper	<i>Climacteris picumnus</i>	3 Oct 2013	27	55H	762943	6436078	443 m	MF
Diamond Firetail	<i>Stagonopleura guttata</i>	5 Oct 2013	64	55H	766337	6440345	447 m	FG
Glossy Black-cockatoo (F)**	<i>Calyptorhynchus lathami</i>	4 October 2013	43	55H	766778	6437116	460 m	FG
Glossy Black-cockatoo (F)**	<i>Calyptorhynchus lathami</i>	4 October 2013	46	55H	766547	6436850	460 m	FG
Glossy Black-cockatoo (F)**	<i>Calyptorhynchus lathami</i>	6 October 2013	71	55H	774183	6449295	496 m	FG
Glossy Black-cockatoo (F)**	<i>Calyptorhynchus lathami</i>	4 October 2013	38	55H	766565	6442427	441 m	MF
Glossy Black-cockatoo (F)**	<i>Calyptorhynchus lathami</i>	4 October 2013	42	55H	767450	6441512	417 m	MF

Name	Scientific name	Description	Map Reference/WP	Zone	x_proj	y_proj	Altitude	Surveyors
Glossy Black-cockatoo (F)**	<i>Calyptorhynchus lathami</i>	8 October 2013	81	55H	766370	6448078	511 m	MF
Glossy Black-cockatoo (F)**	<i>Calyptorhynchus lathami</i>	1 Oct 2013	1	55H	771687	6442334	520 m	GM
Glossy Black-cockatoo (F)**	<i>Calyptorhynchus lathami</i>	1 Oct 2013	3	55H	771834	6442404	516 m	GM
Glossy Black-cockatoo (F)**	<i>Calyptorhynchus lathami</i>	1 Oct 2013	4	55H	771864	6442424	520 m	GM
Glossy Black-cockatoo (F)**	<i>Calyptorhynchus lathami</i>	1 Oct 2013	10	55H	772383	6443724	518 m	GM
Glossy Black-cockatoo (F)**	<i>Calyptorhynchus lathami</i>	3 October 2013	22	55H	771613	6442296	520 m	BvTD/GM
Glossy Black-cockatoo (F)**	<i>Calyptorhynchus lathami</i>	5 October 2013	64	55H	762374	6432569	425 m	BvTD/GM
Glossy Black-cockatoo	<i>Calyptorhynchus lathami</i>	1 Oct 2013	13	55H	767029	6442862	446 m	GM
Glossy Black-cockatoo	<i>Calyptorhynchus lathami</i>	5 October 2013	58	55H	761573	6431227	440 m	GM
Glossy Black-cockatoo	<i>Calyptorhynchus lathami</i>	3 October 2013	31	55H	767149	6442961	431 m	MF
Glossy Black-cockatoo	<i>Calyptorhynchus lathami</i>	6 October 2013	75	55H	767279	6442602	435 m	MF
Grey crowned babbler	<i>Pomatostomus temporalis</i>	3 October 2013	21	55H	771742	6441059	490 m	GM
Grey crowned babbler	<i>Pomatostomus temporalis</i>	3 October 2013	32	55H	767494	6439643	422 m	FG
Grey crowned babbler	<i>Pomatostomus temporalis</i>	1 October 2013	4	55H	775317	6451773	451 m	FG
Grey crowned babbler	<i>Pomatostomus temporalis</i>	4 October 2013	48	55H	765100	6436692	513 m	FG
Painted honeyeater	<i>Grantiella picta</i>	6 October 2013	68	55H	761492	6427033	431 m	BvTD/GM
Painted honeyeater	<i>Grantiella picta</i>	6 October 2013	69	55H	761149	6428477	415 m	BvTD/GM
Powerful owl	<i>Ninox strenua</i>	3 October 2013	37	55H	762614	6433841	418 m	FG
Powerful owl	<i>Ninox strenua</i>	6 October 2013	66	55H	762465	6432819	413 m	BvTD/GM
Speckled warbler	<i>Chthonicola sagittata</i>	3 October 2013	35	55H	766703	6437273	454 m	FG
Speckled warbler	<i>Chthonicola sagittata</i>	4 October 2013	40	55H	767105	6437633	445 m	FG
Speckled warbler	<i>Chthonicola sagittata</i>	4 October 2013	47	55H	766133	6436522	463 m	FG
Speckled warbler	<i>Chthonicola sagittata</i>	5 October 2013	60	55H	766991	6444319	472 m	FG
Speckled warbler	<i>Chthonicola sagittata</i>	2 October 2013	18	55H	766191	6446126	493 m	MF
Speckled warbler	<i>Chthonicola sagittata</i>	1 Oct 2013	5	55H	771920	6442469	516 m	GM

Name	Scientific name	Description	Map Reference/WP	Zone	x_proj	y_proj	Altitude	Surveyors
Speckled warbler	<i>Chthonicola sagittata</i>	3 October 2013	26	55H	771002	6441916	514 m	GM
Speckled warbler	<i>Chthonicola sagittata</i>	3 October 2013	36	55H	769103	6440723	450 m	GM
Speckled warbler	<i>Chthonicola sagittata</i>	3 October 2013	39	55H	768497	6440383	410 m	GM
Speckled warbler	<i>Chthonicola sagittata</i>	4 October 2013	44	55H	762615	6433793	421 m	GM
Speckled warbler	<i>Chthonicola sagittata</i>	3 October 2013	24	55H	762617	6435826	460 m	MF
Square-tailed kite (O & E)***	<i>Lophoictinia isura</i>	5 October 2013	53	55H	761655	6430585	397 m	GM
Squirrel glider	<i>Petaurus norfolcensis</i>	4 October 2013	52	55H	761630	6430513	394 m	GM
Varied Sittella	<i>Daphoenositta chrysoptera</i>	2 October 2013	12	55H	776222	6452647	467 m	FG
Varied Sittella	<i>Daphoenositta chrysoptera</i>	3 October 2013	34	55H	766718	6437272	455 m	FG

*Possible record

** F – Foraging evidence

*** O – Observed; E - Nest

APPENDIX C THREATENED SPECIES EVALUATIONS

The tables in this appendix present the habitat evaluation for threatened species, ecological communities and endangered populations returned from NSW threatened species database searches inclusive of the wind farm and the transmission line for the following catchment areas:

- Wind farm - Hunter/Central Rivers CMA (Liverpool Range and Pillaga subregions), Central West CMA (Liverpool Range and Pillaga subregions) and Namoi CMA (Liverpool Range subregion)
- Transmission line – Hunter/Central Rivers (Kerrabee and Pillaga subregions) and Central West CMA (Pillaga subregion)

Where “N/A” is indicated in the table the threatened species search did not return records for that individual species from that aspect of the development. Hence, the species may be known for the wind farm site, but no records are known for the transmission line site or vice versa.

The *Environment Protection and Biodiversity Conservation Act* Protected Matters search tool was also used to search listed threatened species within a 10 km buffer around the boundary of the project area.

The likelihood of occurrence is based on presence of habitat, proximity of nearest records and mobility of the species (where relevant). The assessment of potential impact is based on the nature of the proposal, the ecology of the species and its likelihood of occurrence. The following classifications are used:

Presence of habitat (PH)

Present: Potential or known habitat is present within the Project Area.

Marginal: Habitat present is not typical but may be suitable, or habitat is typical but condition is poor or microhabitat requirements are not present.

Absent: No potential or known habitat is present within the Project Area.

Likelihood of occurrence¹ (L)

None: Species known or predicted to occur within the locality but no suitable habitat present within the Project Area.

Unlikely: Species known or predicted within the locality. Suitable habitat may be present in the Project Area but the proximity of nearest records suggests it is unlikely to occur.

Possible: Suitable habitat present and the species could occur in the Project Area based on the proximity of nearest records.

Present: Species was recorded during the field investigations.

Potential for impact (PI)

No: The proposal would not result in an impact to this species.

Low: The proposal is unlikely to result in an impact to this species. No Assessment of Significance (AoS) is considered necessary for this species.

¹ In the study area for highly mobile fauna, i.e. birds and bats; likelihood of occurrence in the development envelope for ground- or tree-dwelling fauna and flora (i.e. reptiles, marsupials, amphibians, plants).

Moderate: The proposal could impact this species or its habitats but risks are considered highly manageable. No Assessment of Significance (AoS) is considered necessary for this species. Management measures have been developed to address the risks.

High: The proposal is likely to impact this species or its habitats. An AOS has been applied to these entities to properly characterise the impact and provide information then used to either develop management measures to protect the entity or justify avoidance of the entity.

Information on habitat is sourced from species profiles on the NSW OEH threatened species database or the Australian Government's Species Profiles and Threats database (SPRAT) unless otherwise stated.

C.1 FLORA

Species	Ecology and distribution	Records	Transmission line			Notes
			Presence of Habitat	Likelihood of Occurrence	Potential for Impact	
Ausfeld's Wattle <i>Acacia ausfeldii</i> V TSC	An erect or spreading shrub 2 - 4 m high with narrow phyllodes hairless and dotted with resin glands. Found to the east of Dubbo in the Mudgee-Ulan-Gulgong area.	OEH Atlas – 14 records (dated 1973-2006) located around Ulan Colliery, to the south of the quarry and along the road leading to Goulburn River Stone Cottages. . The site has not been adequately searched for this species	Present	Present	High	Assessment of Significance undertaken
<i>Acacia dangarensis</i> E TSC	Small tree to 10m, with bipinnate foliage similar to <i>Acacia decurrens</i> . Flowers Aug-Sep. In pure stands or in sclerophyll woodland on basalt, Mt Dangar, Goulburn River NP.	Recorded in the Goulburn River NP.	Absent	Unlikely	No	No habitat is present.
Flockton Wattle <i>Acacia flocktoniae</i> V TSC V EPBC	Shrub 2-3m in height, with angled glabrous branchlets, phyllodes straight, linear. Fl June-Aug. On sandstone, Blue Mountains and south.	Known from the Goulburn River NP.	Present	Unlikely	Low	No records within the Study Area.
Weeping Myall <i>Acacia pendula</i> <i>Acacia pendula</i> population in the Hunter catchment E TSC	Major inland floodplains on heavy soils W from upper Hunter region, sometimes dominant. Tree 5-13m, weeping branches, grey foliaged.	OEH Atlas – one record (dated 1932) located SE of Cassilis. Observed 4km N of wind farm site on Liverpool Plains.	N/A	N/A	N/A	No records within the Study Area.
Granite Boronia <i>Boronia granitica</i> V TSC E EPBC	Granite Boronia is a medium-sized shrub 0.6 - 2 m tall. It occurs in scattered localities on the New England Tablelands and North West Slopes north from the Armidale area to the Stanthorpe district in southern Queensland. It can be locally common in appropriate habitat.		N/A	N/A	N/A	No records within the Study Area.
<i>Commersonia rosea</i> E TSC E EPBC	Prostrate shrub with trailing branches to 60cm. Known from 4 localities within 8km radius of Sandy Hollow, upper Hunter Valley. Post-fire coloniser. Grows in skeletal sandy soils in scrub or heath with occas emergent <i>E. caleyi</i> , <i>E. crebra</i> , <i>Callitris endlicheri</i> .	Known to occur in Goulburn River NP.	Present	Unlikely	Low	No records within the Study Area.

Species	Ecology and distribution	Records	Transmission line			Notes
			Presence of Habitat	Likelihood of Occurrence	Potential for Impact	
<p><i>Cymbidium canaliculatum</i> population in the Hunter Catchment</p> <p><i>Cymbidium canaliculatum</i></p> <p>End Pop TSC</p>	<p>An epiphytic orchid which grows in the hollows and forks of eucalypts and wattles, with a scattered distribution across northern and eastern Australia, extending from Hunter River in NSW to Cape York and across northern NT and Queensland to the Kimberley region in WA. Not listed as a species, but only as an Endangered Population, so occurrences outside the Hunter catchment are not relevant. Only part of the site is within the Hunter catchment.</p>	<p>Known to occur in Goulburn River NP.</p> <p>Observed just off-site to the north of Pandora Pass (north of the Wind Farm Study Area).</p>	Present	Unlikely	Low	No records within the Study Area.
<p>White-flowered Wax Plant</p> <p><i>Cynanchum elegans</i></p> <p>E TSC</p> <p>E EPBC</p>	<p>A climber growing in rainforest gullies and on scree slopes, NC, CC, CWS, and west as far as Merriwa in the upper Hunter Valley. Habitat includes dry and littoral rainforest, red gum woodland, spotted gum open forest. Majority of known populations are <30 plants.</p>	<p>Records known from Goulburn River NP, Wollemi NP.</p>	Marginal	Unlikely	Low	Suitable habitat is limited within the study area and no records in area.
<p>Bluegrass</p> <p><i>Dichanthium setosum</i></p> <p>V TSC</p> <p>V EPBC</p>	<p>Grows in woodland and grassland, NT, NWS, CWS, NWP, Q, WA. Associated with heavy basalt soils, often in moderately disturbed areas such as cleared woodland or roadsides. Either tolerates or is advantaged by disturbance. Can be locally common or scattered plants. Associated species include <i>E. albens</i>, <i>E. melliodora</i>, <i>E. viminalis</i>, <i>Aristida ramosa</i>, <i>Themeda australis</i>, <i>Bothriochloa macra</i>, <i>Poa sieberiana</i>.</p>	<p>Not recorded on the NSW OEH Database. Predicted to occur from the EPBC Database.</p>	Marginal	Unlikely	Low	Possible occurrence in more suitable habitat at the northern end within Windfarm study area.
<p>Finger Panic Grass</p> <p><i>Digitaria porrecta</i></p> <p>E TSC</p> <p>E EBC</p>	<p>In grassland, woodland or open forest on better soils, NWS, Q. From near Moree south to Tambar Springs and from Tamworth to Coonabarabran, mostly on private property, roadsides or TSRs. Flowers mid-Jan to late Feb. Frequent associates include <i>E. albens</i>, <i>Acacia pendula</i>, <i>Aurolastipa aristiglumis</i>, <i>Enteropogon acicularis</i>, <i>Hibiscus trionum</i>.</p>	<p>OEH Atlas – 3 records (dated 2004) located approx. 5km NW of the proposed wind farm site.</p>	Marginal	Unlikely	Low	Possible occurrence in more suitable habitat at the northern end within Windfarm study area.
<p>Lobed Blue-grass</p> <p><i>Bothriochloa biloba</i></p> <p>V EPBC</p>	<p><i>Bothriochloa biloba</i> is an erect or decumbent perennial grass to 1 metre high. In NSW the species is widespread along the New England Tablelands and North West Slopes and Plains, including Warialda, Bingara, Merriwa, Hunter Valley and Dubbo areas. It also occurs in Southern Queensland. Prefers (but not limited to) heavy textured soils, such as brown or black clay soils. Flowers from November to June.</p>	<p>OEH Atlas – 2 records located north of Turill SCA and several records located along Warrumbungles Way towards Coolah.</p>	Marginal	Possible at N end, records nearby	Mod	Assessment of Significance under the EPBC Act undertaken

Species	Ecology and distribution	Records	Transmission line			Notes
			Presence of Habitat	Likelihood of Occurrence	Potential for Impact	
<i>Euphrasia arguta</i> CE EPBC	An erect, semi-parasitic annual herb known from Nundle State Forest and adjacent private land where it was rediscovered in 2008 (NSW DPI 2008). These populations occur at the border between the New England Tableland and the North Coast Bioregions (NSW DECCW 2010). Prior to this, the species had not been sighted since 1904 and was previously known from Sydney to Bathurst and north to Walcha, NSW. Collections had also been made from Nundle on the New England Tableland; the Paterson and William Rivers in the Hunter Valley; Mudgee; and the plains near Bathurst (Bentham 1869 cited in Leigh <i>et al.</i> 1984). Habitat is said to be grassy area near rivers, presumably in good condition.	Not recorded on the NSW OEH Database. Predicted to occur from the EPBC Database.	Present	Unlikely	Low	No records within the Study Area.
<i>Diuris pedunculata</i> Small Snake Orchid E TSC E EPBC	Moist grassy areas in sclerophyll forest, Sydney to Tenterfield. Flowers Aug-Sept (Flora of NSW) or Oct (DECCW). Distribution is “mainly NE Tableland, grassland, in stony soils on low ridges or moist flats.” (Bishop, 2005).	No records within the Study area.	Marginal	Unlikely	Low	No records within the Study Area.
Pine Donkey Orchid <i>Diuris tricolor</i> V TSC	Fl. Sep-Nov (flowers lightly scented). Sclerophyll forest among grass, often with <i>Callitris</i> , NT, CT, NWS, CWS, Q (Flora of NSW). Jones: “Widespread and locally common in <i>Callitris</i> woodland in well-drained sandy soils or on low forested ridges in laterite, plains and slopes. Known localities include Muswellbrook, Condobolin-Nymagee Road. Associated species include <i>Callitris glaucophylla</i> , <i>E. populnea</i> , <i>E. intertexta</i> , ironbarks, wattle scrub. Often with a grassy understorey including plants such as <i>Bulbine</i> sp.	Predicted to occur in Coolah Tops NP and Goulburn River NP.	Marginal	Unlikely	Low	No records within the Study Area.
<i>Eucalyptus camaldulensis</i> population in the Hunter catchment End. Pop. EPBC	Widely distributed on alluvial soils near permanent water west from Singleton (from Bylong south of Merriwa east to Hinton in Port Stephens LGA, on the Hunter River, mostly on private property (only coastal occurrence in NSW).	OEH Atlas – one record (dated 1970) located approx. 16km SE of Ulan.	N/A	N/A	N/A	No records within the Study Area.
Capertree Stringybark <i>Eucalyptus cannonii</i> V TSC V EPBC	Similar to the widespread <i>E. macrorhyncha</i> , with more angular buds and larger fruit with a medial rim. May co-occur and hybridise. Restricted to 100 x 60km area of CT with eastern edge on a line between Lithgow and Bylong (67 locations recorded, 460-1040m elevation, most situations except valley floors). Found with numerous other eucalypts including <i>E. rossii</i> , <i>dives</i> , <i>goniocalyx</i> , <i>melliodora</i> , <i>blakelyi</i> , <i>viminalis</i> , <i>dalrympleana</i> , <i>oblonga</i> , <i>sparsifolia</i> .	OEH Atlas – three records (dated 2004-2006) located south of the Ulan Colliery. Known to occur in Goulburn River NP.	Present	Unlikely	Low	Extensive surveys failed to locate this species.

Species	Ecology and distribution	Records	Transmission line			Notes
			Presence of Habitat	Likelihood of Occurrence	Potential for Impact	
Pokolbin Mallee <i>Eucalyptus pumila</i> V TSC V EPBC	A mallee-form eucalypt to 6 m high. Known from one small area on skeletal soil on a west-facing sandstone ridge in Pokolbin Flora Reserve and an adjacent private property (& old records from Sandy Hollow and Wyong). Grows in woodland with <i>E. fibrosa</i> , <i>C. maculata</i> , <i>Callitris endlicheri</i> . An additional two populations of about 150 plants have been found 4km NW of the type locality, occupying flat benches on a steep-sided N-facing spur, separated by a valley.	Closest record from Wollemi NP.	Marginal	Unlikely	Low	No records within the Study Area.
Homoranthus darwinioides V TSC V EPBC	Shrub 1-1.5m in height Grows in dry sclerophyll forest or woodland, usually on sandstone outcrops or ridges from Dubbo to Merriwa, chiefly Goonoo Forest and Lees Pinch.	OEH Atlas – 22 records (dated 1951-2000) located mostly in the eastern part of the Goulburn River NP.	Present	Unlikely	Low	Extensive surveys failed to locate this species and there are no records within close proximity to the study area.
Granite Homoranthus <i>Homoranthus prolixus</i> V TSC V EPBC	Grows in heath in skeletal soil among crevices in granite outcrops near Inverell and Bendemeer (NT and NWS botanical regions) (Flora of NSW)	Not recorded on the NSW OEH Database or EPBC database.	N/A	N/A	N/A	No records within the Study Area.
Leafless Indigo <i>Indigofera efoliata</i> E TSC E EPBC	Only known from a few old collections in the Dubbo area (Harden, 2002). Grows in stony ground. Perennial herb or sub-shrub to 40cm with leaves absent or to 3.5cm long with 5-9 tiny obcordate leaflets, only present at base of annual growth. Flowers pink.	Not recorded on the NSW OEH Database or EPBC database.	Marginal	Unlikely	Low	No records within the Study Area.
Kennedia retrorsa V TSC V EPBC	Climber. Flowers in spring. Mt Dangar, Goulburn River valley to near Putty in dry sclerophyll forest and woodland.	Recorded in the Goulburn River NP.	Present	Unlikely	Low	Extensive surveys failed to locate this species and there are no records within close proximity to the study area.
Lasiopetalum longistamineum V TSC V EPBC	Shrub. Grows in rich alluvial deposits in Gungal-Mt Dangar area.	Recorded in Goulburn River NP.	Marginal	Unlikely	Low	Extensive surveys failed to locate this species and there are no records within close proximity to the study area.
Hoary Sunray <i>Leucochrysum albicans var. tricolor</i> E EPBC	An annual or biennial forb which occurs from Queensland to Victoria and in Tasmania, west from the tablelands. Records from Queensland are historic, and the species most current northern occurrence is Goulburn, NSW (OEH). The species could easily be confused with the unlisted <i>L. molle</i> (distribution NWS, CWS, plains and far inland).	OEH Atlas – 2 records (dated 2005-2008) located within semi-vegetated areas S and SW of Ulan Colliery.	Present	Unlikely	Low	Extensive surveys failed to locate this species and there are no records within close proximity to the study area.

Species	Ecology and distribution	Records	Transmission line			Notes
			Presence of Habitat	Likelihood of Occurrence	Potential for Impact	
Spiny Peppergrass <i>Lepidium aschersonii</i> V TSC V EPBC	Erect perennial herb to 30 cm high. Not widespread, occurring in the marginal central-western slopes and north-western plains regions of NSW (and potentially the south western plains).	Nearest record over 100 km to west of Study Area, from 2003 and in different vegetation community to any found on site.	Present	Unlikely	Low	No records within the study area.
Ozothamnus tessellatus V TSC V EPBC	Dense shrub to 1m high. Grows in eucalypt woodland north of Rylstone.	Recorded in the Goulburn River NP.	Present	Unlikely	Low	Extensive surveys failed to locate this species and there are no records within close proximity to the study area.
Omeo Stork's-bill <i>Pelargonium sp. striatellum</i> MS E EPBC	<p>Pelargonium sp. striatellum (G.W.Carr 10345) is known to occur in NSW and Victoria (NSW SC, 2010) on 5 widely separated tableland lakes between Lake Omeo and Lake Bathurst.</p> <p>It grows just above the high water level of irregularly inundated or ephemeral lakes. During dry periods, the species is known to colonise exposed lake beds.</p>	Not recorded on the NSW OEH Database. Predicted to occur from the EPBC Database.	N/A	N/A	N/A	No records within the study area.
Clandulla Geebung <i>Persoonia marginata</i> V TSC V EPBC	Low spreading shrub. Grows in dry sclerophyll forest on sandstone, restricted to area between Kandos and Portland.	Known to occur in Goulburn River NP.	Present	Unlikely	Low	Extensive surveys failed to locate this species and there are no records within close proximity to the study area.
Philotheca ericifolia V EPBC	Shrub growing to 2 m high .This species inhabits the north-western slopes and central western slopes of NSW, from the upper Hunter Valley, to Pilliga and to the Peak Hill district (Harden 1991). The species is found at Goonoo Forest near Mogriguy, Pilliga Forest, Harvey Ranges and Peak Hill (Ayres <i>et al.</i> 1996). Grows from damp sandy flats to rocky ridges and clifftops (but possibly in seepage areas in this situation as it is said to be water-loving). Found after fire or other disturbance.	Known to occur in Goulburn River NP.	Present	Unlikely	Low	Extensive surveys failed to locate this species and there are no records within close proximity to the study area.
Leek-orchid <i>Prasophyllum sp. Wybong</i> CE EPBC	<i>Prasophyllum</i> sp. Wybong is a terrestrial orchid known from nine populations between Muswellbrook and the Pilliga area, of which the Wybong population is the largest. Habitat is open eucalypt woodland and grassland, presumably principally or entirely on sedimentary substrates such as sandstone.	A number of populations are present more than 50 km to east of Study Area. This species is highly restricted.	Present	Unlikely	Low	Cryptic species that flowers in spring.

Species	Ecology and distribution	Records	Transmission line			Notes
			Presence of Habitat	Likelihood of Occurrence	Potential for Impact	
Scant Pomaderris <i>Pomaderris queenslandica</i> E TSC	A 2-3m shrub growing in open forest, chiefly on Slopes, north from Peak Hill district, also in Gloucester district, NC, NWS, CWS, Q. DECC: widely scattered, a few locations on New England Tbl and NWS including Torrington and Coolatai, and on NC, in moist eucalypt forest or sheltered woodlands with a shrubby understorey, occasionally along creeks. Bell (2001) collected recently in upper Hunter – 2 sites near Denman (single plant each) & several plants on creek on Diamond Ridge Trail in Manobalai NR N of Denman, and in new additions to Towarri NP near Scone.	Scattered records from Goulburn River NP. Grows along creeklines and moist eucalypt forest/woodland.	Marginal	Unlikely	Low	No records within the study area.
Denman Pomaderris <i>Pomaderris reperta</i> CE TSC CE EPBC	In dry sclerophyll woodland, along a single ridgeline over 1ha in the Denman area (Muswellbrook LGA). Growing with <i>E. crebra</i> , <i>E. blakelyi</i> , <i>Allocasuarina littoralis</i> , <i>Notelaea microcarpa</i> . Bell (2001): recently located at Myambat Logistics Company site W of Denman along the same sandstone ridgeline (20-40 plants).	Not found in surveys of Goulburn River or Wollemi NP or Manobalai NR.	Present	Unlikely	Low	No records within the study area.
Silky Pomaderris <i>Pomaderris sericea</i> E TSC V EPBC	Previously only an old record from Berrima area (CT) and Vic. Found in Benjang Gap area of NW Wollemi NP (Bell, 2001).	Not recorded on the NSW OEH Database or EPBC database.	Present	Unlikely	Low	No records within the study area.
Singleton Mint Bush <i>Prostanthera cineolifera</i> V TSC V EPBC	Strongly aromatic shrub. Apparently grows in sclerophyll forest, distribution unclear, NC? CC? DECC: restricted to a few localities near Walcha, Scone and St Albans in open woodland on exposed sandstone ridges. Presumed to be short-lived (10-20 years).	Nearest record over 50 km to the east of the Study Area.	Present	Unlikely	Low	No records within the study area.
Wollemi Mint-bush <i>Prostanthera cryptandroides</i> subsp. <i>cryptandroides</i> V TSC V EPBC	Strongly aromatic shrub. Grows in dry sclerophyll forest, heath or rock scrub, often in rocky sites, chiefly Lithgow to Sandy Hollow area. Also north from Sandy Hollow into Border Rivers/Gwydir catchment and Qld. In open forest,. Flowers Sept-May.	In Wollemi NP and probably in Goulburn River NP.	Present	Unlikely	Low	Extensive surveys failed to locate this species and there are no records within close proximity to the study area.
<i>Prostanthera discolor</i> V TSC V EPBC	Narrow-leaved, strongly aromatic shrub. Flowers Sept-Oct. In dry sclerophyll forest in rocky gullies in Sandy Hollow-Merriwa area.	Known to occur in Goulburn River NP.	Present	Unlikely	Low	Extensive surveys failed to locate this species and there are no records within close proximity to the study area.

Species	Ecology and distribution	Records	Transmission line			Notes
			Presence of Habitat	Likelihood of Occurrence	Potential for Impact	
Mount Vincent Mint-bush <i>Prostanthera stricta</i> V TSC V EPBC	Shrub to 2 x 3m, aromatic. Flowers winter-spring. Grows in sclerophyll forest, in sandy alluvium near streams, Widdin Valley area, CWS.	Known to occur in Goulburn River NP.	Present	Unlikely	Low	Extensive surveys failed to locate this species and there are no records within close proximity to the study area.
Pultenaea sp. olinda E TSC	An erect to procumbent shrub with spreading hairy stems. Known only from a small area at Currant Mountain Gap east of Rylstone within the Rylstone Local Government Area. The majority of known individuals occur within Wollemi National Park.	Nearest records approximately 50 km to the southeast of the Study Area.	Present	Unlikely	Low	Extensive surveys failed to locate this species and there are no records within close proximity to the study area.
Inland Rustyhood <i>Pterostylis cobarensis</i> V EPBC	Terrestrial orchid, flowering Sept-Oct, growing on “sparsely treed rocky hills, stony slopes and in mallee communities, sometimes on isolated rocky outcrops” (Jones, 2006). The known distribution of this species is Broken Hill-Nyngan area to Young (Jones, 2006). Terrestrial orchids seldom persist in heavily grazed areas and the likelihood of this species occurring in farming areas is very low.	Not recorded on the NSW OEH Database. Predicted to occur from the EPBC Database.	Present	Unlikely	Low	No records within the Study Area.
Rulingia procumbens V TSC V EPBC	Prostrate shrub, stems to 30cm long. In sandy sites (often roadsides), mainly in Dubbo-Mendooran-Gilgandra area, also Pilliga and Nymagee areas, CWS, NWP, SWP. Also recent collections from upper Hunter (W-facing spur and a nearby ridge near Sandy Hollow on crown reserve between Goulburn River NP and Manobalai NR– Bell, 2001) and 4 populations in Goonoo SF. Associated spp = <i>E. dealbata</i> , <i>sideroxylon</i> , <i>fibrosa</i> , <i>albans</i> , <i>melliodora</i> , <i>Callitris glaucophylla</i> , <i>Acacia triptera</i> , <i>Philotheca salsolifolia</i> , <i>Calytrix tetragona</i> . Also found on slopes of Mt Dangar in Goulburn River NP, in a burnt area – may be a fire ephemeral.	Known to occur in Goulburn River NP.	Present	Unlikely	Low	Extensive surveys failed to locate this species and there are no records within close proximity to the study area.
Senecio linearifolius var. dangarensis E TSC	Weakly shrubby perennial forb to 2 metres high. <i>Senecio linearifolius</i> var. <i>dangarensis</i> is restricted to a single known population in the Goulburn River National Park where it has been recorded growing on an open scree slope and in woodland and rainforest communities on basalt. The population is estimated to contain 500 - 1000 individuals over an area of 20 hectares.	Recorded in the Goulburn River NP.	Absent	None	No	No habitat present.

Species	Ecology and distribution	Records	Transmission line			Notes
			Presence of Habitat	Likelihood of Occurrence	Potential for Impact	
<i>Stemmacantha australis</i> Extinct TSC	Erect, thistle-like forb to 60cm. Early records from the Jenolan Caves area and “Namoi River”, where it is thought to have grown on heavy soils. Possibly extinct in NSW.	Only three records in NSW, over 50 km to the east of the Study Area.	N/A	N/A	N/A	Species considered extinct.
Slender Darling Pea <i>Swainsona murrayana</i> V TSC V EPBC	Prostrate to erect forb to 25cm high. “Often grows with <i>Maireana</i> species on heavy soils, especially in depressions, west from Warialda district, NWS, CWS, SWS, NWP, SWP, Q, Vic, Tas” (Harden 2002). Mostly W slopes and plains, with records from between Dubbo and Moree. In saltbush, black box and grassland communities on plains, floodplains and depressions, occasionally on intermittently cultivated or grazed sites.	Nearest record over 60 km to the north of the Study Area.	Absent	None	N/A	No habitat present.
Silky Swainson-pea <i>Swainsona sericea</i> V TSC	Prostrate to erect forb to 10cm high, stems silvery hairy. Grows in grassland or grassy eucalypt woodland, sometimes with <i>Callitris</i> , widespread, tablelands, slopes, plains, Vic, SA.	Found at one location on transmission line site.	Present	Present	High	Assessment of Significance undertaken
Austral Toadflax <i>Thesium australe</i> V TSC V EPBC	In <i>Themeda</i> grassland, coastal headlands and inland grassland or grassy woodland, NC, CC, SC, NT, ST, NWS, CWS, Q, Vic, Tas, E Asia. A partial root parasite on Kangaroo Grass (<i>Themeda australis</i>). Unlikely to persist in heavily grazed sites, or to occur where Kangaroo Grass is not at least moderately common.	OEH Atlas – one record (dated 1959) located in Cassilis.	Present in parts	Possible	Mod	Assessment of Significance undertaken
<i>Tylophora linearis</i> V TSC E EPBC	A small vine which grows in dry scrub and open forest in the Barraba, Mendooran, Temora and West Wyalong districts, NWS, CWS, Q. Common associated species are <i>E fibrosa</i> , <i>sideroxylon</i> , <i>albans</i> , <i>Callitris</i> spp, <i>Allocasuarina leuhmanii</i> , <i>Acacia hakeoides</i> , <i>A. lineata</i> .	Not recorded on the NSW OEH Database. Predicted to occur from the EPBC Database.	Present	Unlikely	Low	No records within the Study Area.
Wollemi Pine <i>Wollemia nobilis</i> E TSC E EPBC	Restricted to remote canyons in the Wollemi National Park, north-west of Sydney. Occurs in warm temperate rainforest and rain forest margins in remote sandstone canyons.	Not recorded on the NSW OEH Database. Predicted to occur from the EPBC Database.	N/A	N/A	N/A	No records within the Study Area.
Keith's Zieria <i>Zieria ingramii</i> E TSC E EPBC	Slender, spindly shrub to 0.6 m high, known only from Goonoo SF near Dubbo (Harden 2002), growing in dry sclerophyll forest on light sandy soils.	Not recorded on the NSW OEH Database or EPBC database.	Present	Unlikely	Low	No records within the Study Area.

KEY:

V TSC

Listed as Vulnerable on the *NSW Threatened Species Conservation Act, 1995*

E TSC

Listed as Endangered on the *NSW Threatened Species Conservation Act, 1995*

V EPBC

Listed as Vulnerable on the *Environmental Protection Biodiversity Conservation Act, 1999*

E EPBC Listed as Endangered on the *Environmental Protection Biodiversity Conservation Act, 1999*
CE EPBC Listed as Critically Endangered on the *Environmental Protection Biodiversity Conservation Act, 1999*
M EPBC Listed as Migratory on the *Environmental Protection Biodiversity Conservation Act, 1999*

N/A indicates that the threatened species search did not return the species for the Transmission Line Study Area (returned for the Windfarm study area).

C.2 ENDANGERED ECOLOGICAL COMMUNITIES

EEC name & Status*	Description	Transmission line	
		Presence on site	Potential to be impacted
Brigalow within Brigalow Belt South (BBS), Nandewar & Darling River Plains (DRP) bioregions (<i>Acacia harpophylla</i>)	Dense scrubs or clumps in open box and myall communities on clay loam soils north from Roto. Dominated by <i>Acacia harpophylla</i> , with pockets of <i>Casuarina cristata</i> and <i>Eucalyptus populnea</i> subsp. <i>bimbil</i> . The canopy tends to be quite dense and the understorey and ground cover are only sparse.	Absent	No
<i>Cadellia pentastylis</i> (ooline) community in the Nandewar and BBS bioregions	In thickets, W from Tenterfield and N from Maules Ck (49km SE of Narrabri). A distinctive community with the canopy dominated by <i>Cadellia pentastylis</i> , sometimes with emergent eucalypts. Now known from seven main locations on the NW Slopes between Narrabri and the Qld border, and in Qld. Usually on undulating terrain on a variety of soil types, 300-450m altitude.	Absent	No
Carbeen (<i>Corymbia tessellaris</i>) open forest community in DRP and BBS bioregions	Woodland on flat, deep soils of med-high fertility, N from Woodenbong, N and NW from Narrabri	Absent	No
Central Hunter Grey Box-Ironbark Woodland in the New South Wales North Coast and Sydney Basin Bioregions EEC TSC	Occurs in the Central Hunter Valley between about Singleton and Muswellbrook, in areas of relatively low rainfall and high temperatures. It is associated mostly with Permian lithology, and is situated on gently undulating hills, slopes and valleys, or occasionally on rocky knolls. Typically forms a woodland dominated by <i>Eucalyptus crebra</i> , <i>Brachychiton populneus</i> and <i>E. moluccana</i> . Other tree species such as <i>Angophora floribunda</i> and <i>Callitris endlicheri</i> may be present and occasionally dominate or co-dominant. Common shrub species include <i>Notelaea microcarpa</i> , <i>Breyenia oblongifolia</i> , <i>Bursaria spinosa</i> , <i>Cassinia quinquefaria</i> and <i>Dodonaea viscosa</i> . Subshrubs may also be common and include <i>Solanum cinereum</i> , <i>Phyllanthus virgatus</i> and <i>Maireana microphylla</i> . Ground cover can be moderately dense to dense, and consist of numerous forbs and grass species as well as a small number of ferns, sedges and twiners.	Absent as although the southern end of the site is within the Sydney Basin bioregion, it is not in the central Hunter Valley.	No
Coolibah-Black Box woodland of the northern riverine plains in the DRP and BBS bioregions (<i>E. coolabah</i> , <i>E. largiflorens</i>) EEC EPBC	Grassy woodland on heavy black clay soils in seasonally flooded areas.	Absent	No
Fuzzy Box Woodland on alluvial soils of the South Western Slopes, Darling Riverine Plains & Brigalow Belt South bioregions (<i>Eucalyptus conica</i>) EEC TSC	Grassy or shrubby woodland on light loamy soils of med fertility N from Wagga. A woodland or open forest usually dominated by <i>Eucalyptus conica</i> , which often grows with <i>E. microcarpa</i> , <i>E. melliodora</i> or <i>Brachychiton populneus</i> (or less often <i>E. blakelyi</i> , <i>E. intertexta</i> or <i>E. populnea</i>). <i>Allocasuarina luehmannii</i> is common in places. It occurs on loam or clay alluvial or colluvial soils on prior streams & abandoned channels or slight depressions on the undulating plains or flats of the western slopes of the Great Dividing Range, often upslope from River Red Gum communities, just above frequently inundated areas on the floodplain. It also occurs on colluvial soils on lower slopes and on valley flats.	Absent	No

EEC name & Status*	Description	Transmission line	
		Presence on site	Potential to be impacted
Grey Box (<i>Eucalyptus microcarpa</i>) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia EEC EPBC	A grassy woodland found on relatively fertile soils of the western slopes and plains of NSW, Victoria and Qld in which <i>Eucalyptus microcarpa</i> (Inland Grey Box) is the most characteristic species. Prober and Thiele (2004) identified a correlation between <i>Eucalyptus microcarpa</i> communities and soils of Tertiary and Quaternary alluvial origin. This ecological attribute helps distinguish between Inland Grey Box Woodlands and the White Box Yellow Box Blakely's Red Gum Woodland. The latter community generally occurs further east and typically occupies a wide variety of alluvial and non-alluvial soils. Grey Box woodland also more often contains chenopod shrubs in the understorey.	Absent. Although Inland Grey Box occurs on site, it is in shrubby sandstone forest and as remnant paddock trees in areas where the community has been historically cleared, and no longer forms part of the EEC.	No
Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions EEC TSC	See above. This is similar to the above EPBC-listed community, but has a lower condition threshold.	Absent, as above.	No
Hunter Valley Weeping Myall Woodland in the Sydney Basin bioregion (<i>Acacia pendula</i>)	<i>Acacia pendula</i> , which may occur with <i>E. crebra</i> , <i>A. salicina</i> (Cooba) and/or trees within the <i>A. homalophylla</i> <i>A. melvillei</i> complex. Understorey shrubs may be absent or include <i>Canthium buxifolium</i> , <i>Dodonaea viscosa</i> , <i>Geijera parviflora</i> , <i>Notelaea microphylla</i> var. <i>microphylla</i> and <i>Senna zygophylla</i> . Groundcover varies from dense to sparse, and includes a range of grasses and forbs. Grows on alluvial flats.	Absent	No
Hunter Floodplain Red Gum Woodland in the NSW North Coast and Sydney Basin Bioregions EEC TSC	Generally occurs on floodplains and associated floodplain rises along the Hunter River and tributaries and typically forms a tall woodland. All sites are within the NSW North Coast and Sydney Basin Bioregions. Typical eucalypts are <i>Angophora floribunda</i> , <i>E. camaldulensis</i> , <i>E. melliodora</i> , <i>E. tereticornis</i> sometimes with <i>Casuarina cunninghamii</i> and <i>C. glauca</i> .	Absent as there are no floodplains within this part of the site.	No
Hunter Valley Footslopes Slaty Gum Woodland in the Sydney Basin Bioregion EEC TSC	Generally occurs at the interface of Narrabeen Sandstone and Permian sediments in the Hunter Valley and typically forms a low to mid-high woodland. All sites are within the Sydney Basin Bioregion. Typical eucalypts are <i>E. dawsonii</i> , <i>crebra</i> , <i>moluccana</i> and <i>punctata</i> , with small trees <i>Brachychiton populneus</i> , <i>Callitris endlicheri</i> , <i>Allocasuarina leuhmannii</i> , <i>Geijera salicifolia</i> , shrubs <i>Myoporum montanum</i> , <i>Notelaea microcarpa</i> , <i>Olearia elliptica</i> .	Absent	No
Hunter Valley Vine Thicket in the NSW North Coast and Sydney Basin Bioregions EEC TSC		Absent	No

EEC name & Status*	Description	Transmission line	
		Presence on site	Potential to be impacted
Myall Woodland in the DRP, BBS, Cobar Penepplain bioregions (<i>Acacia pendula</i>)	Typically occurs on red-brown earths and heavy textured alluvial soils within a climatic belt receiving between 375 and 500 mm rainfall. Structure varies from low woodland to low sparse woodland or open shrubland, depending on site quality and disturbance history. The tree layer grows up to a height of about 10 metres and invariably includes <i>Acacia pendula</i> as one of the dominant species or the only tree species present. The understorey includes an open layer of chenopod shrubs and other woody plant species and an open to continuous groundcover of grasses and herbs.	Absent	No
Native vegetation on cracking clay soils of the Liverpool Plains EEC TSC	Mainly a native grassland community which includes a range of small forb and herb species. The main grass species include <i>Aurolastipa aristiglumis</i> , <i>Dichanthium sericeum</i> and <i>Panicum queenslandicum</i> . May contain scattered shrubs and trees, including <i>Acacia pendula</i> , <i>Angophora floribunda</i> , <i>Eucalyptus conica</i> , <i>E. populnea</i> and <i>E. melliodora</i> . In wetter locations rushes and sedges are common. It occurs on the highly fertile cracking clay soils of the Liverpool Plains. Located around Coonabarabran, Gunnedah, Murrurundi, Narrabri, Tamworth and Quirindi, on the NWS & NWP.	N/A as site is not on the Liverpool Plains.	No
Natural grasslands on basalt and fine-textured alluvial plains of northern New South Wales and southern Queensland CEEC EPBC	Essentially the same community as the preceding one, but with the Commonwealth listing covering a wider geographical area.	Absent, grasslands are all derived from clearing of woodland or forest.	No
Semi-evergreen Vine Thicket in the BBS & Nandewar bioregions	A low, dense dry rainforest <10 m high, made up of vines and rainforest trees & shrubs. Includes <i>Cassine australis</i> var. <i>angustifolia</i> , <i>Geijera parvifolia</i> , <i>Notelaea microcarpa</i> var. <i>microcarpa</i> , <i>Ehretia membranifolia</i> , with taller eucalypts and cypress pines from surrounding woodland vegetation emerging above the main canopy. Currant Bush (<i>Carissa ovata</i>) is often present and typical vines include <i>Parsonsia eucalytophylla</i> and <i>Pandorea pandorana</i> . Often occurs on rocky hills, in high nutrient soils derived from basalt or other volcanic rocks, in areas which are sheltered from frequent fire. A scattered distribution near Gunnedah, Barraba, Bingara and Warialda on the NWS & NWP & Qld.	Absent	No
Upland Basalt Eucalypt Forests of the Sydney Basin Bioregion EEC EPBC		Absent in this part of the site	No
White Box-Yellow Box-Blakely's Red Gum (Grassy) Woodland (and Derived Native Grassland) EEC TSC CEEC EPBC	Grassy woodland widespread on the NSW tablelands and slopes, growing on flats, slopes or ridges on higher fertility soils, restricted to drainage lines on poorer soils. Characteristic trees are Yellow Box (<i>E. melliodora</i>), White Box (<i>E. albens</i>) and Blakely's Red Gum (<i>E. blakelyi</i>).	Present	Yes – Assessments of Significance carried out for both the TSC-listed community and the EPBC-listed community.

KEY:

EEC TSC

Listed as an Endangered Ecological Community on the *NSW Threatened Species Conservation Act, 1995*

CEEC TSC

Listed as a Critically Endangered Ecological Community on the *NSW Threatened Species Conservation Act, 1995*

EEC EPBC

Listed as an Endangered Ecological Community on the *Environmental Protection Biodiversity Conservation Act, 1999*

CEEC EPBC

Listed as a Critically Endangered Ecological Community on the *Environmental Protection Biodiversity Conservation Act, 1999*

C.3 FAUNA

Species	Form and Habitat	Records	Transmission Line			Notes
			PH	L	PI	
Amphibians						
Sloane's Froglet <i>Crinia sloanei</i> VTSC	Sloane's Froglet has been recorded from widely scattered sites in the floodplains of the Murray-Darling Basin, with the majority of records in the Darling Riverine Plains, NSW South Western Slopes and Riverina bioregions in New South Wales. It has not been recorded recently in the northern part of its range and has only been recorded infrequently in the southern part of its range in NSW. It is typically associated with periodically inundated areas in grassland, woodland and disturbed habitats (DECCW 2009).	Not recorded on the NSW OEH Database or EPBC database.	N/A	N/A	N/A	No records within the Study Area.
Giant Burrowing Frog <i>Heleioporus australiacus</i> V TSC V EPBC	The species is predicted to be associated with dry forest environments (elevation 150-900m) with high habitat complexity (Penman <i>et al.</i> 2007). It will travel several hundred metres to creeks to breed. It has also been recorded in roadside drains and near slow-flowing creek pools with fringing fern and sedge vegetation. Breeds summer and autumn, apparently in burrows in creek banks, favouring deep loam soils. Coastal lowlands are generally considered unsuitable habitat and the species is rarely associated with permanent ponds or streams (DEWHA 2009; Penman <i>et al.</i> 2007). However, records around Vincentia and Ulladulla suggest this species may in fact be found on coastal lowlands (<100mASL).	Known to occur in Goulburn River NP.	Marginal	Unlikely	Low	No records within the Study Area.
Giant Barred Frog <i>Mixophyes iteratus</i> E TSC E EPBC	Giant Barred Frogs are large frogs, up to 115 mm in length. They are olive to dark brown above with paler or darker blotches, and cream to pale yellow below. The skin is finely granular. The pupil of the eye is vertical and the iris is pale golden in the upper half and brown in the lower half. Coast and ranges from south-eastern Queensland to the Hawkesbury River in NSW. North-eastern NSW, particularly the Coffs Harbour-Dorrigo area, is now a stronghold. Considered to have disappeared south of the Hawkesbury and there are no recent records from the Blue Mountains.	Goulburn River NP – 2 records (dates 2001-2002) SE of Ulan.	Marginal	Unlikely	Low	Inhabits flowing rocky streams, generally in rainforest. No typical habitat in Study Area.

Species	Form and Habitat	Records	Transmission Line			Notes
			PH	L	PI	
Red-crowned Toadlet <i>Pseudophryne australis</i> V TSC	The Red-crowned Toadlet is an unmistakable small frog, usually measuring less than 30 mm long. It is dark brown to black, with distinctive reddish-orange patches, one between the eyes and one along the rump. It also has a white patch at the base of each arm. The belly is marbled black and white. The tadpoles are black and reach about 25 mm. The short, grating and "squelchy" call can be heard all year round. The Red-crowned Toadlet has a restricted distribution. It is confined to the Sydney Basin, from Pokolbin in the north, the Nowra area to the south, and west to Mt Victoria in the Blue Mountains.	Predicted to occur in Coolah Tops NP and Goulburn River NP.	Marginal	Unlikely	Low	Unlikely to occur as far west as the Study Area, and typical sandstone drainage line habitat is absent.
Bush Stone-curlew <i>Burhinus grallarius</i> E TSC	Has a broad distribution although has suffered severe declines throughout its range, particularly in disturbed and fragmented areas and where foxes are common (DEC 2006a). In NSW, it is not found on the escarpments but on lower elevation grassy woodlands of the coast or west of the divide. The area bounded roughly by Albury, Wagga Wagga, Hay and Wentworth is regarded as the stronghold for the species in NSW (DEC 2006a). This species inhabits open forests and grassy woodlands where it builds nests directly on the ground (DECCW). It requires logs, fallen trees and branches, coarse litter and some shrubs for shelter. Foraging may occur over a wide area within woodlands, paddocks, grasslands, residential gardens and saltmarsh (DEC 2006a). Breeding pairs are generally sedentary within home ranges estimated to be 250-600ha for foraging year round, with a core of 10-25ha during breeding. It is very vulnerable to predation by exotic predators, the clearing of native woodlands, habitat degradation and even trampling by stock.	OEH Atlas – One record (dated 2005) located approx 8km W of Ulan near Cope SF. Predicted to occur in Coolah Tops NP.	Marginal	Unlikely	Low	Habitat for this species within the Transmission Line Study Area is marginal and there are no records of this species.
Speckled Warbler <i>Chthonicola sagittata</i> V TSC	This species occurs in a wide range of eucalypt woodland communities in the hills and tablelands of the Great Dividing range. Habitats typically are structurally diverse with a grassy understorey, a sparse shrub layer and an open canopy (DECCW 2010; Watson <i>et al.</i> , 2001). Declines have been linked to habitat fragmentation as the species appears to be locally extinct in districts where no habitat fragments larger than 100ha remain (Watson <i>et al.</i> , 2001). Further, larger remnants (about 300ha) may be required for populations to be viable (Gardner, 2002). The species is sedentary and nests and forages on the ground. Nests are built directly on the ground amongst leaf litter and understorey vegetation and are vulnerable to predation by large birds such as Currawongs (Gardner, 2002).	OEH Atlas – 75 records (dated 1963-2010) scattered records concentrated around vegetated areas within Durrigere SF, Goulburn River NP, Coolah Tops NP and vegetated areas north of Ulan Colliery.	Present	Present	High habitat loss	Assessment of Significance undertaken.

Species	Form and Habitat	Records	Transmission Line			Notes
			PH	L	PI	
<p>Brown Treecreeper (eastern subspecies) <i>Climacteris picumnus victoriae</i> V TSC</p>	<p>Occurs in eucalypt woodlands, mallee and drier open forest of eastern Australia, preferring woodlands lacking dense understorey (Schodde and Tidemann 2007). Feeds on insects in the leaf litter and trunks of trees. Nests in tree hollows, stumps or rotted fence posts. Requires relatively intact woodland areas, nesting in a tree hollow.</p>	<p>OEH Atlas – 81 records (dated 1963-2009) scattered through study area but with most records vegetated areas north of Ulan Colliery and within Goulburn River NP. Also several records within Coolah Tops NP.</p>	Present	Present	High habitat loss	Assessment of Significance undertaken.
<p>Varied Sittella <i>Daphoenositta chrysoptera</i> V TSC</p>	<p>The Varied Sittella is a small (10 cm) songbird with a sharp, slightly upturned bill, short tail, barred undertail, and yellow eyes and feet. In flight the orange wing-bar and white rump are prominent. In NSW most individuals have a grey head and are streaked with dark brown, but in the extreme north-east they have a white head, and in the extreme south-west a black cap. Varied Sittellas are more active and acrobatic among branches than the larger treecreepers. They fly into the heads of trees, typically working their way down branches and trunk with constant motion. The Varied Sittella is sedentary and inhabits most of mainland Australia except the treeless deserts and open grasslands. Distribution in NSW is nearly continuous from the coast to the far west.</p>	<p>OEH Atlas – 18 records (dated 1976-2010) scattered throughout vegetated areas along the proposed powerline routes and one record within W part of Coolah Tops NP.</p>	Present	Present	High habitat loss	Assessment of Significance undertaken.
<p>White-fronted Chat <i>Epthianura albifrons</i> V TSC</p>	<p>The White-fronted Chat is found across the southern half of Australia, from southernmost Queensland to southern Tasmania, and across to Western Australia as far north as Carnarvon. Found mostly in temperate to arid climates and very rarely sub-tropical areas, it occupies foothills and lowlands up to 1000 m above sea level. In NSW, it occurs mostly in the southern half of the state, in damp open habitats along the coast, and near waterways in the western part of the state. The species is gregarious, usually found foraging on bare or grassy ground in wetland areas, singly or in pairs. They are insectivorous, feeding mainly on flies and beetles caught from or close to the ground.</p>	<p>Predicted to occur in Coolah Tops NP.</p>	Marginal	Possible	Low	Habitat for this species within the Transmission Line Study Area is marginal and there are no records of this species.

Species	Form and Habitat	Records	Transmission Line			Notes
			PH	L	PI	
Regent Honeyeater <i>Anthochaera phrygia</i> E TSC E EPBC M EPBC	There are now only a small number of known breeding sites in NSW, the most important of which are: Warrumbungles NP, Pilliga NR, Barraba district, central coast around Gosford, Hunter Valley, and Capertee Valley (DECCW 2010). Most records are from box-ironbark eucalypt associations and it appears to prefer wetter fertile sites within these associations (Menkhorst <i>et al.</i> , 1999). It is a generalist forager, which mainly feeds on the nectar from a wide range of eucalypts and mistletoes. Key eucalypt species include Mugga Ironbark, Yellow Box, Yellow Gum, Blakely's Red Gum and White Box (Menkhorst <i>et al.</i> , 1999). It also occurs in riparian forests of River She-oak and wet lowland coastal forests dominated by Swamp Mahogany and Spotted Gum and (DECCW 2010). The species can undertake large-scale nomadic movements in the order of hundreds of kilometres.	OEH Atlas – 11 records (dated 1985-2000) mostly from eastern Goulburn River NP and SW of Ulan.	Present	Possible	Low habitat loss	Habitat in the Transmission Line Study Area is generally unsuitable for this species, with just scattered occurrences of Box-Gum Woodland and River Oak Forest.
Painted Honeyeater <i>Grantiella picta</i> V TSC	This species primarily occurs on the inland slopes of the Great Dividing Range, although is nomadic and may occur in low densities in other parts of NSW in suitable habitat. It inhabits dry open forests and woodland including Boree, Brigalow and Box Gum Woodlands and Box-Ironbark open forests, also paperbark and casuarinas (DECCW 2010; Pizzey <i>et al.</i> , 2003). It is a specialist feeder on mistletoe, particularly of genus <i>Amyema</i> , and generally requires 5 or more mistletoes per hectare (DECCW 2010). Seasonal migrant, movements are linked to the fruiting of mistletoe.	OEH Atlas – 3 records (dated 2005) located within semi-cleared areas west of Curryall SF and near Goulburn River Stone Cottages.	Present	Present	High habitat loss	Assessment of Significance undertaken.
Pied Honeyeater <i>Certhionyx variegatus</i> V TSC	Inhabits wattle shrub (primarily Mulga, <i>Acacia aneura</i>), mallee, spinifex and eucalypt woodlands, usually when shrubs are flowering; feeds on nectar, predominantly from various species of emu-bushes (<i>Eremophila</i> spp.); also from mistletoes and various other shrubs (e.g. <i>Brachysema</i> spp. and <i>Grevillea</i> spp.); also eats saltbush fruit, berries, seed, flowers and insects.	N/A	Marginal	Possible	Low	Habitat for this species within the Transmission Line Study Area is marginal and the only record in the region is from Munghorn Gap NR to the south.
Black-chinned Honeyeater (eastern subspecies) <i>Melithreptus gularis gularis</i> V TSC	This species is widespread west of the Great Dividing Range, although has declined throughout its range due to removal and fragmentation of habitat. It inhabits the upper levels of drier open forests or woodlands most often dominated by box and ironbark eucalypts, particularly Mugga Ironbark, White Box, Grey Box, Yellow Box and Forest Red Gum. A gregarious species usually seen in pairs and small groups of up to 12 birds and occupies large home ranges of at least 5 hectares. Local populations appear not to persist in remnants less than 200 ha in area (NSW Scientific Committee, 2001).	OEH Atlas – 9 records (dated 1998-2006) concentrated around vegetated areas of Goulburn River NP, NW section of Coolah Tops NP and north of Ulan Colliery.	Present	Present	High habitat loss	Assessment of Significance undertaken.

Species	Form and Habitat	Records	Transmission Line			Notes
			PH	L	PI	
Gilbert's Whistler <i>Pachycephala inornata</i> V TSC	<p>This species is sparsely distributed over much of the arid and semi-arid zone of inland southern Australia, west of the western slopes of NSW (DECCW 2010). There are only three separate populations left in NSW. Most of the eastern population occurs in an area enclosed by a line joining Gilgandra to Cobar, then south to Narrandera, east to Wagga Wagga, north to Wellington and back to Gilgandra.</p> <p>In NSW the species occurs mostly in mallee shrubland in association with Spinifex and low shrubs. It also occurs in box-ironbark woodlands, Cypress Pine and Belah woodlands and River Red Gum forests. In woodland habitats, the species requires a dense shrubby understorey (DECCW 2010).</p>	Not recorded on the NSW OEH Database or EPBC database.	Marginal	Unlikely	Low	No records within the Study Area.
Hooded Robin (south-eastern form) <i>Melanodryas cucullata cucullata</i> V TSC	<p>This species is sparsely distributed throughout much of NSW, and is rarely found on the coast. It is sedentary and occurs in open eucalypt woodland and scrub, often in or near cleared areas (DECCW 2010). The species generally occurs in woodland remnants with high habitat complexity (Watson <i>et al.</i>, 2001) and uses stumps, posts or fallen timber for nesting and locating prey on the ground. Territories range from 10 to 30ha (DECCW 2010).</p>	OEH Atlas – 18 records (dated 63-2009) from vegetated areas along Ulan Rd, Goulburn River NP, north of Ulan Colliery and two records from NW part of Coolah Tops NP.	Present	Possible	Low habitat loss	Not recorded in the Study Area despite extensive surveys.
Scarlet Robin <i>Petroica boodang</i> V TSC	<p>The Scarlet Robin is found in south-eastern Australia and south-west Western Australia. In NSW it occupies open forests and woodlands from the coast to the inland slopes. Scarlet robins breed in dry eucalypt forests and temperate woodland. Fallen timber is an important habitat feature for this species.</p>	OEH Atlas -15 records dated (1975-2009) with majority of records from NW section of Coolah Tops NP and come scattered records around Ulan Colliery.	Marginal	Present	High habitat loss	Assessment of Significance undertaken.
Flame Robin <i>Petroica phoenicea</i> V TSC	<p>Flame Robins are found throughout south-eastern Australia, associated with areas of native vegetation with an open understorey. It breeds in upland forests and woodlands and migrates to more open lowland habitats in winter. The South Western Slopes bioregion is considered the core wintering region for this species (DECCW 2010).</p>	OEH Atlas – 4 records (dated 1975-2005) with majority of records from NW section of Coolah Tops NP.	Marginal	Possible	Low habitat loss	Not recorded in the Study Area despite extensive surveys.
Pink Robin <i>Petroica rodinogaster</i> V TSC	<p>The male Pink Robin has a sooty black throat and upperparts. The wings have faint, tan-buff wing-bars. The breast and belly are deep lilac-pink, and there is a small white patch on the forehead. The Pink Robin is found in Tasmania and the uplands of eastern Victoria and far south-eastern NSW, almost as far north as Bombala. On the mainland, the species disperses north and west and into more open habitats in winter, regularly as far north as the ACT area, and sometimes being found as far north as the central coast of NSW.</p>	Not recorded on the NSW OEH Database or EPBC database.	Marginal	Possible	Low	Not likely to occur as far north as the Study Area, and not recorded in the Study Area despite extensive surveys.

Species	Form and Habitat	Records	Transmission Line			Notes
			PH	L	PI	
<p>Grey-crowned Babbler (eastern subspecies) <i>Pomatostomus temporalis temporalis</i> V TSC</p>	<p>In NSW this species occurs west of the Great Dividing Range and on the coast near the Hunter Valley and several locations on the north coast of NSW. It prefers Box Gum Woodlands although also inhabits open forests, scrub lands, even farmlands and suburbs (DECCW 2010; Pizey <i>et al.</i>, 2003). The species is gregarious and forage on the ground on invertebrates on tree trunks and branches and by foraging amongst litter and tussocks. Territories of family groups range from one to fifty hectares (DECCW 2010).</p>	<p>OEH Atlas – 35 records (dated 1975-2010) concentrated around Ulan Colliery and to the north. One record from Coolah Tops NP.</p>	Present	Present	High habitat loss	Assessment of Significance undertaken.
<p>Rufous Fantail <i>Rhipidura rufifrons</i> M EPBC</p>	<p>This species is found in a variety of habitats including eucalypt woodlands and watercourses where it nests in a horizontal fork of a tree up to 12m from the ground. Breeds in southern Australia, but is known to migrate to inland Australia, PNG, Solomon Islands, New Caledonia and Indonesia.</p>	<p>Predicted to occur from the EPBC Database.</p>	Marginal	Possible	Low	Not recorded despite extensive surveys and habitat is marginal.
<p>Diamond Firetail <i>Stagonopleura guttata</i> V TSC</p>	<p>Occurs predominantly west of the Great Dividing Range (Blakers <i>et al.</i> 1984) although local populations are known. Feeds predominantly on the ground on grass seeds, in groups from 5 to 150 individuals (Schodde and Tidemann 2007), nesting in pairs or communally in shrubs and small trees. Restricted largely to ungrazed or lightly grazed woodland remnants of grassy eucalypt woodlands, including Box-Gum and Snow Gum Woodlands, and grassland and riparian areas, and sometimes lightly wooded farmland. May form large flocks during winter and autumn.</p>	<p>OEH Atlas – 24 records (dated 1963-2010) with majority of records concentrated within vegetated areas E and W of the proposed transmission line routes.</p>	Marginal	Possible	Moderate habitat loss	Assessment of Significance undertaken.
<p>Little Lorikeet <i>Glossopsitta pusilla</i> V TSC</p>	<p>Forages primarily in the canopy of open <i>Eucalyptus</i> forest and woodland, yet also finds food in <i>Angophoras</i>, <i>Melaleucas</i> and other tree species. Riparian habitats are particularly used, due to higher soil fertility and hence greater productivity. Isolated flowering trees in open country, e.g. paddocks, roadside remnants and urban trees also help sustain viable populations of the species.</p>	<p>OEH Atlas – 12 records (dated 1963-2008) scattered throughout study area near Ulan, Goulburn River NP and Coolah Tops NP.</p>	Present	Recorded to the north of the Study area during the survey period	Moderate habitat loss	Assessment of Significance undertaken.

Species	Form and Habitat	Records	Transmission Line			Notes
			PH	L	PI	
Gang-gang Cockatoo <i>Callocephalon fimbriatum</i> V TSC	<p>In NSW, this species is distributed from the south-east coast to the Hunter region, and inland to the Central Tablelands and south-west slopes. It occurs regularly in the ACT. It feeds in pairs or small flocks on seeds of eucalypts and wattles, and occurs primarily in heavily timbered and mature wet forest, but occasionally in towns, farming areas (DECCW 2010). It is often a seasonal altitudinal migrant, moving to lower altitudes and more open forests and woodlands (particularly Box-Ironbark assemblages for winter. This species requires large hollows in which to breed (Gibbons and Lindenmayer, 2000)</p>	<p>OEH Atlas – Four records (dated 2000-2006) located in vegetated areas near Curryall SF, within Goulburn River NP and 3km north of Ulan Colliery. Closest record 2.2km from powerline.</p>	Marginal	Possible	Low habitat loss	Unlikely to occur frequently, and would not rely on the Study Area for foraging or breeding.
Glossy Black-Cockatoo <i>Calyptorhynchus lathami</i> V TSC	<p>Inhabits open forest and woodlands of the coast and the Great Dividing Range up to 1000 m in which stands of She-oak species, particularly Black She-oak (<i>Allocasuarina littoralis</i>), Forest She-oak (<i>A. torulosa</i>) or Drooping She-oak (<i>A. verticillata</i>) occur. Feeds almost exclusively on the seeds of several species of she-oak (<i>Casuarina</i> and <i>Allocasuarina</i> species), shredding the cones with the massive bill.</p>	<p>OEH Atlas – 260 records (dated 1975-2010) scattered throughout study area, several records located on proposed powerline routes.</p> <p>Moolarben Coal Project (2006) – 39 records mainly from veg assoc. with Black Cypress Pine near Ulan Rd and adjacent ridges.</p>	Present (in isolated areas)	Present (feather collected)	High habitat loss	Assessment of Significance undertaken.
Swift Parrot <i>Lathamus discolor</i> E TSC E EPBC	<p>This species breeds in Tasmania, migrating to south and eastern NSW in autumn/winter where it inhabits eucalypt forests and woodlands, particularly Box-Ironbark Forests of central Victoria and southern NSW (DECCW 2010; Smales, 2005). Mostly occurs on the south-west slopes. It feeds on nectar flowers of eucalypts and lerp-insects, also soft fruits and berries sometimes foraging in grass (Pizzey and Knight 2003). Favoured feed trees include winter flowering species such as Swamp Mahogany, Spotted Gum, Red Bloodwood, Mugga Ironbark, and White Box (DECCW 2010).</p>	<p>OEH Atlas – 2 records (dated 2005) located approx. 4km W of Curryall SF in a cleared area.</p> <p>Predicted to occur in Coolah Tops NP.</p>	Marginal	Unlikely	Low	Favoured feed trees uncommon in the Transmission Line Study Area and was not recorded despite extensive surveys.
Major Mitchell's Cockatoo <i>Lophochroa leadbeateri</i> V TSC	<p>Inhabits a wide range of treed and treeless inland habitats, always within easy reach of water. In NSW it is found regularly as far east as about Bourke and Griffith, and sporadically further east than that. Feeds mostly on the ground, especially on the seeds of native and exotic melons and on the seeds of species of saltbush, wattles and cypress pines.</p>	<p>Not recorded on the NSW OEH Database or EPBC database.</p>	N/A	N/A	N/A	No records from Study Area or surrounding region.

Species	Form and Habitat	Records	Transmission Line			Notes
			PH	L	PI	
Turquoise Parrot <i>Neophema pulchella</i> V TSC	<p>In NSW, this species is typically recorded west of the escarpment in the tablelands and on the western slopes, extending to the coastal districts through the Hunter Valley (DECCW 2010). It occurs in grassy woodland and open forest carrying a mixed assemblage of White Box, Yellow Box, Blakely's Red Gum, Red Box and Red Stringybark (NPWS, 1999f). The species will also utilise the edges of woodland, timbered ridges and creeks in farmland and nests in tree hollows, logs or posts (DECCW 2010). The species lives in pairs or small groups and forages on the ground.</p>	<p>OEH Atlas – 14 records (dated 1975-2008) located mostly within Goulburn River NP and one record from Coolah Tops NP.</p>	Marginal	Possible	Low minor habitat loss	Habitat in Transmission Line generally unsuitable for this species.
Superb Parrot <i>Polytelis swainsonii</i> V TSC V EPBC	<p>This species is found throughout eastern inland NSW. On the South-western slopes the core breeding area is roughly bounded by Cowra and Yass in the east, and Grenfell, Cootamundra and Coolac in the west (DECCW 2010). It inhabits Box-Gum, Box-Cypress-pine and Boree Woodlands and River Red Gum Forest. The species nests in the hollows of large trees (dead or alive) in open Box Gum Woodland or isolated paddock trees. Species known to be used for nesting are Blakely's Red Gum, Yellow Box, Apple Box and Red Box (DECCW 2010). It forages on the ground in grassy woodland, also on fruit, seeds and blossoms of acacias, eucalypts and mistletoes (Pizzey and Knight, 2003).</p>	<p>Not recorded on the NSW OEH Database or EPBC database.</p>	N/A	N/A	N/A	No records from the Study Area or surrounding region.
Square-tailed Kite <i>Lophoictinia isura</i> V TSC	<p>This species has a large and sparsely populated range throughout mainland Australia (Griffioen and Clarke, 2002) and is a breeding migrant to the south east from July to December. It occurs primarily in coastal and sub-coastal open forest, woodlands and mallee. It has been recorded inland along timbered watercourses and adjacent areas. The species hunts small passerines, especially honeyeaters in the tree canopy. Resident pairs have large hunting ranges of greater than 100 km² (DECCW 2010). Nests are a platform of sticks up to 90cm in diameter in a fork of a tall tree in forest or woodland (DEC NSW, 2004).</p>	<p>OEH Atlas – Four records (dated 2000-2002) located in open and vegetated areas approx. 13km east of Ulan, within the Goulburn River NP and adjacent farming areas.</p>	Marginal	Possible	High minor habitat loss, potential nest site loss	Assessment of Significance undertaken.

Species	Form and Habitat	Records	Transmission Line			Notes
			PH	L	PI	
Red Goshawk <i>Erythrotriorchis radiatus</i> CE TSC V EPBC	This raptor is distributed sparsely through northern and eastern Australia, from the western Kimberley Division of northern Western Australia to north-eastern Queensland and south to far north-eastern NSW, and with scattered records in central Australia. The species is very rare in NSW, extending south to about 30°S, with most records north of this, in the Clarence River Catchment, and a few around the lower Richmond and Tweed Rivers. Formerly, it was at least occasionally reported as far south as Port Stephens. Red Goshawks inhabit open woodland and forest, preferring a mosaic of vegetation types, a large population of birds as a source of food, and permanent water, and are often found in riparian habitats along or near watercourses or wetlands. In NSW, preferred habitats include mixed subtropical rainforest, <i>Melaleuca</i> swamp forest and riparian <i>Eucalyptus</i> forest of coastal rivers.	Not recorded on the NSW OEH Database. Predicted to occur from the EPBC Database.	Marginal	Unlikely	Low	No records from region.
Little Eagle <i>Hieraetus morphnoides</i> V TSC	Occupies open eucalypt forest, woodland or open woodland. Sheoak or acacia woodlands and riparian woodlands of interior NSW are also used. Nests in tall living trees within a remnant patch, where pairs build a large stick nest in winter.	OEH Atlas – Eleven records (dated 1975-2004). Several located around the Ulan colliery and within Durridgere SF as well as near Coolah and Coolah Tops NP approx. 2.5km from the proposed Wind Farm.	Marginal	Possible	Low	Few historical records, and no individuals observed in the Study Area despite extensive surveys.
Black-breasted Buzzard <i>Hamirostra melanosternon</i> V TSC	Lives in a range of inland habitats, especially along timbered watercourses which is the preferred breeding habitat. Also hunts over grasslands and sparsely timbered woodlands. Not a powerful hunter, despite its size, mostly taking reptiles, small mammals, birds, including nestlings, and carrion. Also specialises in feeding on large eggs, including those of emus, which it cracks on a rock. Breeds from August to October near water in a tall tree. The stick nest is large and flat and lined with green leaves. Normally two eggs are laid.	OEH Atlas – One record (dated 2005) recorded approx. 10km SW of Turill, located on the edge of grassland/woodland vegetation.	Marginal	Unlikely	Low	Sparsely scattered records throughout eastern NSW, and species not observed in Study Area despite extensive surveys.
Grey Falcon <i>Falco hypoleucos</i> E TSC	The Grey Falcon is sparsely distributed in NSW, chiefly throughout the Murray-Darling Basin, with the occasional vagrant east of the Great Dividing Range. Usually restricted to shrubland, grassland and wooded watercourses of arid and semi-arid regions, although it is occasionally found in open woodlands near the coast. Also occurs near wetlands where surface water attracts prey. Utilises old nests of other birds of prey and ravens, usually high in a living eucalypt near water or a watercourse	Known from Coolah Tops NP.	N/A	N/A	N/A	Not likely to occur in Study Area and unlikely to rely on available habitat for any stage of life cycle.

Species	Form and Habitat	Records	Transmission Line			Notes
			PH	L	PI	
Spotted Harrier <i>Circus assimilis</i> V TSC	The Spotted Harrier occurs in a variety of habitats including grassy open woodland and riparian woodland. They generally do not occur in densely forested or wooded habitats of the coast, escarpment and ranges. It is commonly associated with native grasslands.	OEH Atlas – Three records (dated 1997-2008) located at Ulan Colliery, near Uarbry and 10km SW of Turill. Records located in open semi-cleared areas. Known from Coolah Tops NP.	Marginal	Possible	Low	Only marginal habitat present in Study Area, and species not recorded despite extensive surveys.
Malleefowl <i>Leipoa ocellata</i> E TSC V EPBC	The Malleefowl is a large (60 centimetres long, 43 centimetres high and weighing between 1.5 and 2.5 kilograms), distinctive, ground-dwelling bird. It possesses robust, powerful legs, a short bill and a flattish head while the wings are short, broad and rounded at the tip. The head and neck is greyish above, topped with black, the chin is chestnut and the throat and chest are white with a central black stripe. The stronghold for this species in NSW is the mallee in the south west centred on Mallee Cliffs NP and extending east to near Balranald and scattered records as far north as Mungo NP. West of the Darling River a population also occurs in the Scotia mallee including Tarawi NR and Scotia Sanctuary, and is part of a larger population north of the Murray River in South Australia.	Goulburn River NP – one record (dated 1989) near Mogo.	Absent	Unlikely	No	Database searches did not show any records of this species within the Transmission Line Study Area.
Plains Wanderer <i>Pedionomus torquatus</i> E TSC	The vast majority (>99%) of records of Plains-wanderers in NSW over the past 30 years come from an area of the western Riverina bounded by Hay and Narrandera on the Murrumbidgee River in the north, the Cobb Highway in the west, the Billabong Creek in the south, and Urana in the east. Even within its western Riverina stronghold, the Plains-wanderer has a very patchy distribution. They occur in semi-arid, lowland native grasslands that typically occur on hard red-brown soils. These grasslands support a high diversity of plant species, including a number of state and nationally threatened species. Grassland habitat structure is more important than species composition. Preferred habitat typically has 50% bare ground, 10% fallen litter, and the remaining 40% comprised of herbs, forbs and grasses.	OEH Atlas – One record (dated 1984) from near Uarbry approx. 8.5km west of the powerline.	Marginal	Unlikely	No	No recent records from Study Area, and habitat is generally unsuitable.

Species	Form and Habitat	Records	Transmission Line			Notes
			PH	L	PI	
Australian Bustard <i>Ardeotis australis</i> E TSC	Mainly inhabits tussock and hummock grasslands, though prefers tussock grasses to hummock grasses; also occurs in low shrublands and low open grassy woodlands; occasionally seen in pastoral and cropping country, golf courses and near dams. Breeds on bare ground on low sandy ridges or stony rises in ecotones between grassland and protective shrubland cover; roosts on ground among shrubs and long grasses or under trees. Forages on insects, young birds, lizards, mice, leaves, seeds and fruit. Dispersive, with irregular widespread movements over long distances; movements are thought to be in response to habitat and climatic conditions; known to converge on areas with high mice numbers and in recently burnt areas.	Not recorded on the NSW OEH Database or EPBC database.	N/A	N/A	N/A	Database searches did not show any records of this species within the Transmission Line Study Area.
Black-tailed Godwit <i>Limosa limosa</i> V TSC	Primarily a coastal species. Usually found in sheltered bays, estuaries and lagoons with large intertidal mudflats and/or sandflats. Further inland, it can also be found on mudflats and in water less than 10 cm deep, around muddy lakes and swamps	Not recorded on the NSW OEH Database or EPBC database.	N/A	N/A	N/A	Database searches did not show any records of this species within the Transmission Line Study Area.
Australian Painted Snipe or Painted Snipe <i>Rostratula benghalis</i> E TSC V EPBC M EPBC	In NSW, this species has been recorded at the Paroo wetlands, Lake Cowell, Macquarie Marshes and Hexham Swamp. It is most common in the Murray-Darling Basin (DECCW 2010). It inhabits inland and coastal ephemeral and permanent freshwater wetlands, especially where there is a cover of vegetation. It has been recorded on the margins of wetlands, dams and even sewage ponds, also found in wet pastures, marshy areas, irrigation systems, tea tree scrub and adjacent open woodlands (Pizzey and Knight 2003). The species is likely to be nomadic in response to suitable conditions, such as floods (DECCW 2010).	Predicted to occur in Coolah Tops NP.	Marginal	Unlikely	Low	Database searches did not show any records of this species within the Transmission Line Study Area.
Black-necked Stork <i>Ephippiorhynchus asiaticus</i> E TSC	It occurs mostly in the southern half of the state, in damp open habitats along the coast, and near waterways in the western part of the state. Along the coastline, it is found predominantly in saltmarsh vegetation but also in open grasslands and sometimes in low shrubs bordering wetland areas. Gregarious species, usually found foraging on bare or grassy ground in wetland areas, singly or in pairs. In Australia, Black-necked Storks are widespread in coastal and subcoastal northern and eastern Australia, south to central-eastern NSW and with vagrants recorded at scattered sites well away from the coast. In NSW, the species becomes increasingly uncommon south of the Northern Rivers region, and rarely occurs south of Sydney.	Not recorded on the NSW OEH Database or EPBC database.	N/A	N/A	N/A	Database searches did not show any records of this species within the Transmission Line Study Area.

Species	Form and Habitat	Records	Transmission Line			Notes
			PH	L	PI	
Australasian Bittern <i>Botaurus poiciloptilus</i> E TSC E EPBC	Little is known of the behaviour of this cryptic waterbird. May be nomadic as it has been observed occupying ephemeral wetlands. Seeds and invertebrates are foraged for on the water's edge.	Predicted to occur in Coolah Tops NP.	N/A	N/A	N/A	Database searches did not show any records of this species within the Transmission Line Study Area.
Black Bittern <i>Ixobrychus flavicollis</i> V TSC	The Black Bittern has a wide distribution, from southern NSW north to Cape York and along the north coast to the Kimberley region. The species also occurs in the south-west of Western Australia. In NSW, records of the species are scattered along the east coast, with individuals rarely being recorded south of Sydney or inland. Inhabits both terrestrial and estuarine wetlands, generally in areas of permanent water and dense vegetation. Where permanent water is present, the species may occur in flooded grassland, forest, woodland, rainforest and mangroves.	Nearest record more than 50 km to north west.	N/A	N/A	N/A	Database searches did not show any records of this species within the Transmission Line Study Area.
Brolga <i>Grus rubicunda</i> E TSC	This species was formally found across Australia, except for the south-east corner. It inhabits large open wetlands, grassy plains, coastal mudflats and irrigated croplands. Breeding and foraging habitat includes shallow (< 50 cm) wetlands, mudflats and margins of deeper water bodies with emergent vegetation (e.g. canegrass, lignum or sedges) (DECCW 2009).	Not recorded on the NSW OEH Database or EPBC database.	N/A	N/A	N/A	Database searches did not show any records of this species within the Transmission Line Study Area.
Magpie Goose <i>Anseranas semipalmata</i> V TSC	The Magpie Goose is a large, distinctive black and white water-bird (from 70 - 90 cm long) with a prominent knob on the head, and orange legs. It is black at each 'end' - head, neck and upper chest, plus rump and tail - with white body and wings in between. Immature birds have no head-knob and their white parts are mottled grey or brown. It is not a duck or goose, but is regarded as a primitive relative of them. The Magpie Goose is still relatively common in the Australian northern tropics, but had disappeared from south-east Australia by 1920 due to drainage and overgrazing of reed swamps used for breeding. Since the 1980s there have been an increasing number of records in central and northern NSW. Vagrants can follow food sources to south-eastern NSW.	Not recorded on the NSW OEH Database or EPBC database.	N/A	N/A	N/A	Database searches did not show any records of this species within the Transmission Line Study Area.

Species	Form and Habitat	Records	Transmission Line			Notes
			PH	L	PI	
Freckled Duck <i>Stictonetta naevosa</i> V TSC	<p>This species occurs on wetlands of inland NSW. Large temporary swamps created by floods in the Bulloo and Lake Eyre basins and the Murray-Darling system, particularly along the Paroo and Lachlan Rivers, and other rivers within the Riverina are a breeding stronghold (DECCW 2010). The species is partially migratory and may move to coastal habitats during severe inland drought. The species inhabits a variety of plankton-rich wetland types, including swamps, lakes, farm dams, sewerage ponds and floodwaters that are heavily vegetated with Cumbungi, Lignum, Canegrass or Tea-tree (DECCW 2010).</p>	<p>Not recorded on the NSW OEH Database or EPBC database.</p>	N/A	N/A	N/A	<p>Database searches did not show any records of this species within the Transmission Line Study Area.</p>
Barking Owl <i>Ninox connivens</i> V TSC	<p>This species is found throughout Australia except for the central arid regions and Tasmania. It has declined across much of its range across NSW and is most frequently recorded on the western slopes and plain. It occurs in dry box-dominated forest and woodlands and roosts in dense foliage of <i>Acacia</i>, <i>Casuarina</i> or <i>Eucalyptus</i> species. It nests in large hollows (20-46 cm diameter) of large, old eucalypts including River Red Gum, White Box, Red Box and Blakely's Red Gum (NPWS 2003a). Nest and roost sites are usually near watercourses or wetlands (NPWS, 2003a). The species have also been recorded in remnants of forest and woodland and in clumps of trees at farms, towns and golf courses (NPWS, 2003a). Have large territories of 30 to more than 200 hectares (NPWS, 2003a).</p>	<p>OEH Atlas – 11 records (dated 1976-2006) scattered throughout study area, mostly around Coolah and Goulburn River NP. One record from Durrigere SF approx. 1.4km from the proposed powerline route and one record approx. 2km from turbine envelope. Most records located in vegetated areas or on edges.</p>	Marginal	Possible	High habitat loss	<p>Assessment of Significance undertaken.</p>
Powerful Owl <i>Ninox strenua</i> V TSC	<p>This species occurs primarily in tall, moist productive eucalypt forests of the eastern tableland edge and the mosaic of wet and dry sclerophyll forests occurring on undulating, gentle terrain nearer the coast (DEC NSW, 2006b). Only scattered, mainly historical records are from the western slopes and plains (DECCW 2010). The species requires old hollow eucalypts in unlogged, unburnt forests for nesting, and roosts in dense mid-canopy trees or tall shrubs (She-oaks, wattles or rainforest species). Nesting and roosting habitat occurs in sheltered gullies, or within 100m of streams, creekflats or minor drainage lines (DEC NSW, 2006b). Hollows greater than 45 cm diameter and greater than 100 cm deep are required. Breeding pairs of this species defend large (300-1500 hectare), permanent territories. Optimal habitat includes a tall shrub layer with abundant hollows and supporting high densities of arboreal marsupials (DEC NSW, 2006b).</p>	<p>OEH Atlas – 24 records dated (1985-2012) scattered throughout Study area, mostly from vegetated areas within Goulburn River NP and Coolah Tops NP. Some records located along powerline route.</p>	Marginal	Possible	High habitat loss	<p>Assessment of Significance undertaken.</p>

Species	Form and Habitat	Records	Transmission Line			Notes
			PH	L	PI	
Masked Owl <i>Tyto novaehollandiae</i> V TSC	Extends from the coast where it is most abundant to the western plains. Overall records for this species fall within approximately 90% of NSW, excluding the most arid north-western corner. There is no seasonal variation in its distribution. Roosts and breeds in moist eucalypt forested gullies, using large tree hollows or sometimes caves for nesting. Lives in dry eucalypt forests and woodlands from sea level to 1100 m. A forest owl, but often hunts along the edges of forests, including roadsides. Pairs have a large home-range of 500 to 1000 hectares.	OEH Atlas – five records (dated 1993-2005) from within densely vegetated areas of Goulburn River NP, Coolah Tops NP and near Uarbry.	Marginal	Possible	High habitat loss	Assessment of Significance undertaken.
White-throated Needletail <i>Hirundapus caudacutus</i> M EPBC	Noted as one of the world's fastest birds, this species has been recorded in the airspace above woodlands, forests and farmlands. Often seen 'patrolling' favoured feeding grounds above ridges and hilltops. This species migrates to Australia from mid-October and is a regular summer migrant until April when it returns to breed.	Predicted to occur from the EPBC Database.	Marginal	Possible	Low	May occur on occasion but not likely to rely on Study Area for any stage of the lifecycle.
Rainbow Bee-eater <i>Merops ornatus</i> M EPBC	This species inhabits open woodlands with sandy, loamy soil. It builds a burrow in sandy ground or bank cuttings such as roads or creeks. The species is a summer breeding migrant (Sept-Apr) to south-eastern Australia, but winters in northern Australia, Solomon Islands, PNG and Indonesia.	Predicted to occur from the EPBC Database. Observed in Study Area.	Marginal	Present	Low	May occur on occasion but not likely to rely on Study Area for any stage of the lifecycle.
Satin Flycatcher <i>Myiagra cyanoleuca</i> M EPBC	This species is found in heavily vegetated gullies in forests, usually above a shrub layer. During migration it is often found in coastal forests. It breeds mostly in south-east Australia, and usually departs in March to winter in northern QLD, PNG and the Torres Strait Islands. Occasional vagrant to New Zealand.	Predicted to occur from the EPBC Database.	Marginal	Possible	Low	May occur on occasion but not likely to rely on Study Area for any stage of the lifecycle.
Fork-tailed Swift <i>Apus pacificus</i> M EPBC	This species breeds from central Siberia eastwards through Asia and winters south to Australia. Uncommon in eastern Australia. It spends most of its time in the air feeding on insects, occasionally roosting on cliffs or in large trees (Pizzey <i>et al.</i> , 2006). It occurs throughout mainland Australia, mostly west of the divide.	Predicted to occur from the EPBC Database.	Marginal	Possible	Low	May occur on occasion but not likely to rely on Study Area for any stage of the lifecycle.

Species	Form and Habitat	Records	Transmission Line			Notes
			PH	L	PI	
Great Egret <i>Ardea alba</i> M EPBC	The Great Egret has been reported in a wide range of wetland habitats (for example inland and coastal, freshwater and saline, permanent and ephemeral, open and vegetated, large and small, natural and artificial). These include swamps and marshes; margins of rivers and lakes; damp or flooded grasslands, pastures or agricultural lands; reservoirs; sewage treatment ponds; drainage channels; salt pans and salt lakes; salt marshes; estuarine mudflats, tidal streams; mangrove swamps; coastal lagoons; and offshore reefs. The Great Egret can retreat to permanent wetlands or coastal areas when other wetlands are dry (for example, during drought). This may occur annually in some regions with regular wet and dry seasons or erratically where the availability of wetland habitat is also erratic.	Predicted to occur from the EPBC Database.	Marginal	Possible	Low	May occur on occasion but not likely to rely on Study Area for any stage of the lifecycle.
Cattle Egret <i>Ardea ibis</i> M EPBC	The Cattle Egret occurs in tropical and temperate grasslands, wooded lands and terrestrial wetlands. It has occasionally been seen in arid and semi-arid regions however this is extremely rare. High numbers have been observed in moist, low-lying poorly drained pastures with an abundance of high grass; it avoids low grass pastures. It has been recorded on earthen dam walls and ploughed fields. It is commonly associated with the habitats of farm animals, particularly cattle, but also pigs, sheep, horses and deer. The Cattle Egret is known to follow earth-moving machinery and has been located at rubbish tips. It uses predominately shallow, open and fresh wetlands including meadows and swamps with low emergent vegetation and abundant aquatic flora. They have sometimes been observed in swamps with tall emergent vegetation (Marchant & Higgins 1990; Morton <i>et al.</i> 1989).	Predicted to occur from the EPBC Database.	Marginal	Possible	Low	May occur on occasion but not likely to rely on Study Area for any stage of the lifecycle.
Latham's Snipe, Japanese Snipe <i>Gallinago hardwickii</i> M EPBC	Latham's Snipe occurs in permanent and ephemeral wetlands up to 2000 m above sea-level. They usually inhabit open, freshwater wetlands with low, dense vegetation (e.g. swamps, flooded grasslands or heathlands, around bogs and other water bodies). However, they can also occur in habitats with saline or brackish water, in modified or artificial habitats, and in habitats located close to humans or human activity. They usually occur in open, freshwater wetlands that have some form of shelter (usually low and dense vegetation) nearby.	Predicted to occur from the EPBC Database.	Marginal	Unlikely	Low	May occur on occasion but not likely to rely on Study Area for any stage of the lifecycle.
White-bellied Sea-eagle <i>Haliaeetus leucogaster</i> M EPBC	This species occurs around coastal areas, islands and estuaries, but is also found in inland areas around large rivers, wetlands and reservoirs. This species shows a high fidelity to nest sites, where it constructs conspicuous stick nests in the forks of tall trees and stags.	Predicted to occur from the EPBC Database. Observed at Ulan Mine dam.	Marginal	Possible	Low	May have nest in locality, but likely to be close to water and not in vicinity of proposed Transmission Line routes.

Species	Form and Habitat	Records	Transmission Line			Notes
			PH	L	PI	
Reptiles						
Large-eared Pied Bat <i>Chalinolobus dwyeri</i> V TSC	Found mainly in areas with extensive cliffs and caves, from Rockhampton in Queensland south to Bungonia in the NSW Southern Highlands. It is generally rare with a very patchy distribution in NSW. It roosts in caves (near their entrances), crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of the Fairy Martin (<i>Hirundo ariel</i>), frequenting low to mid-elevation dry open forest and woodland close to these features. Females have been recorded raising young in maternity roosts (c. 20-40 females) from November through to January in roof domes in sandstone caves. Found in well-timbered areas containing gullies.	OEH Atlas – 7 records (dated 2000) with all records located within vegetated areas of Goulburn River NP. Also recorded from Coolah Tops NP.	Marginal	Present (Anabat record)	High	Assessment of Significance undertaken.
Little Pied Bat <i>Chalinolobus picatus</i> V TSC	This species occurs in dry open forest, open woodland, mulga woodlands, chenopod shrublands, cypress-pine forest, mallee, bimbil box (DECCW 2010). It roosts in caves, rock outcrops, mine shafts, tunnels, tree hollows and buildings. It often forages along watercourses (Menkhorst and Knight 2003) where it feeds on moths and possibly other flying invertebrates.	Not recorded on the NSW OEH Database or EPBC database.	N/A	N/A	N/A	Database searches did not show any records of this species within the Transmission Line Study Area.
Little Bentwing-bat <i>Miniopterus australis</i> V TSC	East coast and ranges of Australia from Cape York in Queensland to Wollongong in NSW. Moist eucalypt forest, rainforest, vine thicket, wet and dry sclerophyll forest, <i>Melaleuca</i> swamps, dense coastal forests and banksia scrub. Generally found in well-timbered areas. Roost in caves, tunnels, tree hollows, abandoned mines, stormwater drains, culverts, bridges and sometimes buildings during the day, and at night forage for small insects beneath the canopy of densely vegetated habitats.		Marginal	Possible	Low	Database searches did not show any records of this species within the Transmission Line Study Area.
Eastern Bentwing-bat <i>Miniopterus schreibersii oceanensis</i> V TSC	This species is a common although a vulnerable species that is likely to be widely distributed throughout the region. It roosts and raises its young in caves and mine tunnels (Strahan 1995). The species appears to forage above the forest canopy in a diverse range of forest types (Strahan 1995). The species forms discrete populations centred on a maternity cave that is used annually in spring and summer for the birth and rearing of young.	OEH Atlas – 2 records (dated 1997-2000) located within Goulburn River NP. Also recorded in Coolah Tops NP.	Marginal	Present (Anabat record)	Moderate Habitat loss	Assessment of Significance undertaken.

Species	Form and Habitat	Records	Transmission Line			Notes
			PH	L	PI	
Eastern Freetail-bat <i>Mormopterus norfolkensis</i> V TSC	The Eastern Freetail-bat is found along the east coast from south Queensland to southern NSW. The species occurs in dry sclerophyll forest, woodland, swamp forests and mangrove forests east of the Great Dividing Range. It roosts mainly in tree hollows but will also roost under bark or in man-made structures.	N/A	Marginal	Possible	Low	
Corben's Long-eared Bat <i>Nyctophilus corbeni</i> V TSC V EPBC	The south eastern form of the Greater Long-eared Bat is also known as Eastern Long-eared Bat and has recently been described as new species Corben's Long-eared Bat (<i>N. corbeni</i>). Overall, the distribution of the south eastern form coincides approximately with the Murray Darling Basin with the Pilliga Scrub region being the distinct stronghold for this species. Inhabits a variety of vegetation types, including mallee, bullock <i>Allocasuarina leuhmanni</i> and box eucalypt dominated communities, but it is distinctly more common in box/ironbark/cypress-pine vegetation that occurs in a north-south belt along the western slopes and plains of NSW and southern Queensland. It roosts in tree hollows, crevices, and under loose bark. The species is a slow flying agile bat, utilising the understorey to hunt non-flying prey - especially caterpillars and beetles - and will even hunt on the ground.	OEH Atlas – 6 records (dated 2000-2002) with the majority of records from vegetated valleys within Goulburn NP and one record near Turill SF. Also known from Coolah Tops NP.	Marginal	Present (Anabat record)	Moderate Habitat loss	Assessment of Significance undertaken.
Yellow-bellied Sheath-tail-bat <i>Saccolaimus flaviventris</i> V TSC	This species is a wide-ranging species across northern and eastern Australia. It roosts alone or in groups of up to six, in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows (DECCW 2010). When foraging for insects, flies high and fast over the forest canopy, but lower in more open country. Seasonal movements are unknown, however the species may migrate to southern Australia in late summer and autumn.	Known to occur in Coolah Tops NP.	Marginal	Possible	Moderate	Assessment of Significance undertaken.
Eastern Cave Bat <i>Vespadelus troughtoni</i> V TSC	The Eastern Cave Bat is found in a broad band on both sides of the Great Dividing Range from Cape York to Kempsey, with records from the New England Tablelands and the upper north coast of NSW. The western limit appears to be the Warrumbungle Range, and there is a single record from southern NSW, east of the ACT. It is a cave-roosting species that is usually found in dry open forest and woodland, near cliffs or rocky overhangs; has been recorded roosting in disused mine workings, occasionally in colonies of up to 500 individuals.	Predicted to occur in Coolah Tops NP.	Marginal	Present (Anabat record)	Moderate	Assessment of Significance undertaken.

Species	Form and Habitat	Records	Transmission Line			Notes
			PH	L	PI	
Eastern False Pipistrelle <i>Falsistrellus tasmaniensis</i> V TSC	<p>It is widely distributed in eastern NSW from the Dividing Ranges through to the coast (Van Dyck & Strahan 2008). It is found in wet sclerophyll forest and coastal mallee. It appears to prefer wet sclerophyll forest although also utilises open forest at lower altitudes (Churchill 2008; Hall and Richards 1979). Absent from small patches of remnant forest, preferring continuous forest, although have been recorded foraging or moving through open/cleared landscapes (Churchill 2008). The Eastern False Pipistrelle prefers moist habitats, with trees taller than 20 m. It generally roosts in eucalypt hollows, but has also been found under loose bark on trees or in buildings. Hunts beetles, moths, weevils and other flying insects above or just below the tree canopy.</p>	<p>OEH Atlas – 2 records (dated 1993-2000) located in Goulburn River NP and Coolah Tops NP within close proximity to the proposed wind farm.</p>	Marginal	Possible	Low	Not recorded in the Study Area despite extensive surveys.
Greater Broad-nosed Bat <i>Scoteanax rueppellii</i> V TSC	<p>Utilises a variety of habitats from woodland through to moist and dry eucalypt forest and rainforest, though it is most commonly found in tall wet forest. Although this species usually roosts in tree hollows, it has also been found in buildings. Forages after sunset, flying slowly and directly along creek and river corridors at an altitude of 3 - 6 m. Open woodland habitat and dry open forest suits the direct flight of this species as it searches for beetles and other large, slow-flying insects; this species has been known to eat other bat species. Little is known of its reproductive cycle, however a single young is born in January; prior to birth, females congregate at maternity sites located in suitable trees, where they appear to exclude males during the birth and raising of the single young.</p>	<p>Known from Coolah Tops NP.</p>	Marginal	Possible	Low	Not recorded in the Study Area despite extensive surveys.
Greater Long-eared bat (south-eastern form)/ Eastern Long-eared Bat <i>Nyctophilus timoriensis</i> V TSC V EPBC	<p>The species prefers more arid regions, the distribution of the south eastern form approximately coincides with the Murray Darling Basin with the Pilliga Scrub region being the distinct stronghold for this species. This species inhabits a variety of vegetation types, including mallee, bulloke but more commonly box/ironbark/cypress-pine communities that occurs in a north-south belt along the western slopes and plains of NSW and southern Queensland (DECCW). It is a slow flying agile species and forages in the lower parts of the canopy, even amongst the shrub layers and on the ground (Menkhorst and Knight 2001) and often over water bodies. The species roosts in tree hollows, and under loose bark.</p>	<p>Not recorded on the NSW OEH Database or EPBC database.</p>	N/A	N/A	N/A	Database searches did not show any records of this species within the Transmission Line Study Area.

Species	Form and Habitat	Records	Transmission Line			Notes
			PH	L	PI	
Grey-headed Flying-fox <i>Pteropus poliocephalus</i> V TSC V EPBC	This species roosts in large camps, generally in wetter vegetation such as riparian areas, rainforest or swamp forest. Groups fly out at night to feed on fruit, nectar and blossom, particularly of <i>Eucalyptus</i> , <i>Melaleuca</i> and <i>Banksia</i> . This species shows fidelity to roosting areas but may feed in orchards. It appears to be showing increasing tolerance to human disturbance.	Predicted to occur in Coolah Tops NP.	Marginal	Possible	Low	Not recorded in the Study Area despite extensive surveys. Any individuals in region likely to be vagrants.
Spotted-tailed Quoll <i>Dasyurus maculatus</i> V TSC E EPBC	This species is found in a variety of forest types such as rainforest, wet and dry sclerophyll forest, woodland, coastal heath and scrub, sometimes Red Gum forest along inland waterways (Menkhorst and Knight, 2004). It utilises hollow-bearing trees, fallen logs, rock caves and crevices as denning and breeding sites (DECCW 2010). Mostly nocturnal it hunts mammals, birds and large arthropods. Females occupy home ranges up to about 750 hectares and males up to 3500 hectares; usually traverse their ranges along densely vegetated creeklines.	OEH Atlas – 2 records (dated 1980-2008) located along roadsides NW of Coolah and along the Golden Hwy SE of Cassilis. Known to occur in Coolah Tops NP.	Marginal	Possible	Low	Unlikely to be any populations remaining in Study Area.
Bilby <i>Macrotis lagotis</i> Extinct TSC V EPBC	Extinct.		-	-	-	
Yellow-bellied Glider <i>Petaurus australis</i> V TSC	They feed primarily on plant and insect exudates, including nectar, sap, honeydew and manna with pollen and insects providing protein. They den, often in family groups, in hollows of large trees. The species is very mobile and occupies large home ranges between 20 to 85 ha to encompass dispersed and seasonally variable food resources. Occur in tall mature eucalypt forest generally in areas with high rainfall and nutrient rich soils. Forest type preferences vary with latitude and elevation; mixed coastal forests to dry escarpment forests in the north; moist coastal gullies and creek flats to tall montane forests in the south.	Predicted to occur in Coolah Tops NP.	Marginal	Unlikely	Low	Unlikely to be any populations remaining in Study Area.

Species	Form and Habitat	Records	Transmission Line			Notes
			PH	L	PI	
Squirrel Glider <i>Petaurus norfolcensis</i> V TSC	This species inhabits mature or old growth Box, Box-Ironbark woodlands and River Red Gum forest west of the Great Dividing Range and Blackbutt-Bloodwood forest with heath understorey in coastal areas (DECCW 2010). It prefers mixed species stands with a shrub or Acacia understorey although will occur in areas where no understorey if there is more than one species of Eucalypt. Feeds on insects, nectar and exudates from leaves and trees (<i>Eucalyptus</i> and <i>Acacia</i>) and requires abundant tree hollows greater than 5cm diameter (DECCW 2010). It can use patches less than 1 ha & isolated trees if within 75 m of other patches (DECCW 2010). Has a mean home range of 1.4–9 ha (Ahern & van der Ree 2003; Quin, 1995; Ree and Bennett, 2003).	OEH Atlas – 16 records (dated 2000-2009) with most records from surveys done north of the Ulan Colliery within vegetated areas.	Moderate	Possible	High habitat loss	Assessment of Significance undertaken.
Brush-tailed Rock-wallaby <i>Petrogale penicillata</i> V TSC V EPBC	Isolated populations along the Great Dividing Range. This species prefers rocky habitats, including loose boulder-piles, rocky outcrops, steep rocky slopes, cliffs, gorges and isolated rock stacks. In many parts of their range, rock-wallabies are closely associated with dense arboreal cover, especially fig trees (NSW NPWS 2003a). The vegetation on and below the cliff appear to be important to this species as a source of food and shelter and in some cases may provide some protection from predation (Wong 1993; 1997). A range of vegetation types are associated with Brush-tailed Rock-wallaby habitat, including dense rainforest, wet sclerophyll forest, vine thicket, dry sclerophyll forest, and open forest (Murray <i>et al.</i> 2008).	OEH Atlas – 3 records (dated 1999-2009) located north of the Ulan Colliery and within the E part of Goulburn River NP. Known to occur in Coolah Tops NP.	Marginal	Unlikely	Low	Unlikely to be any populations remaining in Study Area.
Brush-tailed Phascogale <i>Phascogale tapoatafa</i> V TSC	Found in a variety of forest types although prefers dry sclerophyll forest with a sparse groundcover (DECCW). It generally occurs in areas where the annual rainfall exceeds 500mm. Have large overlapping territories between 20 – 100 hectares. It requires tree hollows with openings 25-40mm wide for nesting and utilises multiple trees throughout its lifetime. Prefer large trees and are most abundant where there are more than 2 trees per ha greater than 60cm DBH. It requires remnants greater than 25ha in dry forests and ridges.	Predicted to occur in Coolah Tops NP.	Marginal	Possible	Low	Unlikely to be any populations remaining in Study Area.

Species	Form and Habitat	Records	Transmission Line			Notes
			PH	L	PI	
Koala <i>Phascolarctos cinereus</i> V TSC V EPBC	<p>This species was historically abundant in the south of NSW, although now occurs in sparse and possibly disjunct populations. It occurs in woodland communities, coastal forests, woodlands of the tablelands and western slopes and the riparian communities of the western plains (NPWS, 2003b). May also utilise isolated paddock trees (NPWS, 2003b). Primary feed tree species listed for the central and southern tablelands are Ribbon Gum and River Red Gum, secondary species include Candle Bark, Blakely's Red Gum, White Box, Yellow Box and Brittle Gum (NPWS, 2003b).</p>	<p>OEH Atlas – 7 records (dated 1957-2002) with four of this located in close vicinity to the proposed wind farm site.</p>	Marginal	Possible	Low Potential minor habitat loss	<p>Feed trees common in parts of the Study Area, but species not recorded despite extensive surveys.</p>
Common Planigale <i>Planigale maculata</i> V TSC	<p>Common Planigales are tiny marsupials with a body length of about 8 cm and a tail as long again. They differ from the common house mouse in having a long, pointed snout and large rounded ears. The head has a flattened appearance. Their fur is grey-brown above, sometimes with tiny white spots, and paler below. Coastal north-eastern NSW, coastal east Queensland and Arnhem Land. The species reaches its confirmed southern distribution limit on the NSW lower north coast however there are reports of its occurrence as far south as the central NSW coast west of Sydney.</p>	<p>Known to occur in Coolah Tops NP.</p>	N/A	N/A	N/A	<p>Database searches did not show any records of this species within the Transmission Line Study Area.</p>
Pilliga Mouse <i>Pseudomys pilligaensis</i> V TSC V EPBC	<p>The Pilliga Mouse is very sparsely distributed and appears to prefer areas with a sparse ground cover. Some evidence exists of marked population fluctuations by this species. The Pilliga Mouse is restricted to an isolated area of low-nutrient deep sand which has long been recognised as supporting a distinctive vegetation type (Pilliga Scrub). Recent studies indicate that the Pilliga Mouse were found in greatest abundance in recently burnt moist gullies, areas dominated by broombush and areas containing an understorey of kurricabah (<i>Acacia burrowii</i>) with a bloodwood (<i>Corymbia trachyphloia</i>) overstorey. Consistent features of the latter two habitats were: a relatively high plant species richness; a moderate to high low shrub cover; and a moist groundcover of plants, litter and fungi. The gully where high rates of capture were encountered had an extensive cover by low grasses and sedges, with little shrub cover and large areas of ash-covered ground. It is nocturnal and appears to live in burrows.</p>	<p>Not recorded on the NSW OEH Database or EPBC database.</p>	N/A	N/A	N/A	<p>Database searches did not show any records of this species within the Transmission Line Study Area.</p>
New Holland Mouse <i>Pseudomys novaehollandiae</i> V EPBC	<p>The New Holland Mouse has been found from coastal areas and up to 100 km inland on sandstone country. The species has been recorded from sea level up to around 900 m above sea level. Due to the largely granivorous diet of the species, sites where the New Holland Mouse is found are often high in floristic diversity, especially leguminous perennials.</p>	<p>Recorded in Goulburn River NP.</p>	Marginal	Unlikely	Low	<p>Most records located more than 30 km to the east of the Study Area; unlikely to be any populations in the Study Area.</p>

Species	Form and Habitat	Records	Transmission Line			Notes
			PH	L	PI	
Stripe-faced Dunnart <i>Sminthopsis macroura</i> V TSC	A mouse-sized marsupial which is pale grey-brown above, with white underparts and feet. It has a slender pointed muzzle and a distinct black stripe that extends from between the eyes to between the ears. They often have a fattened carrot-shaped tail. Throughout much of inland central and northern Australia, extending into central and northern NSW, western Queensland, Northern Territory, South Australia and Western Australia. They are rare on the NSW Central West Slopes and North West Slopes with the most easterly records of recent times located around Dubbo, Coonabarabran, Warialda and Ashford.	Not recorded on the NSW OEH Database or EPBC database.	N/A	N/A	N/A	Database searches did not show any records of this species within the Transmission Line Study Area.
Eastern Pygmy-possum <i>Cercartetus nanus</i> V TSC	The Eastern Pygmy-possum is found in a broad range of habitats from rainforest through sclerophyll (including Box-Ironbark) forest and woodland to heath, but in most areas woodlands and heath appear to be preferred. It feeds largely on nectar and pollen collected from banksias, eucalypts and bottlebrushes, and also feeds on insects throughout the year. Shelters in tree hollows, rotten stumps, holes in the ground, abandoned bird-nests, Ringtail Possum (<i>Pseudocheirus peregrinus</i>) dreys or thickets of vegetation, (eg. grass-tree skirts); nest-building appears to be restricted to breeding females; tree hollows are favoured but spherical nests have been found under the bark of eucalypts and in shredded bark in tree forks.	Predicted to occur in Coolah Tops NP.	Marginal	Possible	Low	No records from region.
Reptiles						
Pink-tailed Legless Lizard <i>Aprasia parapulchella</i> V TSC V EPBC	This species is only known from the Central and Southern Tablelands, and the South Western Slopes (Osborne and Jones, 1995). It inhabits sloping, open woodland areas with predominantly native grass groundlayers, particularly those dominated by Kangaroo Grass (<i>Themeda australis</i>). Typically these areas are well-drained, with rocky outcrops or scattered, partially-buried rocks. Commonly found beneath small, partially-embedded rocks in burrows below these rocks; the burrows usually have been constructed by and are often still inhabited by small black ants and termites (Osborne and Jones, 1995). This species feeds on the larvae and eggs of these ants (DECCW 2010).	Goulburn River NP – One record (dated 2000) near Mogo.	Marginal	Unlikely	Low	Not recorded in Study Area despite extensive surveys.

Species	Form and Habitat	Records	Transmission Line			Notes
			PH	L	PI	
Pale-headed Snake <i>Hoplocephalus bitorquatus</i> V TSC	<p>The Pale-Headed Snake is a medium-sized largely tree-dwelling snake to 90 cm long. It is a uniform light brown or grey above with a white or cream band on the nape, bordered by a narrow blackish bar which may be solid, or broken in the middle. The top of the head is grey, and may have a series of black spots, which are most prominent along the edge of the white nape. The lips may have black vertical bars. The belly is creamy grey sometimes with darker flecks. A patchy distribution from north-east Queensland to north-east NSW. In NSW it occurs from the coast to the western side of the Great Divide as far south as Tuggerah.</p>	<p>Known to occur in Coolah Tops NP.</p>	Marginal	Unlikely	Low	Not recorded in Study Area despite extensive surveys.
Broad-headed Snake <i>Hoplocephalus bungaroides</i> E TSC V EPBC	<p>The Broad-headed Snake is generally black above with yellow spots forming narrow, irregular cross-bands. Other yellow scales may link these cross-bands laterally to form a straight or zigzagged stripe along the body. These cross-bands help distinguish it from the similar-looking but harmless juvenile Diamond Python. Its head is flattened on top and distinct from the body. The belly is grey or greyish-black. The average length is about 60 cm, with a maximum of around 150 cm. The Broad-headed Snake is largely confined to Triassic and Permian sandstones, including the Hawkesbury, Narrabeen and Shoalhaven groups, within the coast and ranges in an area within approximately 250 km of Sydney.</p>	<p>Not recorded on the NSW OEH Database. Predicted to occur from the EPBC Database.</p>	Marginal	Unlikely	Low	Database searches did not show any records of this species within the Transmission Line Study Area.
Stephens' Banded Snake <i>Hoplocephalus stephensii</i> V TSC	<p>Stephens' Banded Snake is a medium-sized partly tree-dwelling snake up to one metre long. It is brown or yellow-brown above, with a series of irregular, broad, dark crossbands. The head is black with a brown crown and a brown or cream patch on either side of the nape and the lips are barred with black and cream. Coast and ranges from Southern Queensland to Gosford in NSW.</p>	<p>Not recorded on the NSW OEH Database. Predicted to occur from the EPBC Database.</p>	Marginal	Unlikely	Low	Database searches did not show any records of this species within the Transmission Line Study Area.
Rosenberg's Goanna <i>Varanus rosenbergi</i> V TSC	<p>This species occurs on the Sydney Sandstone in Wollemi National Park to the north-west of Sydney, in the Goulburn and ACT regions and near Cooma in the south. It is found in heath, open forest and woodland. It is known to nest in termite mounds and feeds on carrion, birds, eggs, reptiles and small mammals. Individuals require large areas of habitat.</p>	<p>Not recorded on the NSW OEH Database. Predicted to occur from the EPBC Database.</p>	Marginal	Possible	Low	Database searches did not show any records of this species within the Transmission Line Study Area.
Invertebrates						

Species	Form and Habitat	Records	Transmission Line			Notes
			PH	L	PI	
Giant Dragonfly <i>Petalura gigantea</i> E TSC	The Giant Dragonfly is the third largest dragonfly in Australia and one of the largest dragonflies in the world. The Giant Dragonfly is found along the east coast of NSW from the Victorian border to northern NSW. It is not found west of the Great Dividing Range. There are known occurrences in the Blue Mountains and Southern Highlands, in the Clarence River catchment, and on a few coastal swamps from north of Coffs Harbour to Nadgee in the south.	Predicted to occur in the Goulburn River NP.	Marginal	Possible	Low	No suitable habitat present in Study Area.

Key:

- V TSC Listed as Vulnerable on the *NSW Threatened Species Conservation Act, 1995*
- E TSC Listed as Endangered on the *NSW Threatened Species Conservation Act, 1995*
- V EPBC Listed as Vulnerable on the *Environmental Protection Biodiversity Conservation Act, 1999*
- E EPBC Listed as Endangered on the *Environmental Protection Biodiversity Conservation Act, 1999*
- CE EPBC Listed as Critically Endangered on the *Environmental Protection Biodiversity Conservation Act, 1999*
- M EPBC Listed as Migratory on the *Environmental Protection Biodiversity Conservation Act, 1999*

N/A indicates that the threatened species search did not return the species from the transmission line development area searches, and is therefore only applicable to the Wind Farm Study Area.

APPENDIX D ASSESSMENTS OF SIGNIFICANCE

D.1 NEW SOUTH WALES

Assessments of significance pursuant to EP&A Act and the TSC Act have been undertaken for the following species, following *Threatened Species Assessment Guidelines* (DECC 2007).

Flora

- *Dichanthium setosum*
- *Digitaria porrecta*
- *Swainsona sericea*
- *Acacia ausfeldii*
- *Thesium australe*

Woodland Birds

- Speckled Warbler
- Brown Treecreeper
- Diamond Firetail
- Varied Sittella
- Painted Honeyeater
- Black-chinned Honeyeater
- Grey-crowned Babbler
- Scarlet Robin
- Turquoise Parrot
- Little Lorikeet
- Glossy Black-cockatoo

Raptors

- Little Eagle
- Square-tailed Kite

Nocturnal Birds

- Powerful Owl
- Masked Owl
- Barking Owl

Mammals (excluding bats)

- Squirrel Glider

Bats

- Eastern Bentwing-bat
- Yellow-bellied Sheath-tail-bat
- Eastern Cave Bat
- Corben's Long-eared Bat
- Large-eared Pied Bat

Endangered Ecological Communities

- White Box Yellow Box Blakely's Red Gum Woodland

D.1.1 Flora

a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

Swainsona sericea

Swainsona sericea is a prostrate or low growing perennial shrub to about 10cm high. It grows in grassland and eucalypt woodland, sometimes with *Callitris* species (OEH 2011).

The OEH database search did not return any records of this species in the Wind Farm or Transmission Line search area. The online Bionet database (accessed 1/11/2013) shows one record of this species between Ulan and Gulgong, south-west of the Transmission Line Study Area.

A single individual of this species was recorded in the northern part of the Transmission Line Study Area in the 2012 survey approximately 2.5 km south-east of the junction of Ulan Road and the Golden Highway. The plant was recorded in low grazed grassland on a south facing hillside on a sheep-grazing property. This site was revisited in the 2013 survey and three individual plants were recorded. This location is about 100m to the east of the preferred transmission line route.

A thorough walkover of the surrounding area recorded no additional individuals. This population may however be more widely distributed in this part of the site. These individuals will not be directly affected by clearing for the easement or construction of the transmission line in this area. Management measures will be put in place to ensure that this area is protected from accidental damage during construction and is not used for access, parking of machinery etc.

This species has not been recorded in the Wind Farm Study Area. Habitats are considered to be marginal at best and subject to generally high levels of disturbance from grazing, feral goats and other land use pressures. It may occur however in circumstances similar to where it was recorded in the Transmission Line Study Area. The majority of proposed turbine locations were surveyed and this species was not recorded. The majority of groundcover vegetation within the nominated survey envelope will not be impacted by the development of the wind farm. It is unlikely that the Proposed development would result in a significant impact on this species should it occur in the Wind Farm Study Area.

Dichanthium setosum

Dichanthium setosum, also known as Bluegrass, is an upright perennial grass less than 1 m tall. The species can form pure swards or occur as scattered clumps. *Dichanthium setosum* occurs chiefly on the northern tablelands in the Saumarez area, west of Armidale, and 18-30 km east of Guyra. It is more rarely found on the north-western slopes, central western slopes and north-western plains of NSW, extending west to Narrabri. *Dichanthium setosum* is associated with heavy basaltic black soils and stony red-brown hard-setting loam with clay subsoil and is found in moderately disturbed areas such as cleared woodland, grassy roadside remnants, grazed land and highly disturbed pasture. The extent to which this species tolerates disturbance is unknown (Commonwealth Department of the Environment 2008b).

This species was not recorded in the search area in the OEH database search. It was not recorded during surveys in the Wind Farm Study Area or the Transmission Line Study Area. If it occurs in the project area it is likely to be confined to basalt derived soils in the Wind Farm Study Area. The majority of groundcover vegetation within the nominated survey envelope will not be impacted by the development of the wind farm. It is unlikely that the Proposed development would result in a significant impact on this species should it occur in the Wind Farm Study Area.

Digitaria porrecta

Digitaria porrecta, also known as Finger Panic Grass, is a loosely tufted perennial growing to 60 cm tall. It seeds from March to April but also reproduces vegetatively by dying back to the tussock base, from which it resprouts in summer. In NSW, it occurs from near Inverell south to the Liverpool Plains near Coonabarabran and Werris Creek (33 sites). Its population is estimated to be 200 000 individuals with

75% occurring near Premer (approximately 41 500 individuals) and Tambar Springs (114 000 individuals) in NSW. Finger Panic Grass usually occurs in grasslands on extensive basaltic plains, and in undulating woodlands and open forests with an underlying basaltic geology. It usually occurs on dark and fine textured soils with some degree of seasonal cracking. It also persists in disturbed habitats, such as fallow paddocks, but its capability to maintain a viable population is unknown (Commonwealth Department of the Environment 2008c).

The OEH database search for the project area returned 3 records of this species from one location in farmland (elevation 635m) 15km north of Coolah. This area is outside the Wind Farm Study Area. This species was not recorded during surveys in the Wind Farm Study Area or the Transmission Line Study Area, however this species may not have been detectable due to the timing of the surveys (October). If it occurs in the project area it is likely to be confined to basalt derived soils in the Wind Farm Study Area. The majority of groundcover vegetation within the nominated survey envelope will not be impacted by the development of the wind farm and will continue to provide potential marginal habitat for this grass. It is unlikely that the Proposed development would result in a significant impact on this species should it occur in the Wind Farm Study Area.

Acacia ausfeldii

Acacia ausfeldii is an erect or spreading shrub 2 - 4 m high. Found to the east of Dubbo in the Mudgee-Ulan-Gulgong area of the NSW South Western Slopes bioregion, with some records in the adjoining Brigalow Belt South, South Eastern Highlands and the Sydney Basin bioregions. Associated species include *Eucalyptus albens*, *E. blakelyi* and *Callitris* spp., with an understorey dominated by *Cassinia* spp. and grasses (OEH 2011). The OEH database search returned 14 records of this species from south of the Ulan mine site and from Goulburn River NP.

This species was recorded in three locations during the current survey. Two plants were recorded growing on basalt (but close to an old sandstone quarry) in the south-western corner of Turill SCA north of the Golden Highway and a second occurrence of a single plant was recorded north of the Turill Bus Route Road, on sandstone, near the alternative route. A wider search of an area of 300 x 50 metres in the vicinity of the single plant failed to locate any other plants.

Clearing for the easement for any of the proposed routes will not result in the direct removal of any of these recorded plants but will result in the temporary loss of potential habitat for this species. Following construction the easement will generally provide suitable habitat for *Acacia ausfeldii* to recolonise. The Proposed development is unlikely to result in a significant impact on the local population of this species.

Thesium australe

Austral Toadflax is a small, straggling herb to 40 cm tall. This species is often hidden amongst grasses and herbs. Austral Toad-flax is found in very small populations scattered across eastern NSW, along the coast, and from the Northern to Southern Tablelands, where it occurs in grassland or grassy woodland. A root parasite that takes water and some nutrient from other plants, it is often found in damp sites in association with Kangaroo Grass (*Themeda australis*). The OEH database search returned one record of this species from north of the village of Cassillis.

This species was not recorded during the current survey. Its potential occurrence is considered in the context of the distribution of Kangaroo grass. Kangaroo grass is uncommon in the Transmission Line Study Area and only recorded as small patches in a few locations, primarily within Box Gum woodland in the northern section of the Transmission Line Study Area. The majority of areas are in poor to moderate condition, subject to grazing pressure and provide only poor to moderate quality habitat for this species.

Clearing for the easement will result in the temporary loss of potential habitat for this species. Following construction the easement will generally provide suitable habitat for Kangaroo grass to recolonise. These areas will continue to be subject to disturbances that may threaten the local population, including from grazing, vehicles and other land use practices. The Proposed development is unlikely to result in a significant impact on the local population of this species.

b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

Not applicable.

c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable

d) In relation to the habitat of a threatened species, population or ecological community:

i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

Swainsona sericea

- i. Suitable habitat is widespread throughout the region for this species, however previous clearing and disturbances have reduced population sizes and extents to small areas. Due to this, no particularly suitable habitat for the species is expected to be permanently removed, although some may be temporarily disturbed. Three individuals of this species were observed during the surveys, at one location in the Transmission Line Study Area, but are unlikely to be impacted by the works, particularly as there will be protections put in place prior to the commencement of works to ensure they are not impacted for access tracks, storage of materials or other indirect impacts. Clearing for the easement will result in the temporary loss of potential future habitat for the expansion of the local population of *Swainsona sericea*. Following construction the easement will provide suitable habitat. Grazed grassland and patchy woodland habitat, similar to that where this species was recorded, is widespread in the vicinity and wider locality. These areas will continue to be subject to disturbances that may threaten the local population, including from grazing, vehicles and other land use practices. Protecting the remaining individuals of the population within the study area may help the population to expand into surrounding habitat.
- ii. No area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action.
- iii. The habitat to be removed or modified is not considered important to the long-term survival of the species in the locality, due to the limited occurrence of the population, and the widespread availability of similar habitat.

Dichanthium setosum

- i. Suitable habitat is widespread throughout the region for this species, however there are no records in the study area and no individuals were observed during the surveys. Due to this, no particularly suitable habitat for the species is expected to be permanently removed.

- ii. No area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action.
- iii. The habitat to be removed or modified is not considered important to the long-term survival of the species in the locality, due to the absence of any known populations in the area.

Digitaria porrecta

- i. Suitable habitat is widespread throughout the region for this species, however there are no records in the study area and no individuals were observed during the surveys. Due to this, no particularly suitable habitat for the species is expected to be permanently removed.
- ii. No area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action.
- iii. The habitat to be removed or modified is not considered important to the long-term survival of the species in the locality, due to the absence of any known populations in the area.

Acacia ausfeldii

- i. If the preferred transmission line route is developed, there is unlikely to be much, if any, potential habitat removed or modified. Two individuals were observed at one location on the second alternative route, and clearing for this route could directly or indirectly impact upon these individuals due to the removal of approximately 5 ha of good-quality Box Gum Woodland, in which the plants were found. If the alternative route is developed, there is potential to impact upon at least one other individual, which was found in a different section of Turill State Conservation Area.
- ii. No area of habitat for this species is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action.
- iii. The habitat to be removed or modified varies in importance to the species in the locality, depending on the route selected. If the preferred route, which likely has fewer biodiversity constraints in general, is selected, the habitat to be removed or modified is unlikely to be important to the long-term survival of the species in the locality. However, if either of the alternative routes are selected, there is a risk that the local population(s) may be impacted, particularly as only a small number of individuals were observed despite targeted searches in surrounding areas.

Thesium australe

- i. Suitable habitat is widespread throughout the region for this species, particularly in the Wind Farm Study Area, due to the abundance of Kangaroo Grass. However, there are no records in the study area and no individuals were observed during the surveys. Due to this, no utilised habitat for the species is expected to be permanently removed. Potential habitat is likely to remain stable over the long-term, because, despite some vegetation removal, clearing activities may actually benefit Kangaroo Grass in the region.
- ii. No area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, as construction footprints are relatively minor.
- iii. The habitat to be removed or modified is not considered important to the long-term survival of the species in the locality, due to the absence of any known populations in the project area.

e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

There are no areas of declared critical habitat within the Project Area or greater locality.

f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

Swainsona sericea

Of the identified priority actions for this species, the recommendation to *Document known sites on database* is relevant to this proposal. This study has identified additional records of this species and locations have been made available to OEH.

Dichanthium setosum

Of the identified priority actions for this species, the recommendation to *Control goats and pigs in the species range* is relevant to this proposal. This Biodiversity assessment discusses opportunities for feral goat control as part of the proposal.

Digitaria porrecta

Of the identified priority actions for this species, the recommendation to *Conduct weed control, especially of invasive exotic grasses* is relevant to this proposal. This Biodiversity assessment discusses the need for adequate weed management, including exotic invasive grasses (e.g. Coolatai Grass and African Lovegrass), as part of the proposal.

Acacia ausfeldii

There are no recovery plans, threat abatement plans, or relevant identified priority actions available for this species.

Thesium australe

Of the identified priority actions for this species, the recommendation to *Control weeds in known habitat for this species* and *Control feral animals in key habitat* is relevant to this proposal. This Biodiversity assessment discusses the need for pest and weed management as part of the proposal.

g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The proposal may increase the impact of the following key threatening processes relevant to the species assessed herein:

- Clearing of native vegetation.

In the determination, the NSW Scientific Committee found that ‘clearing of any area of native vegetation, including areas less than two hectares in extent, may have significant impacts on biological diversity’. Clearing can lead to direct habitat loss, habitat fragmentation and associated genetic impacts, habitat degradation, loss of the leaf litter layer, increased habitat for invasive species and off-site impacts such as downstream sedimentation.

While the proposal contributes to clearing of native vegetation, including the potential removal of over 400 ha of threatened Box Gum Woodland (although approximately half of this is derived grassland and actual clearing extents will be much less), the majority of this is in historically cleared and fragmented areas that have been highly degraded through long-term grazing practices. Clearing of better quality vegetation is generally restricted to proposed access tracks and powerline easements where these intersect with more closed woodland or sandstone forest communities.

- The invasion of native vegetation by exotic perennial grasses

A number of exotic perennial grasses, including Coolatai Grass and African Lovegrass, were observed within the project area. The proposed development may contribute to the spread of these species within or between sites, although weed management recommendations and other mitigations have been suggested to prevent this from occurring. Recommendations have been given to reduce spread of invasive weeds into good quality woodland vegetation, including a vehicle hygiene protocol for cleaning of vehicles. The proposal is not expected to significantly increase the impact of this Key Threatening Process in the Project Area.

- Loss of hollow-bearing trees

Hollow-bearing trees will be removed during the vegetation clearing required for the proposed development. The majority of these will likely be in the less-disturbed patches of vegetation that the transmission line may pass through, such as parts of Durrigere State Conservation Area and the southern end of Ulan Road. Hollows vary considerably in density and size throughout the Transmission Line Study Area, as well as by vegetation type. Recommendations have been made to perform hollow-bearing tree targeted surveys prior to clearing to determine micro-siting of infrastructure and minimise losses. It is deemed unlikely that any threatened species will be significantly affected by the vegetation clearance associated with the proposed development. Recommendations regarding the installation of nest boxes have been made to prevent a reduction in the number of available hollows in the landscape.

- Removal of dead wood and dead trees

The removal of dead wood and dead trees from the landscape may occur as a result of the proposed development. It is unlikely that any threatened reptiles species will be utilising dead wood within the study area, although dead standing trees may provide shelter for threatened bird and bat species, and to a lesser degree, Squirrel Gliders in certain locations. It is unlikely that the removal of dead wood and trees will result in a significant impact to any threatened species in the region. Recommendations are given for fallen timber greater than 50 cm to be left in place or moved to a nearby area to retain fauna habitat, where possible.

- Predation by the European Red Fox (*Vulpes vulpes*)

There is potential for the proposed works to increase the suitability of certain areas of the project area for use by foxes. It is likely that foxes are already present throughout most, if not all, of the study area, although tree-clearing within large intact vegetation patches may result in more easily-traversed terrain and provide movement corridors for foxes.

- Predation by the Feral Cat (*Felis catus*)

There is potential for the proposed works to increase the suitability of certain areas of the project area for use by foxes. It is likely that feral cats are already present throughout all of the study area, although tree-clearing within large intact vegetation patches may result in more easily-traversed terrain and provide movement corridors for cats.

D.1.2 Raptors

a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

Little Eagle

Little Eagles were not recorded during surveys but are known to occur in the locality. Should a Little Eagle forage or nest in the Project Area, the proposal has potential to affect the species during the operational phase; the turbine rotors present a collision risk to the species. As no Little Eagle nests were found within 100 metres of surveyed proposed turbine locations, the risk to fledging Little Eagles is considered low to moderate. Adult birds, including raptors, have generally shown an ability to habituate to the turbines by taking avoidance action around rotors or by modifying their behaviour (such as approach a root at the head of a gully from below rather than above – EBS Ecology 2012). Further, the carcass monitoring results reviewed (refer Table 10-1) suggest more common species are most at risk of colliding with turbines. Thus on the basis of probability it appears unlikely that a viable local population of Little Eagle within the Project Area would be placed at risk of extinction from the wind farm proposal. However, this species should be a focal species of an operational Bird and Bat Management Plan to confirm the assumptions of this assessment, addressing inherent uncertainty.

Square-tailed Kite

The Square-tailed kite was not recorded in the Wind Farm Study Area but was recorded nesting near the Ulan Mine site toward the southern end of the Transmission Line Study Area in the 2013 survey. As no Square-tailed Kite nests were found within 100 metres of surveyed proposed turbine locations the risk to nesting or fledgling Square-tailed Kites is considered low to moderate. The NSW Scientific Committee (2009) considers that “windfarms may cause occasional collision mortalities of Square-tailed Kites, although this species is a very manoeuvrable, slow flyer and is probably capable of generally avoiding collisions with turbine blades”. Thus on the basis of probability it appears unlikely that a viable local population of Square-tailed Kites would be placed at risk of extinction from the wind farm proposal. However, this species should be considered as part of an operational Bird and Bat Management Plan to confirm the assumptions of this assessment, addressing inherent uncertainty.

The proposed alignment has been modified to prevent interfering with an active nest. The new alignment is proposed to cross the Goulburn River approximately 250 m to the west of the former alignment, which provides an acceptable buffer zone between any clearing and construction works and the nest.

b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

Not applicable.

c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable.

d) In relation to the habitat of a threatened species, population or ecological community:

i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

i) Section 10 of the Wind Farm report and Section 8 of the Transmission Line report discuss the extent of native vegetation types to be removed or modified as a result of the proposal. In general, relatively small areas of good quality forest or woodland habitat would be removed or modified within the Wind Farm Study Area, with most of the proposal affecting exotic pasture or cleared scattered trees over pasture. Larger areas of better quality vegetation may be cleared within the Transmission Line Study Area for the 60 m easement which has the potential to include loss of hollow bearing trees and threatened species habitat. Recommendations have been provided to microsite infrastructure to avoid hollows in the first instance and then survey to accurately quantify hollows to be removed in order to offset or replace all hollows that are cleared during construction.

ii) In the Wind Farm Study Area, turbines are located on ridges, often adjacent ridges, with a spacing of approximately 2 to 5 km between them. Spacing between turbines in the current layout is generally around 300-600 m. The distance between turbine clusters and also the distance between individual turbines is expected to allow for safe passage between turbines for birds and bats, without creating a barrier effect. There may be some alteration to movement patterns for some species, but areas of habitat are unlikely to become isolated from each other.

iii) Areas of habitat to be removed for turbines, access tracks, power infrastructure, and transmission line associated with the proposal are well represented in the overall Project Area and surrounding locality, including within large areas of conservation reserves and state forests such as Coolah Tops NP, Goulburn River and Munghorn Gap NP, Durrigere SCA and Curryall, Turill and Munmurra State Forests. The majority of the habitat to be removed in the Wind Farm Study Area is degraded and has been subject to ongoing disturbance from agricultural land use. As a result, the majority of potential habitat within the Project Area is considered unlikely to support the fauna species assessed, considering land use history, condition assessments and the results of the field surveys.

e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

There are no areas of declared critical habitat within the Project Area or greater locality.

f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

OEH have not identified any relevant priority actions to help recover these species (OEH 2012).

In general, design measures to avoid and mitigate impacts have included avoiding areas of high conservation value fauna habitat and this is consistent with the actions and objectives of recovery plans and priority actions developed for species considered in this assessment.

g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The proposal may increase the impact of the following key threatening processes relevant to the species assessed herein:

- Clearing of native vegetation.

In the determination, the NSW Scientific Committee found that ‘clearing of any area of native vegetation, including areas less than two hectares in extent, may have significant impacts on biological diversity’. Clearing can lead to direct habitat loss, habitat fragmentation and associated genetic impacts, habitat degradation, loss of the leaf litter layer, increased habitat for invasive species and off-site impacts such as downstream sedimentation.

While the proposal contributes to clearing of native vegetation, including the potential removal of over 400 ha of threatened Box Gum Woodland (although approximately half of this is derived grassland and actual clearing extents will be much less), the majority of this is in historically cleared and fragmented areas that have been highly degraded through long-term grazing practices. Clearing of better quality vegetation is generally restricted to proposed access tracks and powerline easements where these intersect with more closed woodland or sandstone forest communities.

Clearing activities have been shifted to prevent any disturbance to the active Square-tailed Kite nest, which is considered to mitigate any impact on the population or species.

- Removal of dead wood and dead trees

The removal of dead wood and dead trees from the landscape may occur as a result of the proposed development. It is unlikely that the removal of dead wood and trees will result in a significant impact to any threatened species in the region.

- Predation by the European Red Fox (*Vulpes vulpes*)

There is potential for the proposed works to increase the suitability of certain areas of the project area for use by foxes. It is likely that foxes are already present throughout most, if not all, of the study area, although tree-clearing within large intact vegetation patches may result in more easily-traversed terrain and provide movement corridors for foxes.

- Predation by the Feral Cat (*Felis catus*)

There is potential for the proposed works to increase the suitability of certain areas of the project area for use by foxes. It is likely that feral cats are already present throughout all of the study area, although tree-clearing within large intact vegetation patches may result in more easily-traversed terrain and provide movement corridors for cats.

D.1.3 Woodland Birds

a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

Speckled Warbler

The Speckled Warbler occurs in a wide range of Eucalypt Woodland communities in the hills and tablelands of the Great Dividing range. Habitats typically are structurally diverse with a grassy understorey, a sparse shrub layer and an open canopy (Watson *et al.* 2001). Declines have been linked to habitat fragmentation as the species appears to be locally extinct in districts where no habitat fragments larger than 100 ha remain (Watson *et al.* 2001). Further, larger remnants (about 300 ha) may be required for populations to be viable (Gardner 2002a).

The Speckled Warbler was recorded on two occasions during the 2012 survey, in Sandstone Forest habitats along the proposed transmission line route. The 2013 survey recorded this species more widely in the Transmission Line Study Area. The OEH Atlas contained 75 records (dated 1963-2010), generally concentrated around vegetated areas within Durrigere SCA, Goulburn River NP, Coolah Tops NP and vegetated areas north of Ulan Colliery.

This species is unlikely to occur in the majority of the Wind Farm Study Area due to the existing high level of fragmentation of habitats in this area. It may occur in more intact patches of forest in the gullies and on the lower slopes and in areas closer to Coolah Tops. It is highly unlikely to be susceptible to blade strike from the operation of wind turbines given it will generally forage at low height, within the shrub or canopy layer.

Brown Treecreeper

The Brown Treecreeper occurs in Eucalypt Woodlands, Mallee and drier open forest on inland slopes and plains of the Great Dividing Range. Populations have declined over much of their range, particularly in fragments smaller than 300 ha that have been isolated or fragmented for more than 50 years (Barrett *et al.* 1994). Declines in NSW have been attributed primarily to habitat fragmentation which limits dispersal and recruitment (Cooper and Walters, 2002; Walters *et al.* 1999).

The Brown Treecreeper was recorded on one occasion during the 2012 survey, in Sandstone Forest habitat west of Turill State Forest. The 2013 survey recorded this species in the same location as well as several locations throughout the Transmission Line Study Area. The OEH Atlas contained 81 records (dated 1963-2009) with most records from vegetated areas north of Ulan Colliery and Goulburn River NP as well as within Coolah Tops NP.

This species is likely to be restricted to more intact patches of woodland and forest along the Transmission Line Study Area, although it may extend into larger patches of woodland within the Wind Farm Study Area. Clearing of woodland and forest vegetation for the transmission line will result in the loss of habitat for this species. The most important areas to be affected are likely to be within private land west of, or within Durrigere SCA and west of Ulan Road just above the Ulan Coal Mine. The surrounding locality around the Transmission Line Study Area also supports extensive areas of forest and woodland which will not be affected by the proposal (i.e. Goulburn River NP and most areas of Durrigere SCA) and it is therefore considered unlikely that a viable local population of this species would be placed at risk of extinction however, mitigation strategies related to further survey work in forested

areas of the transmission line easement have been recommended for other species which also includes habitat for this species.

Grey-crowned Babbler

The Grey-crowned Babbler was recorded on six occasions during the 2012 survey, in Sandstone Forest habitats within the Transmission Line Study Area. The six records are from within, or in the vicinity of, Durrigere SCA. The 2013 survey identified additional locations for this species, including south of Durrigere SCA and on the edge of Turill SCA in the northern part of the Transmission Line Study Area. The OEH Atlas contained 35 records (dated 1975-2010) concentrated around Ulan Colliery and lands to the north. There is one record from Coolah Tops NP.

The Grey-crowned Babbler prefers Box Gum Woodlands although also inhabits open forests, scrub lands and even farmlands and suburbs (Pizzey *et al.* 2006). The proposal will largely affect heavily degraded woodland or exotic vegetation that does not support an understorey shrub layer. As a result the diversity of bird species recorded within the Wind Farm Study Area was extremely low for woodland birds and revealed high numbers of aggressive species (i.e. Noisy miner, Noisy Friarbird, and Rosellas). This species is unlikely to occur in the majority of the Wind Farm Study Area due to the existing high level of degradation as well as fragmentation of habitats in this area. It may occur in more intact patches of forest in the gullies and on the lower slopes and in areas closer to Coolah Tops.

This species is likely to inhabit more intact patches of woodland and forest along the Transmission Line Study Area. Clearing of woodland and forest vegetation for the transmission line will result in the loss of habitat for this species. The surrounding locality around the Transmission Line Study Area also supports extensive areas of forest and woodland which will not be affected by the proposal (i.e. Goulburn River NP and most areas of Durrigere SCA) and it is therefore considered unlikely that a viable local population of this species would be placed at risk of extinction however, mitigation strategies related to further survey work in forested areas of the transmission line easement have been recommended for other species which also includes habitat for this species.

Painted Honeyeater

This honeyeater primarily occurs on the inland slopes of the Great Dividing Range, although is nomadic and may occur in low densities in other parts of NSW in suitable habitat. It inhabits dry open forests and woodland including Boree, Brigalow and Box Gum Woodlands and Box-Ironbark open forests, also paperbark and casuarinas. It is a specialist feeder on mistletoe, particularly of genus *Amyema*, and generally requires five or more mistletoes per hectare (NSW Scientific Committee 2011). Extent of available vegetation is considered to be important for this species and it is considered less likely to be found in strips or fragmented patches of vegetation than it is in wider blocks (Robinson 1994). The known location of records in vegetated areas and the record of this species this survey in good quality Sandstone Forest, as well as its absence from most of the Project Area (i.e. degraded areas) suggests a reliance on good quality vegetation. It is therefore considered this species would not occupy the Wind Farm Study Area; however habitat may be present within the Transmission Line Study Area.

The OEH Atlas contained 18 records (dated 1976-2010) scattered throughout vegetated areas along the proposed transmission line route and one record within the western part of Coolah Tops NP. The Painted Honeyeater was recorded on one occasion during the 2012 survey, foraging in mistletoe in Sandstone Forest habitat south-west of Durrigere SCA. The 2013 survey recorded this species in similar habitat along Ulan Road in the southern part of the Transmission Line Study Area.

As mentioned for other woodland birds, the most important areas to be affected are likely to be in the Transmission Line Study Area within private land west of, or within Durrigere SCA and west of Ulan

Road just above the Ulan Coal Mine. Clearing of woodland and forest vegetation for the transmission line could result in the loss of habitat for this species. However, the surrounding locality around the Transmission Line Study Area also supports extensive areas of forest and woodland which will not be affected by the proposal (i.e. Goulburn River NP and most areas of Durrigere SCA) and it is therefore considered unlikely that a viable local population of this species would be placed at risk of extinction however, mitigation strategies related to further survey work in forested or woodland areas of the transmission line easement have been recommended for other species which also include habitat for this species.

Black-chinned Honeyeater

The Black-chinned Honeyeater was recorded on one occasion during the 2012 survey, in scattered open woodland on native pasture in the northern part of the Transmission Line Study Area. The OEH Atlas contained 9 records (dated 1998-2006) concentrated around vegetated areas of Goulburn River NP, the north-western section of Coolah Tops NP and north of Ulan Colliery.

This honeyeater inhabits the upper levels of drier open forests or woodlands most often dominated by box and ironbark eucalypts, particularly Mugga Ironbark, White Box, Grey Box, Yellow Box and Forest Red Gum (NSW Scientific Committee 2001). Recent studies have found that the Black-chinned Honeyeater tends to occur in the largest woodland patches in the landscape as birds are locally nomadic and forage over large home ranges of at least 5 ha. The species feeds mostly on nectar and insects in the shrub or canopy layers and a diversity of species is considered to be required. The known location of records in vegetated areas and the record of this species this survey in Sandstone Forest over native grasses, as well as its absence from most of the Project Area (i.e. degraded areas) suggests a reliance on moderate-good quality vegetation. It is therefore considered this species would not be reliant on the majority of habitat within the Wind Farm Study Area given its degraded state; however habitat may be present within the Transmission Line Study Area.

As mentioned for other woodland birds, the most important areas to be affected are likely to be within private land west of, or within Durrigere SCA and west of Ulan Road just above the Ulan Coal Mine. Clearing of woodland and forest vegetation for the transmission line could result in the loss of habitat for this species. However, the surrounding locality around the Transmission Line Study Area also supports extensive areas of forest and woodland which will not be affected by the proposal (i.e. Goulburn River NP and most areas of Durrigere SCA) and it is therefore considered unlikely that a viable local population of this species would be placed at risk of extinction however, mitigation strategies related to further survey work in forested or woodland areas of the transmission line easement have been recommended for other species which also include habitat for this species.

Varied Sittella

This species inhabits Eucalypt Forests and Woodlands, especially rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia Woodland. Survival and population viability are sensitive to habitat isolation, reduced patch size and habitat simplification, including reductions in tree species diversity, tree canopy cover, shrub cover, ground cover, logs, fallen branches and litter. The Varied Sittella is also adversely affected by the dominance of Noisy Miners in woodland patches (NSW Scientific Committee 2011). The OEH Atlas contained 18 records (dated 1976-2010) scattered throughout vegetated areas along the proposed transmission line routes and one record within the western part of Coolah Tops NP.

The Varied Sitella was recorded on two occasions during the 2012 survey, in Sandstone Forest habitat near the north-eastern corner of Durridgere SCA and in ridgetop Box Gum Woodland in the eastern part of the Wind Farm Study Area. The 2013 survey recorded this species in Turill SCA.

During the survey, this species was detected within Box Gum Woodland that supported a higher diversity of shrubs in the understorey and was not observed in other areas of the Wind Farm Study Area. It is expected this species would not occur within degraded areas (exotic pasture or scattered trees over exotic pasture) of the Wind Farm Study Area, which are the areas the majority of the proposal will affect. Additionally, the entire Project Area supports a high density of aggressive bird species, including the Noisy miner which displaces this species, as detailed above.

As the proposal will largely affect heavily degraded woodland or exotic vegetation that does not support an understorey shrub layer within the Wind Farm Study Area, the proposal is not considered to have an adverse effect on the life cycle of this species such that it would be placed at risk of extinction.

As mentioned for other woodland birds, the most important areas to be affected are likely to be within private land west of, or within Durridgere SCA and west of Ulan Road just above the Ulan Coal Mine. Clearing of woodland and forest vegetation for the transmission line could result in the loss of habitat for this species. However, the surrounding locality around the Transmission Line Study Area also supports extensive areas of forest and woodland which will not be affected by the proposal (i.e. Goulburn River NP and most areas of Durridgere SCA) and it is therefore considered unlikely that a viable local population of this species would be placed at risk of extinction however, mitigation strategies related to further survey work in forested or woodland areas of the transmission line easement have been recommended for other species which also include habitat for this species.

Diamond Firetail

The Diamond Firetail occupies eucalypt woodlands, forests and mallee where there is a grassy understorey. Firetails build bottle-shaped nests in trees and bushes, and forage on the ground, largely for grass seeds and other plant material, but also for insects. The Diamond Firetail is threatened by clearance and fragmentation of habitat. Isolation and reductions in remnant area inhibit dispersal and increase their vulnerability to local extinction via stochastic events. Small, isolated populations also lose their long term genetic viability. Further, Diamond Firetail populations appear unable to persist in areas which lack remnants of native vegetation larger than 200ha (NSW Scientific Committee 2011). The OEH Atlas contained 24 records (dated 1963-2010) widely scattered throughout vegetated areas in the vicinity of the proposed transmission line route, including within Durridgere and Turill SCAs. There are also two records from the north-eastern slopes of Coolah Tops NP.

The 2013 survey recorded this species in four locations in or adjacent to larger tracts of sandstone forest in the Transmission Line Study Area, including within Durridgere and Turill SCAs. It is expected this species would not occur within degraded and fragmented areas (exotic pasture or scattered trees over exotic pasture) of the Wind Farm Study Area, which are the areas the majority of the proposal will affect.

As the proposal will largely affect heavily degraded woodland or exotic vegetation within the Wind Farm Study Area, the proposal is not considered to have an adverse effect on the life cycle of this species such that it would be placed at risk of extinction. This finch is highly unlikely to be affected by physical interaction with wind turbines.

As mentioned for other woodland birds, the most important areas to be affected are likely to be within private land west of, or within Durridgere SCA and west of Ulan Road just above the Ulan Coal Mine. Clearing of woodland and forest vegetation for the transmission line could result in the loss of habitat for this species. However, the surrounding locality around the Transmission Line Study Area also

supports extensive areas of forest and woodland which will not be affected by the proposal (i.e. Goulburn River NP and most areas of Durridgere SCA) and it is therefore considered unlikely that a viable local population of this species would be placed at risk of extinction however, mitigation strategies related to further survey work in forested or woodland areas of the transmission line easement have been recommended for other species which also include habitat for this species.

Scarlet Robin

The Scarlet Robin breeds in drier eucalypt forests and temperate woodlands, often on ridges and slopes, within an open understorey of shrubs and grasses and sometimes in open areas. Abundant logs and coarse woody debris are important structural components of its habitat. In autumn and winter it migrates to more open habitats such as grassy open woodland or paddocks with scattered trees (NSW Scientific Committee 2011). The OEH Atlas database search returned 15 records (dated 1975-2009) with the majority of records from the north-west section of Coolah Tops NP as well as some scattered records from around Ulan Colliery.

The Scarlet Robin was recorded on one occasion during the 2012 survey, in Brittle Gum/Silver-top Stringybark Woodland in the north-eastern corner of the Wind Farm Study Area. The habitat in the areas where this species has previously been recorded (north-east section of the Wind Farm Study Area) supports substantially superior quality habitat than most of the Wind Farm Study Area; the proposal will largely affect exotic vegetation and very open woodland habitat. The area where this species was recorded in 2012 is now no longer proposed for locating of wind turbines. This species is not expected to occur in the more open and exposed ridgetop habitats where the majority of turbines will be located and the proposal is therefore not expected to have an adverse effect on the lifecycle of this species.

As mentioned above for other woodland birds, the most important areas to be affected are likely to be within private land west of, or within Durridgere SCA and west of Ulan Road just above the Ulan Coal Mine Clearing of woodland and forest vegetation for the transmission line could result in the loss of habitat for this species also. However, the surrounding locality around the Transmission Line Study Area also supports extensive areas of forest and woodland which will not be affected by the proposal (i.e. Goulburn River NP and most areas of Durridgere SCA) and it is therefore considered unlikely that a viable local population of this species would be placed at risk of extinction however, mitigation strategies related to further survey work in forested or woodland areas of the transmission line easement have been recommended for other species which also include habitat for this species.

Parrots

Little Lorikeet

Little Lorikeets mostly occur in dry, open eucalypt forests and woodlands. They have been recorded from both old-growth and logged forests in the eastern part of their range, and in remnant woodland patches and roadside vegetation on the western slopes. The OEH Atlas database search returned 12 records (dated 1963-2008) scattered throughout the study area near Ulan, Goulburn River NP and Coolah Tops NP.

The Little Lorikeet was not recorded in either the Transmission line or the Wind Farm Study Area during the current survey, but was recorded about 15 kms to the north of the Wind Farm Study Area during the 2012 survey period. This species has the potential to occur at times throughout the majority of the Wind Farm and Transmission Line Study Areas where there is open forest, woodland or patches of eucalypts. It may roost within tree hollows in living or recently dead trees. It is highly unlikely to be susceptible to blade strike from the operation of wind turbines given that the species is a nomadic species and primarily

feeds on nectar and pollen in the tree canopy, particularly on profusely-flowering eucalypts. Hence it does not traverse large distances and will forage below the rotor swept area (OEH 2012).

The proposal will largely affect heavily degraded woodland or exotic vegetation that does not support an understorey shrub layer. The diversity of bird species recorded within the Wind Farm Study Area was extremely low for woodland birds and revealed high numbers of aggressive species (i.e. Noisy miner, Noisy Friarbird, and Rosellas). These species are expected to occupy many of the remaining hollows that occur within the woodland patches and therefore prevent the more cryptic or threatened species from breeding in these areas. Given the high abundance of aggressive common birds and the heavily degraded nature of the site of the Wind Farm Study Area the proposal is not expected to have an adverse effect on the life cycle of the Little Lorikeet.

However, provisions for pre-clearance hollow-bearing tree surveys and micrositing of infrastructure to avoid hollows, where possible, form mitigation measures to prevent adverse impacts to hollow-dependent species.

As mentioned above for other woodland birds, the most important areas to be affected are likely to be within private land west of, or within Durrigere SCA and west of Ulan Road just above the Ulan Coal Mine Clearing of woodland and forest vegetation for the transmission line could result in the loss of habitat for this species also. However, the surrounding locality around the Transmission Line Study Area also supports extensive areas of forest and woodland which will not be affected by the proposal (i.e. Goulburn River NP and most areas of Durrigere SCA) and it is therefore considered unlikely that a viable local population of this species would be placed at risk of extinction however, mitigation strategies related to further survey work in forested areas of the transmission line easement have been recommended for other species which also include habitat for this species.

Turquoise parrot

The Turquoise Parrot inhabits eucalypt and cypress-pine open forests and woodlands (commonly box or box-ironbark) with native grasses, sometimes with a low shrubby understorey, often in undulating or rugged country, or on footslopes. It also lives in open woodland or riparian gum woodland, and often near ecotones between woodland and grassland, or coastal forest and heath. The richer habitat types on creek or river flats and foothills are preferred, but have been targeted for agricultural clearing, and habitat remnants are degraded by logging (for firewood and fenceposts), grazing, dominance by Noisy Miners, and decline in tree health (rural eucalypt dieback). The Turquoise Parrot requires live or dead trees, stumps and logs for nesting, trees and shrubs for shelter, and seeding grasses and forbs (often beneath trees) for food (NSW Scientific Committee, 2009). The OEH Atlas database search returned 14 records (dated 1975-2008) of this parrot, the majority of which are in Goulburn River NP with one record in Coolah Tops NP.

The Turquoise Parrot was not recorded in either the Transmission line or the Wind Farm Study Area during the current survey. This species has the potential to occur at times throughout areas of the Wind Farm and Transmission Line Study Areas where there is open forest, woodland or patches of eucalypts and available grassland foraging habitat. It may roost within tree hollows in living or recently dead trees. It is highly unlikely to be susceptible to blade strike from the operation of wind turbines given that it prefers to feed within 100m of the nest and is resident and locally dispersive, with most movements of less than 10km often along treed corridors (NSW Scientific Committee, 2009). Hence it does not traverse large distances and will forage below the rotor sweep area.

The proposal will largely affect heavily degraded woodland or exotic vegetation that does not support an understorey shrub layer. The diversity of bird species recorded within the Wind Farm Study Area was

extremely low for woodland birds and revealed high numbers of aggressive species (i.e. Noisy miner, Noisy Friarbird, and Rosellas). These species are expected to occupy many of the remaining hollows that occur within the woodland patches and therefore prevent the more cryptic or threatened species from breeding in these areas. Given the high abundance of aggressive common birds and the heavily degraded nature of the site of the Wind Farm Study Area the proposal is not expected to have an adverse effect on the life cycle of the Turquoise Parrot.

However, provisions for pre-clearance hollow-bearing tree surveys and micro-siting of infrastructure to avoid hollows, where possible, form mitigation measures to prevent adverse impacts to hollow-dependent species.

As mentioned above for other woodland birds, the most important areas to be affected are likely to be within private land west of, or within Durridgere SCA and west of Ulan Road just above the Ulan Coal Mine. Clearing of woodland and forest vegetation for the transmission line could result in the loss of habitat for this species also. However, the surrounding locality around the Transmission Line Study Area also supports extensive areas of forest and woodland which will not be affected by the proposal (i.e. Goulburn River NP and most areas of Durridgere SCA) and it is therefore considered unlikely that a viable local population of this species would be placed at risk of extinction.

Glossy Black-cockatoo

The OEH Atlas search returned 260 records (dated 1975-2010) scattered throughout the study area, including within Coolah Tops NP, Durridgere SCA and Ulan Colliery lands. Moolarben Coal Project (2006) discusses 39 records of this species, mainly from vegetation associations with Black Cypress Pine near Ulan Road and adjacent ridges. Evidence of the Glossy Black-cockatoo (a single tail-feather) was recorded in the 2012 survey in a larger tract of Sandstone Forest in the western central part of the Transmission Line Study Area. This species was recorded in several locations (frequently where poor sandstone-derived soils have high densities of *Allocasuarina* spp. growing) within the Transmission Line Study Area during the 2013 survey and evidence of foraging was relatively widespread.

Of the *Casuarina* and *Allocasuarina* species recorded during the present study, two species - *Allocasuarina diminuta* and *A. gymnanthera* – are known to be preferred feed trees for the Glossy Black-Cockatoo. Both these species are present throughout areas of sandstone forest in the Transmission Line Study Area, with *A. gymnanthera* the more common. These species are not common in the Wind Farm Study Area. Searches for chewed seed cones were completed in fauna plots containing *Allocasuarina diminuta* and *A. gymnanthera* but no additional evidence of foraging by Glossy Black-Cockatoos was recorded in the Wind Farm Study Area.

Clearing for the transmission line easement will result in the loss of some areas of vegetation containing *Allocasuarina diminuta* and *A. gymnanthera* as well as the loss of some hollow-bearing trees and stags and mature trees that represent a future source of hollows. These habitat resources are relatively widely available within areas of the transmission line route to be retained and within the surrounding area.

The Wind Farm Study Area does not generally provide areas of suitable foraging habitat for the Glossy Black-cockatoo, although it does contain hollow-bearing trees and larger stags that may provide suitable roost sites for this species. However, given the degraded nature of the Wind Farm Study Area in general and its lack of foraging resources, it is unlikely the Glossy Black-cockatoo would be reliant on this area for breeding. The Transmission Line Study Area provides areas of suitable foraging habitat for the Glossy Black-cockatoo, and supports hollow-bearing trees and larger stags that may provide suitable roost sites for this species within the southern section of the easement (i.e. near Durridgere SCA and Ulan Road).

Provisions for pre-clearance hollow-bearing tree surveys and micrositing of infrastructure to avoid hollows, where possible, form mitigation measures to prevent adverse impacts to hollow-dependent species such as this.

It therefore appears unlikely that a viable local population at the Liverpool Range study area would be placed at risk of extinction.

b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

Not applicable.

c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable.

d) In relation to the habitat of a threatened species, population or ecological community:

i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

i) Section 10 of the Wind Farm report and Section 8 of the Transmission Line report discuss the extent of native vegetation types to be removed or modified as a result of the proposal. In general, relatively small areas of good quality forest or woodland habitat would be removed or modified within the Wind Farm Study Area, with most of the proposal affecting exotic pasture or cleared scattered trees over pasture. However, recommendations have been given in areas of good quality habitat for follow up survey work to determine its value as threatened species habitat before clearing proceeds. Recommendations have also been provided to protect and microsite infrastructure to avoid hollows in the first instance and then survey to accurately quantify hollows to be removed in order to offset or replace all hollows that are cleared during construction.

ii) In the Wind Farm Study Area, turbines are located on ridges, often adjacent ridges, with a spacing of approximately 2 to 5 km between them. Spacing between turbines in the current layout is generally around 300-600m. The distance between turbine clusters and also the distance between individual turbines is expected to allow for safe passage between turbines for birds and bats, without creating a barrier effect. There may be some alteration to movement patterns for some species, but areas of habitat are unlikely to become isolated from each other.

The clearing of the transmission line easement is unlikely to create an impediment to movement for the woodland birds and parrots considered in this assessment.

However given the already degraded and modified state of the vegetation in the vicinity of the wind farm, and the expansive areas of vegetation conserved in national parks and state conservation reserves in the region, the importance of any habitat loss through clearing for the wind farm should be considered relatively low. Loss of habitat through avoidance of an area (indirect habitat loss) has not been shown for any Australian wind farm. The question of indirect habitat loss through avoidance of an area under operational wind farm can be monitored through comparison of data from pre-construction baseline surveys with operational survey data. Monitoring of bird utilisation and avoidance behaviour, for woodland birds and raptors would be part of a Bird and Bat adaptive Management Plan for the project.

iii) Types of habitat to be removed for turbines, access tracks, power infrastructure, and transmission lines associated with the proposal are well represented in the overall Project Area and surrounding locality, including within conservation reserves and state forests such as Coolah Tops NP, Goulburn River NP, Durridgere SCA and Curryall, Turill and Munmurra State Forests. The majority of the habitat to be removed in the Wind Farm Study Area is degraded and has been subject to ongoing disturbance from agricultural land use. As a result, the majority of potential habitat within the Project Area is considered unlikely to support the fauna species assessed, considering land use history, condition assessments and the results of the field surveys

e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

There are no areas of declared critical habitat within the Project Area or greater locality.

f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

OEH have not identified any relevant priority actions to help recover *Speckled Warbler*, *Glossy Black-Cockatoo*, *Brown Treecreeper*, *Diamond firetail*, *Black-chinned Honeyeater*, *Scarlet Robin*, *Grey-crowned babbler*, *Little Lorikeet* or *Varied Sittella*

Painted Honeyeater

Of the identified priority actions for this species, the recommendation to *Encourage retention of natural densities of mistletoes, particularly Amyema sp.* is relevant to this proposal. Extent of available vegetation is considered to be important for this species and it is considered less likely to be found in strips or fragmented patches of vegetation than it is in wider blocks. Given that the proposal largely affects disturbed areas where this species is unlikely to occur, the removal of mistletoe in these parts is not expected to be significant.

Turquoise parrot

Of the identified priority actions for this species, the recommendation to *Ensure the largest hollow bearing trees (including dead trees and paddock trees) are given highest priority for retention in PVP assessments and or other land assessment tools* is relevant to this proposal. This assessment has identified mitigation measures to minimise the loss of hollow bearing trees and dead trees and offset hollow bearing trees that would be removed.

In general, design measures to avoid and mitigate impacts have included avoiding areas of high conservation value fauna habitat and this is consistent with the actions and objectives of recovery plans and priority actions developed for species considered in this assessment.

g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The proposal may increase the impact of the following key threatening processes relevant to the species assessed herein:

- Clearing of native vegetation.

In the determination, the NSW Scientific Committee found that ‘clearing of any area of native vegetation, including areas less than two hectares in extent, may have significant impacts on biological diversity’. Clearing can lead to direct habitat loss, habitat fragmentation and associated genetic impacts, habitat degradation, loss of the leaf litter layer, increased habitat for invasive species and off-site impacts such as downstream sedimentation.

While the proposal contributes to clearing of native vegetation, including the potential removal of over 400 ha of threatened Box Gum Woodland (although approximately half of this is derived grassland and actual clearing extents will be much less), the majority of this is in historically cleared and fragmented areas that have been highly degraded through long-term grazing practices. Clearing of better quality vegetation is generally restricted to proposed access tracks and powerline easements where these intersect with more closed woodland or sandstone forest communities.

- Loss of hollow-bearing trees

Hollow-bearing trees will be removed during the vegetation clearing required for the proposed development. The majority of these will likely be in the less-disturbed patches of vegetation that the transmission line may pass through, such as parts of Durrigere State Conservation Area and the southern end of Ulan Road. Hollows vary considerably in density and size throughout the Transmission Line Study Area, as well as by vegetation type. However, recommendations have been given to minimise the impact of the proposal to an acceptable level specifically in relation to hollow bearing trees. Where hollow bearing trees are to be cleared and cannot be avoided an offset ratio is to be applied at 1:1 and is supplementary to other areas offset.

- Removal of dead wood and dead trees

The removal of dead wood and dead trees from the landscape may occur as a result of the proposed development. It is unlikely that any threatened reptiles species will be utilising dead wood within the study area, although dead standing trees may provide shelter for threatened bird and bat species, and to a lesser degree, Squirrel Gliders in certain locations. It is unlikely that the removal of dead wood and trees will result in a significant impact to any threatened species in the region. Recommendations are given for fallen timber greater than 50 cm to be left in place or moved to a nearby area to retain fauna habitat, where possible.

- Predation by the European Red Fox (*Vulpes vulpes*)

There is potential for the proposed works to increase the suitability of certain areas of the project area for use by foxes. It is likely that foxes are already present throughout most, if not all, of the study area, although tree-clearing within large intact vegetation patches may result in more easily-traversed terrain and provide movement corridors for foxes.

- Predation by the Feral Cat (*Felis catus*)

There is potential for the proposed works to increase the suitability of certain areas of the project area for use by foxes. It is likely that feral cats are already present throughout all of the study area, although

tree-clearing within large intact vegetation patches may result in more easily-traversed terrain and provide movement corridors for cats.

D.1.4 Mammals (excluding bats)

a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

Squirrel Glider

Squirrel Gliders show a preference for lower altitude habitats and Rowston *et al* report that throughout their range they have not been reported above 300 m (Rowston *et al* 2002). Squirrel Gliders are unlikely to occur on higher elevation ridges to be affected by any tree removal for turbine location or ridgetop tracks.

The OEH Atlas database search returned 16 records of Squirrel Glider (dated 2000-2009) with most records from previous surveys north of the Ulan Colliery (within the Transmission Line Study Area). These records are from near Ulan and located around 420 m altitude. Clearance of habitat within the Transmission Line Study Area has the potential to affect this species.

A single Squirrel Glider was recorded during the 2012 survey program, in open woodland vegetation along a valley floor within the Wind Farm Study Area. While the Squirrel Glider was found within a valley floor of the Wind Farm Study Area, it is not considered at risk within this study area given the location of development largely on ridgetops where habitat does not occur for this species. A single individual was also recorded in riparian vegetation north-east of the Ulan Mine site in the 2013 survey.

Proposed routes for the transmission line are largely located within cleared areas that do not represent suitable habitat for the Squirrel Glider, however suitable habitat does occur within areas of more intact native forest and woodland and in areas with patchy tree distribution within the southern section of the easement nearby Durridgere SCA. As vegetation clearing for the transmission line will result in the loss of woodland and forest vegetation, it is expected that some areas of suitable habitat and some loss of tree hollows suitable for denning could be affected as part of the proposal.

Regarding potential to affect movement, the distance that Squirrel Gliders can travel in a single glide is a function of the height of the tree from which they take off. Goldingay and Taylor (2009) concluded that to travel a distance of 43 m, Squirrel Gliders would require trees at least 25m tall from which to take off. Tree heights in the Transmission Line Study Area were generally 25 m or less, indicating that a clearing of 60 m for the transmission line easement may impact on movement opportunities for the Squirrel Glider across the cleared easement, particularly as foxes pose a threat to any arboreal mammals that are on the ground for any period of time.

In practice, the total clearance of vegetation for this species is overestimated as these areas will continue to have some habitat value for this species during the operational phase of transmission line where the existing vegetation cover can be micro-sited or understorey regrowth promoted after construction. However, the proposal has the potential to remove hollow-bearing trees and affect movement patterns in forested areas of good condition (i.e. nearby Durridgere SCA).

It appears unlikely that a viable local population within the Project Area would be placed at risk of extinction however further investigation of suitable denning sites (i.e. hollow-bearing trees) is required within the southern section of the transmission line easement to confirm this. Mitigation strategies related to further survey work, removal of hollow-bearing trees (i.e. potential breeding sites) and facilitation of crossing easements within suitable habitat for this species now form part of the proposal.

b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

Not applicable.

c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable.

d) In relation to the habitat of a threatened species, population or ecological community:

i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

i) Section 10 of the Wind Farm report and Section 8 of the Transmission Line report discuss the extent of native vegetation types to be removed or modified as a result of the proposal. In general, relatively small areas of good quality forest or woodland habitat would be removed or modified within the Wind Farm Study Area, with most of the proposal affecting exotic pasture or cleared scattered trees over pasture. Larger areas of better quality vegetation may be cleared within the Transmission Line Study Area for the 60 m easement which has the potential to include loss of hollow bearing trees and threatened species habitat. However, recommendations have been given in areas of good quality habitat for follow up survey work to determine its value as threatened species habitat before clearing proceeds. Recommendations have also been provided to protect and microsite infrastructure to avoid hollows in the first instance and then survey to accurately quantify hollows to be removed in order to offset or replace all hollows that are cleared during construction.

ii) In the Wind Farm Study Area, turbines are located on ridges, often adjacent ridges, with a spacing of approximately 2 to 5 km between them. Spacing between turbines in the current layout is generally around 300-600 m. The distance between turbine clusters and also the distance between individual turbines is expected to allow for safe passage between turbines for birds and bats, without creating a barrier effect. There may be some alteration to movement patterns for some species, but areas of habitat are unlikely to become isolated from each other.

For Squirrel Gliders, the distance that they can travel in a single glide is a function of the height of the tree from which they take off. Goldingay and Taylor (2009) concluded that to travel a distance of 43 m, Squirrel Gliders would require trees at least 25 m tall from which to take off. Tree heights in the Transmission Line Study Area were generally 25 m or less, indicating that a clearing of 60 m for the

transmission line easement may impact on movement opportunities for the Squirrel Glider across the cleared easement, particularly as foxes pose a threat to any arboreal mammals that are on the ground for any period of time. Mitigation methods including installing glider poles, and minimisation of clearance in known habitat for the Squirrel Glider are incorporated into the recommendations.

iii) Areas of habitat to be removed for turbines, access tracks, power infrastructure, and transmission line associated with the proposal are well represented in the overall Project Area and surrounding locality, including within conservation reserves and state forests such as Coolah Tops NP, Goulburn River NP, Durridgere SCA and Curryall, Turill and Munmurra State Forests. The majority of the habitat to be removed in the Wind Farm Study Area is degraded and has been subject to ongoing disturbance from agricultural land use. As a result, the majority of potential habitat within the Project Area is considered unlikely to support the fauna species assessed, considering land use history, condition assessments and the results of the field surveys.

e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

There are no areas of declared critical habitat within the Project Area or greater locality.

f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

OEH have not identified any relevant priority actions to help recover the Squirrel Glider.

A Threat Abatement Plan (TAP) has been prepared for the threatening process *Predation by the Red Fox*. The proposal is not located near to any priority sites discussed under the TAP and is consistent with the objectives and actions of the TAP.

g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The proposal may increase the impact of the following key threatening processes relevant to the species assessed herein:

- Clearing of native vegetation.

In the determination, the NSW Scientific Committee found that ‘clearing of any area of native vegetation, including areas less than two hectares in extent, may have significant impacts on biological diversity’. Clearing can lead to direct habitat loss, habitat fragmentation and associated genetic impacts, habitat degradation, loss of the leaf litter layer, increased habitat for invasive species and off-site impacts such as downstream sedimentation.

While the proposal contributes to clearing of native vegetation, including the potential removal of over 400 ha of threatened Box Gum Woodland (although approximately half of this is derived grassland and actual clearing extents will be much less), the majority of this is in historically cleared and fragmented areas that have been highly degraded through long-term grazing practices. Clearing of better quality vegetation is generally restricted to proposed access tracks and powerline easements where these intersect with more closed woodland or sandstone forest communities.

- Loss of hollow-bearing trees

Hollow-bearing trees will be removed during the vegetation clearing required for the proposed development. The majority of these will likely be in the less-disturbed patches of vegetation that the transmission line may pass through, such as parts of Durridgere State Conservation Area and the southern end of Ulan Road. Hollows vary considerably in density and size throughout the

Transmission Line Study Area, as well as by vegetation type. Recommendations have been made to perform hollow-bearing tree targeted surveys prior to clearing to determine micro-siting of infrastructure and minimise losses. It is deemed unlikely that any threatened species will be significantly affected by the vegetation clearance associated with the proposed development. Recommendations regarding the installation of nest boxes have been made to prevent a reduction in the number of available hollows in the landscape.

- Removal of dead wood and dead trees

The removal of dead wood and dead trees from the landscape may occur as a result of the proposed development. It is unlikely that any threatened reptiles species will be utilising dead wood within the study area, although dead standing trees may provide shelter for threatened bird and bat species, and to a lesser degree, Squirrel Gliders in certain locations. It is unlikely that the removal of dead wood and trees will result in a significant impact to any threatened species in the region. Recommendations are given for fallen timber greater than 50 cm to be left in place or moved to a nearby area to retain fauna habitat, where possible.

- Predation by the European Red Fox (*Vulpes vulpes*)

There is potential for the proposed works to increase the suitability of certain areas of the project area for use by foxes. It is likely that foxes are already present throughout most, if not all, of the study area, although tree-clearing within large intact vegetation patches may result in more easily-traversed terrain and provide movement corridors for foxes.

- Predation by the Feral Cat (*Felis catus*)

There is potential for the proposed works to increase the suitability of certain areas of the project area for use by foxes. It is likely that feral cats are already present throughout all of the study area, although tree-clearing within large intact vegetation patches may result in more easily-traversed terrain and provide movement corridors for cats.

D.1.5 Nocturnal Birds

a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

Powerful Owl

Powerful Owls require large territories that include woodlands. Breeding pairs are known to defend up to 1000 ha areas of permanent territories (Blakers *et al.* 1984; Soderquist and Gibbons 2007), although more recent research has shown home ranges may be up to 3000 ha (Hollands 2008). Numerous studies have found that territories usually centre around gullies (Dept. of Environment and Conservation 2006). Moist forest in unlogged corridors in gully systems is used for nesting and roosting, and also preferentially for foraging, although much foraging is also conducted in dry and regrowth forest (Kavanagh 1997). The OEH Atlas contained 24 records (dated 1985-2012) scattered nearby the Project Area, mostly from vegetated areas within Goulburn River NP and Coolah Tops NP, with some records located along the transmission line route.

The Powerful Owl was recorded during the 2013 survey on two occasions within the southern part of the Transmission Line Study Area, although it is likely to have been the same individual. The Project Area contains several gully systems containing mature trees or patches of mature forest within the north-eastern section of the Wind Farm Study Area. As most of the Wind Farm Study Area has been cleared in the past due to agricultural practices, most of the remnant mature vegetation is also concentrated in gullies. This area of the Wind Farm Study Area provides a habitat corridor to Coolah Tops NP in which most known records of the Powerful Owl are located. Common Brushtail Possums and Greater Gliders were observed during the survey in very high abundance in the north-eastern section of the Wind Farm Study Area and are known prey species for the Powerful Owl.

The ability of Powerful Owls to avoid wind turbines is not well understood. Generally, raptors have been found to be at greatest risk when swooping on prey, a risk not present for the Powerful Owl which hunts within forest. Powerful Owls have great manoeuvrability and it is expected that their ability to avoid turbines while dispersing would be high. However ecological characteristics such as low density and low reproduction rates increase the consequence of collisions to the local population's viability.

The habitat clearance associated with the Wind farm and transmission line easement is not expected to be large enough to have an adverse effect on the Powerful Owl given the transmission line generally traverses degraded habitat, except for the southern section of the alignment. The most important areas to be affected are likely to be within private land west of, or within Durridgere SCA and west of Ulan Road just above the Ulan Coal Mine. Clearing of woodland and forest vegetation for the transmission line is unlikely to result in an adverse impact for this species, given the large home ranges it occupies and available habitat in the wider region which also connects to this area. The most likely affect would be the clearance of hollow-bearing trees; however provisions for pre-clearance hollow-bearing tree surveys and micrositing of infrastructure to avoid hollows, where possible, form mitigation measures to prevent adverse impacts to hollow-dependent species.

Given the large home ranges of the Powerful Owl, the presence of forested gullies, and a high abundance of known prey species in the location of turbines within the north eastern section of the Wind Farm Study Area, the proposal has the potential to reduce foraging habitat or result in blade strike for this species within this area. Proposed turbine locations in the very north-eastern section of the Wind Farm Study Area have been removed from the proposal due to these ecological considerations.

The Powerful Owl should be a focal species of the adaptive Bird and Bat Management Plan to confirm the assumptions of this assessment, addressing inherent uncertainty.

Masked Owl

This species forages in a range of forest and woodland types but roosts and breeds in moist eucalypt forested gullies, using large tree hollows or sometimes caves for nesting. It requires forested areas adjacent to areas of dense and sparse ground cover within close proximity for foraging. Suitable large tree hollows for breeding are generally rare within the Wind Farm Study Area. The OEH Atlas contained five records (dated 1993-2005) from within densely vegetated areas within Goulburn River NP and Coolah Tops NP and near Uarbry. Kavanagh (1995) discusses a relatively high number of recordings of the Masked Owl within Coolah Tops NP.

The Masked Owl was not recorded during the current survey. Masked Owls are more likely to roost and nest within moister, denser forest types in Coolah Tops and Goulburn River NPs and other more vegetated areas outside of the Project Area. They may occur where these moister forest types occur in denser gullies in the north eastern corner of the Wind Farm Study Area.

Masked Owls prey on small terrestrial and scansorial mammals (and to a lesser extent, on birds) and may forage throughout the study areas, including in more open habitats and pasture where rats, rabbits and other small terrestrial mammals occur. Loss of habitat affecting the prey base for this species (primarily terrestrial mammals) is likely to be less of a factor than for the Powerful Owl.

Whilst clearing for small (< 200 ha) forest fragments that are more than 1 km from large areas of forest are not used by Powerful Owls, they may provide marginal habitat for non-breeding Masked Owls. Due to the patchy nature of most of the vegetation that occurs in the study area, the impact of the proposal on this species is considered less than for the Powerful Owl, and unlikely to affect the lifecycle of this species such that it is placed at risk of extinction. Proposed turbine locations in the very north-eastern section of the Wind Farm Study Area have been removed from the proposal partly due to the potential for owls to be utilising the high-quality habitat of that area.

The Masked Owl should be a species considered within the adaptive Bird and Bat Management Plan to confirm the assumptions of this assessment, addressing inherent uncertainty.

Barking Owl

The Barking Owl was not recorded during the current survey. The OEH Atlas contained 11 records (dated 1976-2006) scattered throughout the Project Area, mostly around Coolah Tops and Goulburn River NP. There is one record from Durridgere SCA approximately 1.4 km from the proposed transmission line alignment. Most records are located in vegetated areas or on the edge of these areas.

This species occurs in dry box-dominated forest and woodlands and roosts in dense foliage of *Acacia*, *Casuarina* or *Eucalyptus* species. It nests in large hollows (20-46 cm diameter) of large, old eucalypts including River Red Gum, White Box, Red Box and Blakely's Red Gum. Although the Barking Owl is known from Coolah Tops NP, it is considered likely to depend on lower slopes outside the park for foraging (NPWS 2002).

Roost sites are typically in, or under dense foliage in large trees of streamside gallery forests (NPWS 2003). Such habitats are rare in the Transmission Line and Wind Farm Study Areas, where watercourses are generally small and surrounded by degraded areas and also feature sparse vegetation. Loss of habitat affecting the prey base for this species (including arboreal mammals, birds and terrestrial mammals including rabbits) is likely to be less of a factor than for the Powerful Owl.

Similarly to the Masked Owl, the impact of the proposal on this species is considered less than for the Powerful Owl, and unlikely to affect the lifecycle of this species such that it is placed at risk of extinction. Proposed turbine locations in the very north-eastern section of the Wind Farm Study Area have been removed from the proposal partly due to the potential for owls to be utilising the high-quality habitat of that area.

The Barking Owl should be a should be a species considered within the adaptive Bird and Bat Management Plan to confirm the assumptions of this assessment, addressing inherent uncertainty.

b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

Not applicable.

c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable.

d) In relation to the habitat of a threatened species, population or ecological community:

i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

i) Section 10 of the Wind Farm report and Section 8 of the Transmission Line report discuss the extent of native vegetation types to be removed or modified as a result of the proposal. In general, relatively small areas of good quality forest or woodland habitat would be removed or modified within the Wind Farm Study Area, with most of the proposal affecting exotic pasture or cleared scattered trees over pasture. Larger areas of better quality vegetation may be cleared within the Transmission Line Study Area for the 60 m easement which has the potential to include loss of hollow bearing trees and threatened species habitat. However, recommendations have been given in areas of good quality habitat for follow up survey work to determine its value as threatened species habitat before clearing proceeds. Recommendations have also been provided to protect and microsite infrastructure to avoid hollows in the first instance and then survey to accurately quantify hollows to be removed in order to offset or replace all hollows that are cleared during construction.

ii) In the Wind Farm Study Area, turbines are located on ridges, often adjacent ridges, with a spacing of approximately 2 to 5 km between them. Spacing between turbines in the current layout is generally around 300-600m. The distance between turbine clusters and also the distance between individual turbines is expected to allow for safe passage between turbines for birds and bats, without creating a barrier effect. There may be some alteration to movement patterns for some species, but areas of habitat are unlikely to become isolated from each other.

iii) Areas of habitat to be removed for turbines, access tracks, power infrastructure, and transmission line associated with the proposal are well represented in the overall Project Area and surrounding locality, including within conservation reserves and state forests such as Coolah Tops NP, Goulburn River NP, Durrigere SCA and Curryall, Turill and Munmurra State Forests. The majority of the habitat to be

removed in the Wind Farm Study Area is degraded and has been subject to ongoing disturbance from agricultural land use. As a result, the majority of potential habitat within the Project Area is considered unlikely to support the fauna species assessed, considering land use history, condition assessments and the results of the field surveys. However, the importance of habitat in the southern section of the Transmission Line Study Area and the north-eastern section of the Wind Farm Study Area are not known and precautionary measures, primarily focusing on more survey work, have been implemented to ensure that significant impacts to the species considered in this assessment are avoided.

e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

There are no areas of declared critical habitat within the Project Area or greater locality.

f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

Owls

The recovery plan for the Large Forest Owls, including Powerful Owl and Masked Owl, identifies the actions that need to be undertaken to ensure their long-term conservation. The action proposed is generally consistent with the objectives of the recovery plan for large forest owls, however the vegetation clearing required for the proposal is likely to remove foraging and potentially breeding habitat. Despite this, vegetation clearing is not expected to increase the barriers to gene flow between populations.

Relevant non-specific actions and plans

In general, design measures to avoid and mitigate impacts have included avoiding areas of high conservation value fauna habitat and this is consistent with the actions and objectives of recovery plans and priority actions developed for species considered in this assessment.

g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The proposal may increase the impact of the following key threatening processes relevant to the species assessed herein:

- Clearing of native vegetation.

In the determination, the NSW Scientific Committee found that 'clearing of any area of native vegetation, including areas less than two hectares in extent, may have significant impacts on biological diversity'. Clearing can lead to direct habitat loss, habitat fragmentation and associated genetic impacts, habitat degradation, loss of the leaf litter layer, increased habitat for invasive species and off-site impacts such as downstream sedimentation.

While the proposal contributes to clearing of native vegetation, including the potential removal of over 400 ha of threatened Box Gum Woodland (although approximately half of this is derived grassland and actual clearing extents will be much less), the majority of this is in historically cleared and fragmented areas that have been highly degraded through long-term grazing practices. Clearing of better quality vegetation is generally restricted to proposed access tracks and powerline easements where these intersect with more closed woodland or sandstone forest communities.

- Loss of hollow-bearing trees

Hollow-bearing trees will be removed during the vegetation clearing required for the proposed development. The majority of these will likely be in the less-disturbed patches of vegetation that

the transmission line may pass through, such as parts of Durrigere State Conservation Area and the southern end of Ulan Road. Hollows vary considerably in density and size throughout the Transmission Line Study Area, as well as by vegetation type. Recommendations have been made to perform hollow-bearing tree targeted surveys prior to clearing to determine micro-siting of infrastructure and minimise losses. It is deemed unlikely that any threatened species will be significantly affected by the vegetation clearance associated with the proposed development. Recommendations regarding the installation of nest boxes have been made to prevent a reduction in the number of available hollows in the landscape.

- Removal of dead wood and dead trees

The removal of dead wood and dead trees from the landscape may occur as a result of the proposed development. It is unlikely that any threatened reptiles species will be utilising dead wood within the study area, although dead standing trees may provide shelter for threatened bird and bat species, and to a lesser degree, Squirrel Gliders in certain locations. It is unlikely that the removal of dead wood and trees will result in a significant impact to any threatened species in the region. Recommendations are given for fallen timber greater than 50 cm to be left in place or moved to a nearby area to retain fauna habitat, where possible.

- Predation by the European Red Fox (*Vulpes vulpes*)

There is potential for the proposed works to increase the suitability of certain areas of the project area for use by foxes. It is likely that foxes are already present throughout most, if not all, of the study area, although tree-clearing within large intact vegetation patches may result in more easily-traversed terrain and provide movement corridors for foxes.

- Predation by the Feral Cat (*Felis catus*)

There is potential for the proposed works to increase the suitability of certain areas of the project area for use by foxes. It is likely that feral cats are already present throughout all of the study area, although tree-clearing within large intact vegetation patches may result in more easily-traversed terrain and provide movement corridors for cats.

D.1.6 Bats

a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

Microbats

Eastern Bentwing Bat

This species was observed to utilise all habitats in the Wind Farm Study Area except pasture with scattered trees and exposed ridgetops with sparse trees. The Atlas database search showed two records of this species, from within Coolah Tops NP and Goulburn River NP. The proposal has the potential to affect the species during the operational phase as a result of collisions with infrastructure. Based on carcass search results reviewed for other projects, the risk to Eastern Bentwing Bat within general habitat appears low; however in overseas studies, migratory bats are considered at higher risk. The Eastern Bentwing Bat is known as a sub- and over-canopy feeder, so the majority of foraging is expected to be below the rotor-swept area.

There are no known maternity caves in close proximity to the Project Area or within the region. The known nearest maternity cave is within Willi Willi (near Kempsey), approximately 500 km east (OEH 2012). These caves are used by a large proportion of the female and juvenile population. Given the apparent distribution of the species across the Project Area over summer it appears possible that the local population of Eastern Bentwing Bats may spike slightly during migration periods (November and February-March).

Given the long distance of the Project Area from known maternity caves the proposal is unlikely to have an adverse impact on the lifecycle of this species so that it would be placed at risk of extinction. Additionally, on the basis of carcass search monitoring elsewhere it appears unlikely that the local population would be placed at risk of extinction from the wind farm proposal; however given that the bat was recorded from six locations across the wind farm, there is potential for this species to be impacted as a result of collision with turbine blades during the operation life of the wind farm. This species should be a focal species of an operational Bird and Bat Management Plan to confirm the assumptions of this assessment, addressing inherent uncertainty.

Eastern Cave Bat

The proposal has the potential to affect this species during the operational phase (blade-strike risk and barotrauma). The Eastern Cave Bat is a cave-roosting species that is usually found in dry open forest and woodland, near cliffs or rocky overhangs. It has been recorded roosting in disused mine workings, occasionally in colonies of up to 500 individuals. Churchill (2008) suggests that forests without natural roosting sites (caves or large rock overhangs) do not provide habitat for this species. Maternity caves have generally been found in shallow sandstone caves (Churchill 2008). While the Eastern Cave Bat is considered to be a sub- and over-canopy feeder, little is known about the ecology of this species. It is considered the species forages over a small area and will forage close to the ground, but has been observed flying up to 500 m over cleared paddocks. Given the available information on this species it is expected it would forage well below the rotor-swept area on most occasions, primarily with a preference for creeklines.

Given that this species is more likely to forage in gullies or creeklines, rather than on ridgetops and the carcass searching monitoring does not indicate high fatality rates for this species, it appears unlikely that the local population would be placed at risk of extinction. However, given that sandstone rocky outcrops are present within the Transmission Line Study Area this species should be a focal species of an operational Bird and Bat Management Plan to confirm the assumptions of this assessment, addressing inherent uncertainty.

Corben's long-eared Bat

The proposal has the potential to affect this species during the operational phase (blade-strike risk and barotrauma) as well as a result of habitat loss. Corben's long-eared bat inhabits a variety of vegetation types, including mallee, bulloke (*Allocasuarina leuhmannii*) and box eucalypt-dominated communities, but it is distinctly more common in box/ironbark/cypress-pine vegetation that occurs in a north-south belt along the western slopes and plains of NSW and southern Queensland.

The bat data from the 2012 survey indicated that *N. corbeni* showed a distinct preference for *Casuarina* along creeklines, open forest without understorey and dense woodland, supporting the concept that all long-eared bats prefer cluttered habitats (Greg Richards & Associates 2012). This species roosts in tree hollows, crevices and under bark.

This species is a slow flying agile bat and utilises the understorey to hunt non-flying prey - especially caterpillars and beetles - even hunting on the ground (OEH 2012). It is considered unlikely to encounter turbines and be susceptible to blade-strike and/or barotrauma impacts.

Given that this species is likely to forage in the understorey and that sandstone forest types to be cleared for the transmission line are widespread in the surrounding area, it appears unlikely that the local population would be placed at risk of extinction. However, this species should be a focal species of an operational Bird and Bat Management Plan to confirm the assumptions of this assessment, addressing inherent uncertainty.

Yellow-bellied Sheathtail Bat

The 2012 Anabat survey completed as part of this assessment returned one possible record of this species, from along the north-eastern edge of Durrigere SCA in the Transmission Line Study Area. This species was not recorded at sites in the Wind Farm Study Area. This species is known to roost in large hollow-bearing trees in a variety of habitats. They migrate into Southern Australia during the summer months (Jan – Apr). This species forages at canopy level, but lower over open spaces at forest edges. In pursuit of prey, this species is capable of tight lateral turns (Chruchill 2008).

The data suggests this species is not common in the area as only one 'possible' call of this species was recorded and only in the Transmission Line Study Area. Given that the species is more likely to forage near the forest edge beneath the rotor-swept area in open habitat it is not expected the proposal will have an adverse effect on this species such that it would be placed at risk of extinction from blade-strike. In practice, the Wind Farm Study Area will also continue to have foraging habitat value for this species during the operational phase of the development, where the existing vegetation cover will largely be retained within turbine envelopes. However, some habitat removal is expected within the Transmission Line Study Area and there may be some loss of hollow-bearing trees (roost sites) for this species, primarily within the southern section of the easement (near Durrigere SCA).

On the basis of the results of the site survey (low call recordings), it appears unlikely that the local population would be placed at risk of extinction. However, this species should be a focal species of an operational Bird and Bat Management Plan to confirm the assumptions of this assessment, addressing inherent uncertainty. Mitigation strategies related to further survey work and removal of hollows (i.e. potential breeding sites) in the southern section of the Transmission Line Study Area have been recommended to ensure impact to this species is not significant.

Large-eared Pied Bat

The Large-eared pied bat is found mainly in areas with extensive cliffs and caves, from Rockhampton in Queensland south to Bungonia in the NSW Southern Highlands. It is generally rare with a very patchy distribution in NSW. It roosts in caves (near their entrances), crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of the Fairy Martin (*Hirundo ariel*), frequenting low to mid-elevation dry open forest and woodland close to these features. Females have been recorded raising young in maternity roosts (c. 20-40 females) from November through to January in roof domes in sandstone caves. It is found in well-timbered areas containing gullies.

The OEH database search returned 7 records of this species, all from within Goulburn River NP. The 2013 survey recorded this bat in 2 locations in the Wind Farm Study Area and 4 in the Transmission Line Study Area. The 2013 survey recorded this species in an additional 2 locations in the Transmission Line Study Area.

This bat roosts in caves and will not be affected by the loss of tree hollows. Based on their wing aspect ratio (an indicator of foraging style) the Large-eared pied bat is likely to be a sub- and over-canopy feeder and the majority of foraging in the Wind farm would be below the rotor-swept area (Richards 2012). The primary impact on this species associated with the Proposed development would result from clearance of forest and woodland areas along the transmission line within the Transmission Line Study Area. The transmission line easement would result in the loss of between 126ha and 162.2ha (depending on the final route option selected) of forest and woodland habitat types.

Given that sandstone forest types to be cleared for the transmission line are widespread in the surrounding area, it appears unlikely that the local population would be placed at risk of extinction. However, this species should be a focal species of an operational Bird and Bat Management Plan to confirm the assumptions of this assessment, addressing inherent uncertainty.

b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

Not applicable.

c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

ii) Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable.

d) In relation to the habitat of a threatened species, population or ecological community:

i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

Bats

i) Section 10 of the Wind Farm report and Section 8 of the Transmission Line report discuss the extent of native vegetation types to be removed or modified as a result of the proposal. In general, relatively small areas of good quality forest or woodland habitat would be removed or modified within the Wind Farm Study Area, with most of the proposal affecting exotic pasture or cleared scattered trees over pasture. However, recommendations have been given in areas of good quality habitat for follow up survey work to determine its value as threatened species habitat before clearing proceeds. Recommendations have also been provided to protect and microsite infrastructure to avoid hollows in the first instance and then survey to accurately quantify hollows to be removed in order to offset or replace all hollows that are cleared during construction.

ii) In the Wind Farm Study Area, turbines are located on ridges, often adjacent ridges, with a spacing of approximately 2 to 5 km between them. Spacing between turbines in the current layout is generally around 300-600m. The distance between turbine clusters and also the distance between individual turbines is expected to allow for safe passage between turbines for birds and bats, without creating a barrier effect. There may be some alteration to movement patterns for some species, but areas of habitat are unlikely to become isolated from each other. Vegetation in the landscape is already very fragmented, and bats persist in that environment because of their mobility. The small amount of clearing for each turbine location is unlikely to increase fragmentation at a landscape level, particularly for mobile bat species.

The clearing of the transmission line easement is unlikely to create an impediment to movement for the microchiropteran bat species considered in this assessment.

iii) Types of habitat to be removed for turbines, access tracks, power infrastructure, and transmission line associated with the proposal are well represented in the overall Project Area and surrounding locality, including within conservation reserves and state forests such as Coolah Tops NP, Goulburn River NP, Durrigere SCA and Curryall, Turill and Munmurra State Forests. The majority of the habitat to be removed in the Wind Farm Study Area is degraded and has been subject to ongoing disturbance from agricultural land use.

The presence of the wind farm has the potential to represent indirect habitat loss if bats avoid the entire area of the wind farm. However, research to date (summarised in the main report) suggests that bats readily fly among turbines with only a small percentage suffering mortality from collision with turbines. There is no evidence available to suggest that bat utilisation of remnant vegetation within the turbine envelope, decreases following wind farm construction. Regardless, microchiropteran bats (species diversity and activity levels) would be a focus of the Bird and Bat Adaptive Management Plan for the project.

e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

There are no areas of declared critical habitat within the Project Area or greater locality.

f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

Eastern Cave Bat

Of the identified priority actions for this species, the recommendation to *Identify and protect natural roost habitat such as caves and overhangs* is relevant to this proposal. No roost sites were identified that were considered appropriate for this species during the field survey.

Corben's long-eared Bat

Of the identified priority actions for this species, the recommendation to *Ensure the largest hollow bearing trees (including dead trees and paddock trees) are given highest priority for retention in PVP assessments and or other land assessment tools* is relevant to this proposal. This assessment has identified mitigation measures to minimise the loss of hollow bearing trees and dead trees and offset hollow bearing trees that would be removed.

Yellow-bellied Sheathtail Bat

Of the identified priority actions for this species, the recommendation to *Ensure the largest hollow bearing trees (including dead trees and paddock trees) are given highest priority for retention in PVP assessments and or other land assessment tools* is relevant to this proposal. This assessment has identified mitigation measures to minimise the loss of hollow bearing trees and dead trees and offset hollow bearing trees that would be removed.

Eastern Bentwing Bat

OEH have identified priority actions which relate to protection of roost sites; none are relevant to the proposal.

Large-eared Pied Bat

Of the identified priority actions for this species, the recommendation to *Ensure protection of caves and overhangs in area of suitable geology when undertaking PVP assessments (offsets should include nearby remnants in high productivity) or other land assessment tools* is relevant to this proposal. No roost sites were identified that were considered appropriate for this species during the field survey.

Relevant non-specific actions and plans

In general, design measures to avoid and mitigate impacts have included avoiding areas of high conservation value fauna habitat and this is consistent with the actions and objectives of recovery plans and priority actions developed for species considered in this assessment.

A Threat Abatement Plan (TAP) has been prepared for the threatening process *Predation by the Red Fox*. The proposal is not located near to any priority sites discussed under the TAP and is consistent with the objectives and actions of the TAP.

g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The proposal may increase the impact of the following key threatening processes relevant to the species assessed herein:

- Clearing of native vegetation.

In the determination, the NSW Scientific Committee found that ‘clearing of any area of native vegetation, including areas less than two hectares in extent, may have significant impacts on biological diversity’. Clearing can lead to direct habitat loss, habitat fragmentation and associated genetic impacts, habitat degradation, loss of the leaf litter layer, increased habitat for invasive species and off-site impacts such as downstream sedimentation.

While the proposal contributes to clearing of native vegetation, including the potential removal of over 400 ha of threatened Box Gum Woodland (although approximately half of this is derived grassland and actual clearing extents will be much less), the majority of this is in historically cleared and fragmented areas that have been highly degraded through long-term grazing practices. Clearing of better quality vegetation is generally restricted to proposed access tracks and powerline easements where these intersect with more closed woodland or sandstone forest communities.

- Loss of hollow-bearing trees

Hollow-bearing trees will be removed during the vegetation clearing required for the proposed development. The majority of these will likely be in the less-disturbed patches of vegetation that the transmission line may pass through, such as parts of Durrigere State Conservation Area and the southern end of Ulan Road. Hollows vary considerably in density and size throughout the Transmission Line Study Area, as well as by vegetation type. Recommendations have been made to perform hollow-bearing tree targeted surveys prior to clearing to determine micro-siting of infrastructure and minimise losses. It is deemed unlikely that any threatened species will be significantly affected by the vegetation clearance associated with the proposed development. Recommendations regarding the installation of nest boxes have been made to prevent a reduction in the number of available hollows in the landscape.

- Removal of dead wood and dead trees

The removal of dead wood and dead trees from the landscape may occur as a result of the proposed development. It is unlikely that any threatened reptiles species will be utilising dead wood within the study area, although dead standing trees may provide shelter for threatened bird and bat species, and to a lesser degree, Squirrel Gliders in certain locations. It is unlikely that the removal of dead wood and trees will result in a significant impact to any threatened species in the region. Recommendations are given for fallen timber greater than 50 cm to be left in place or moved to a nearby area to retain fauna habitat, where possible.

- Predation by the European Red Fox (*Vulpes vulpes*)

There is potential for the proposed works to increase the suitability of certain areas of the project area for use by foxes. It is likely that foxes are already present throughout most, if not all, of the study area, although tree-clearing within large intact vegetation patches may result in more easily-traversed terrain and provide movement corridors for foxes.

- Predation by the Feral Cat (*Felis catus*)

There is potential for the proposed works to increase the suitability of certain areas of the project area for use by foxes. It is likely that feral cats are already present throughout all of the study area, although tree-clearing within large intact vegetation patches may result in more easily-traversed terrain and provide movement corridors for cats

D.1.7 Endangered Ecological Communities

White Box Yellow Box Blakely's Red Gum Woodland

a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

Not applicable.

b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

Not applicable.

c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

i) *White Box Yellow Box Blakely's Red Gum Woodland* is the predominant woodland vegetation type present within the Wind Farm Study Area, with the exception of the northern ridge tops above roughly 950 m. The community occurs on lower slopes in the northern part of the site and on the lower elevation ridge tops and adjacent slopes in the southern part of the site. Areas of Yellow Box occurring on valley floor flats are also included in this community (although these areas are located outside the turbine envelope, but may be subject to impacts associated with access routes and/or powerline construction).

The EEC is less common in the Transmission Line Study Area where sandstone forest vegetation types are dominant.

Under the TSC Act, areas of degraded native pasture that once comprised Box Gum Woodland canopy species may still be considered part of the EEC. The EEC over the vast majority of the entire Project Area is characterised by low diversity native pasture in poor or poor-moderate condition.

In terms of EECs, calculations are expressed for the entire project area (approximately 7920 ha) including the Wind Farm Study Area and the Transmission Line Study Area in order to assess a cumulative impact to this EEC. Calculations are provided for the three alternative infrastructure layouts so comparisons can be made (see Tables 7-1 to 7-3 in the main report). Total clearing of the EEC is lowest under the preferred infrastructure layout (441.7 ha), slightly more under the alternative layout (445.7 ha), and greatest under the second alternative layout (462.8 ha). These values represent approximately 0.16% of the cumulative Box Gum Woodland remaining in the South-western Slopes and the Brigalow Belt South Bioregions, a total of approximately 270800 ha. Due to the overlap between the three CMAs and three Bioregions that occur in the region, it is difficult to determine the extent of the community at a more localised scale. However, as there is a general trend for Box Gum Woodland to be present in the Coolah region below altitudes of 800-900 m (pers. obs.), it is expected that the local extent of the EEC is also far greater than the maximum extent of proposed clearing. This assumption is strengthened by the

fact that the condition of the EEC on the side slopes of hills (which is to be retained) is better than the condition of the EEC on hilltops (where most clearing will occur), due to the greater impact that livestock and management practices have on the flat ridge tops.

When considering clearing of EEC in Moderate-good and Good condition, the least clearing would again occur under the preferred infrastructure layout (3.9 ha), more than three times as much under the 2nd alternative (14.0 ha), and the most (23.0 ha) under the alternative route.

It should be noted that the amount of clearing on the wind farm varies little with each infrastructure layout as the alternatives relate primarily to the transmission line route to the south of the wind farm. As there is far more Box Gum Woodland present in the Wind Farm Study Area than the Transmission Line Study Area, the overall extents of clearing for the three alternatives are similar.

ii) The majority of impacts associated with the wind farm construction will occur along the ridge tops. These areas are generally in poorer condition than the adjacent slopes due to more grazing pressure. These areas are typically defined by a more open canopy layer with little to no native understorey compared to adjacent slopes. Therefore construction of turbines along the ridge tops would most likely only result in the clearing of scattered trees within the turbine footprints.

Within the Wind Farm Study Area, and areas of Transmission Line Study Area EEC with little or no tree component, EEC values will still be retained to a large extent despite the location of powerpoles, turbines and other infrastructure and shorter term disturbance from construction impacts.

Areas of better quality EEC with a greater understorey diversity and structural integrity are typically concentrated along adjacent slopes. These areas are located outside the turbine envelopes and would remain mostly undisturbed except where they intersect with transmission line easements and access roads; existing tracks are to be utilised where possible. These impact areas are considered minor in terms of the extent of the community available in the locality

Predominately, the areas to be impacted contain a moderate to low tree density with an understorey of exotic and/or native grass dominated pasture with a relatively low native forb and shrub diversity (0 – 11 non-grass species in poor and moderate condition). This structural and understorey configuration is common and widespread within the locality and there are large expanses of this vegetation type with or without tree cover. Based on field observations and known extents of Box Gum Woodland within the Wind Farm Project Area and surrounding region, the loss of this vegetation is not considered likely to substantially affect the extent or modify the community such that it would be placed at risk of extinction.

d) In relation to the habitat of a threatened species, population or ecological community:

i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

i) The proposal will impact upon habitat for Box Gum Woodland in the form of direct clearing of this community and the extent of this impact is discussed in Section c) above. Up to 462 ha of Box Gum Woodland EEC may be cleared as a result of the proposal, although the actual clearing is expected to be far less.

ii) The areas of habitat within the site are already largely fragmented due to previous clearing, grazing pressure, the planting of exotic pastures, the ingress of weeds and the occurrence of other vegetation communities in habitats not suitable for Box Gum Woodland. The proposal would not further fragment or isolate habitat for this community.

iii) The majority of suitable habitat likely to be removed by the proposal is in poor condition. Generally a canopy layer is present (sometimes very sparse), but much of the understorey is cleared and altered to such a state that it is highly unlikely to regenerate without costly and intensive long-term assistance. The extent of clearing is not anticipated to impact the long-term survival of this ecological community in the locality, due to (1) the total extent of the community present in the region, (2) the small footprint of the proposed infrastructure, (3) the poor quality of most of the EEC proposed for clearing, and (4) the retention of understorey species.

e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

There are no areas of declared critical habitat within the Project Area or greater locality.

f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

A draft national recovery plan for this community has been prepared and is currently available for public comment. The proposal is inconsistent with the objective of the draft recovery plan that aims to '*achieve no net loss in extent and condition of the ecological community throughout its geographic distribution*'. Of the 7171.7 ha assessed, Box Gum Woodland covers up to 462.8 ha of which approximately 61.4% is in poor or poor-moderate condition. However, as discussed above, given the majority to be cleared is in poor condition, there is a large extent of the community remaining within the Project Area and the locality, and the potential to improve outcomes for this community through off setting, the clearing is not considered to be significant.

With the correct implementation and management of an offset plan the proposal has the potential to contribute to the following Recovery Plan Objectives;

- Increasing landscape functionality of the ecological community through management and restoration of degraded sites;
- Increasing transitional areas around remnants and linkages between remnants; and
- Bringing about enduring changes in participating land manager attitudes and behaviours towards environmental protection and sustainable land management practices to increase extent, integrity and function of Box Gum Woodland.

g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The proposal may increase the impact of the following key threatening processes relevant to the species assessed herein:

- Clearing of native vegetation.

In the determination, the NSW Scientific Committee found that 'clearing of any area of native vegetation, including areas less than two hectares in extent, may have significant impacts on biological diversity'. Clearing can lead to direct habitat loss, habitat fragmentation and associated genetic impacts,

habitat degradation, loss of the leaf litter layer, increased habitat for invasive species and off-site impacts such as downstream sedimentation.

While the proposal contributes to clearing of native vegetation, including the potential removal of over 400 ha of threatened Box Gum Woodland (although approximately half of this is derived grassland and actual clearing extents will be much less), the majority of this will occur in historically cleared and fragmented areas that have been highly degraded through long-term grazing practices. Clearing of better quality vegetation is generally restricted to proposed access tracks and powerline easements where these intersect with more closed woodland or sandstone forest communities. As most of the overstorey and shrub clearing is expected to occur in common and well-conserved sandstone forest communities, and relatively little clearing in the historically cleared Box Gum Woodland environments, the proposal is expected to contribute minimally to this key threatening process with respect to EECs.

- The invasion of native vegetation by exotic perennial grasses

A number of exotic perennial grasses, including Coolatai Grass and African Lovegrass, were observed within the project area. The proposed development may contribute to the spread of these species within or between sites, although weed management recommendations and other mitigations have been suggested to prevent this from occurring. Recommendations have been given to reduce spread of invasive weeds into good quality woodland vegetation, including a vehicle hygiene protocol for cleaning of vehicles. The proposal is not expected to significantly increase the impact of this Key Threatening Process in the Project Area.

- Loss of hollow-bearing trees

Hollow-bearing trees will be removed during the vegetation clearing required for the proposed development. The majority of these will likely be in the less-disturbed patches of vegetation that the transmission line may pass through, such as parts of Durridgere State Conservation Area and the southern end of Ulan Road. Hollows vary considerably in density and size throughout the Transmission Line Study Area, as well as by vegetation type. Recommendations have been made to perform hollow-bearing tree targeted surveys prior to clearing to determine micro-siting of infrastructure and minimise losses. It is deemed unlikely that any threatened species will be significantly affected by the vegetation clearance associated with the proposed development. Recommendations regarding the installation of nest boxes have been made to prevent a reduction in the number of available hollows in the landscape.

- Removal of dead wood and dead trees

The removal of dead wood and dead trees from the landscape may occur as a result of the proposed development. It is unlikely that any threatened reptiles species will be utilising dead wood within the study area, although dead standing trees may provide shelter for threatened bird and bat species, and to a lesser degree, Squirrel Gliders in certain locations. It is unlikely that the removal of dead wood and trees will result in a significant impact to any threatened species in the region. Recommendations are given for fallen timber greater than 50 cm to be left in place or moved to a nearby area to retain fauna habitat, where possible.

D.2 COMMONWEALTH

The following species listed under the EPBC Act are assessed in accordance with *EPBC Policy Statement 1.1, Significant Impact Guidelines*:

- White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland
- *Digitaria porrecta*
- *Bothriochloa biloba*
- *Dichanthium setosum*
- Large-eared Pied Bat

White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland

a) Will the action reduce the extent of a community?

The proposal would result in the clearing of a small area of Box Gum woodland within the Wind Farm Study Area which forms part of the CEEC. No areas of CEEC were located within the Transmission Line Study Area.

Areas of moderate-good and good condition EEC are likely to meet the condition thresholds of the CEEC. The proposal has the potential to result in the removal of up to 3.9 ha (preferred), 23 ha (alternative) or 14 ha (2nd alternative) of the Box Gum Woodland CEEC causing a localised reduction in the occurrence of this community. This assessment has considered that the worst case scenario would be the total loss of CEEC within the TL easement (up to 60 m); however in reality the vegetation is open woodland meaning that only scattered trees would need to be cleared. In areas of derived grassland (native pasture), very little clearing is expected to be required, as the footprint for the infrastructure is minor. The understorey would be, in most instances, retained, excluding small areas required for footings and maintenance tracks. It is considered likely that the community would maintain its existing functionality following construction. Large extents of moderate-good condition Box Gum Woodland also occur within the Project Area which will not be affected as a result of the proposed works.

b) Will the action fragment or increase fragmentation of the community, for example by clearing vegetation for roads or transmission lines?

The Box Gum Woodland CEEC community within the proposal site boundary has already been highly fragmented due to past clearing and agricultural practices. Permanent clearing will be limited to the removal of scattered trees and high diversity ground cover for the purposes of constructing access roads and the transmission line easement. The preferred route would only require the removal of a small amount (3.9 ha) of Box Gum Woodland CEEC. This includes two small areas of CEEC which are located adjacent to existing roads and thus would not fragment any larger areas of CEEC. The alternative and second alternative routes would result in a higher amount of fragmentation (23 ha and 14 ha respectively) as they pass directly through larger areas of CEEC. Micrositing of infrastructure is also likely to reduce the total extent of the CEEC being cleared, and minimise the fragmentation of affected patches.

c) Will the action adversely affect habitat critical to the survival of an ecological community which consists of, or includes, fauna species?

The preferred route of the proposal will permanently remove less than 4 ha of habitat for the CEEC. The proposed works would not impact habitat critical to the survival of the CEEC, which is abundant across the northern part of the Transmission Line Study Area and the majority of the Wind Farm Study Area. Given the relatively small amount to be removed, it is not considered critical to the survival of the CEEC in the locality.

d) Will the action modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for the community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns?

Localised disturbance to hydrological patterns that support the CEEC may result from the proposal but are unlikely to be substantial. The risks associated with the ingress of invasive species and disease and potential impacts from chemicals and fertilizers are considered to be acceptable if the recommendations included within Section 9 of this report are adhered to.

Soils and nutrient balance in parts of the Project Area are already highly disturbed due to grazing and clearing impacts which have been widespread and long-term in nature. The proposal would have a short term gross impact upon soils and possibly surface water flow, within discreet areas. These impacts are manageable with the implementation of erosion and sediment controls and would be unlikely to further degrade the Project Area above levels already occurring from present landuses.

The construction of roads may cause minor alterations to drainage patterns due to localised reduction in infiltration and runoff. However, the actions associated with the proposal are not considered likely to substantially alter hydrological patterns necessary for the community's survival.

e) Will the action 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?

The development is unlikely to cause a substantial change in species composition in areas of CEEC, including through clearing, harvesting, disease infection, weed invasion or alteration to grazing, burning or flooding regimes. Management associated with offsetting has the potential to increase the diversity of functionally important species within more extensive areas of the CEEC within the proposal site.

Large potential offset areas exist within the site boundary that if properly managed can assist with the recovery of this community, arresting existing threats and managing the land for biodiversity outcomes in perpetuity. Offsetting is recommended by this report to maintain or improve the biodiversity values associated with the proposal in the longer term. The offset plan for the proposal would include provisions for offsetting Commonwealth listed EEC to demonstrate compliance with the Commonwealth Offset Policy.

f) Will the action 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; and - causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community?

The construction phase of the proposal has the potential to introduce or assist the spread of invasive weed species. The invasion of native vegetation by exotic perennial grasses is a particular risk for the CEEC. These risks could be reduced to acceptable levels through weed hygiene protocols, pre- and post-works weed control, soil erosion and sedimentation control, effective and timely site rehabilitation and the avoidance of fertiliser use in areas within and adjacent to the CEEC.

Protocols for pollution prevention and site management are given in Section 12. With controls in place, the works are not expected to result in significant impacts from weeds or pollutants.

g) Will the action interfere with the recovery of an ecological community?

The proposal is unlikely to interfere with the recovery of the CEEC and with the implementation of a suitable offset plan is likely to assist with the recovery of the broader extent of the community within the proposal site.

Conclusion

With the implementation of the controls and recommendations of this report the proposal is considered unlikely to have a significant impact on the Box Gum Woodland CEEC and, through long-term management and improvement, would result in a net gain. Referral to the Commonwealth government under the EPBC Act is also recommended however, to confirm that the action would not be deemed a Controlled Action on the basis of impacts to the Commonwealth listed EEC.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

lead to a long-term decrease in the size of an important population of a species

- **reduce the area of occupancy of an important population**
- **fragment an existing important population into two or more populations**
- **adversely affect habitat critical to the survival of a species**
- **disrupt the breeding cycle of an important population**
- **modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline**
- **result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat**
- **introduce disease that may cause the species to decline, or**
- **interfere substantially with the recovery of the species.**

What is an important population of a species?

An 'important population' is a population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in recovery plans, and/or that are:

- **key source populations either for breeding or dispersal**
- **populations that are necessary for maintaining genetic diversity, and/or**
- **populations that are near the limit of the species range.**

Large-eared Pied Bat

The Large-eared Pied Bat is listed as Vulnerable under the EPBC Act 1999.

The OEH database search returned 7 records of this species, all from within Goulburn River NP. The 2013 survey recorded this bat in 2 locations in the Wind Farm Study Area and 4 in the Transmission Line Study Area. The 2013 survey recorded this species in an additional 2 locations in the Transmission Line Study Area.

This bat roosts in caves and will not be affected by the loss of tree hollows. Based on their wing aspect ratio (an indicator of foraging style) the Large-eared Pied Bat is likely to be a sub- and over-canopy feeder and the majority of foraging in the Wind farm would be below the rotor-swept area (Richards 2012). The primary impact on this species associated with the Proposed development would result from clearance of forest and woodland areas along the transmission line within the Transmission Line Study Area.

Given that sandstone forest types to be cleared for the transmission line are widespread in the surrounding area, it is considered that the Proposed development (including wind farm and transmission line components) is unlikely to reduce the area of occupancy of the local population of Large-eared pied bats, fragment this population, adversely affect critical habitat, disrupt the breeding cycle or modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.

Dichanthium setosum* and *Bothriochloa biloba

Neither *Dichanthium setosum* nor *Bothriochloa biloba* were recorded within the Wind Farm or Transmission Line Study Area. Both are considered possible occurrences in the Wind Farm Study Area. *Dichanthium setosum* was not recorded in the OEH database search. If this species occurs in the project area it is likely to be confined to basalt derived soils in the Wind Farm Study Area.

Lobed blue-grass (*Bothriochloa biloba*) is an erect or decumbent grass to 1m high. This species grows in cleared eucalypt forests and relict grassland, preferring heavier-textured soils such as brown or black clay soils (Commonwealth Department of the Environment 2008a). The OEH database search returned 27 records of this species, indicating that the local population is quite widespread. The majority of these records are from west of the Wind Farm and Transmission Line Study Areas, however some records are from within the Study Areas.

The majority of groundcover vegetation within the Wind Farm survey envelope will not be impacted by the development of the wind farm and will continue to provide potential marginal habitat for these grasses. Within the Transmission line easement, grass species will not be cleared except to create some new access tracks, widen existing ones and install power poles (with associated ground disturbance in the vicinity of this infrastructure). It is unlikely that the Proposed development would result in a significant impact on these grass species should they occur in the Project Area.

An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:

- **lead to a long-term decrease in the size of a population;**
- **reduce the area of occupancy of the species;**
- **fragment an existing population into two or more populations;**
- **adversely affect habitat critical to the survival of a species;**
- **disrupt the breeding cycle of a population;**
- **modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline;**
- **result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat;**
- **introduce disease that may cause the species to decline; or**
- **interfere with the recovery of the species.**

Digitaria porrecta

Digitaria porrecta was not recorded within the Wind Farm or Transmission Line Study Area. This species may not have been detectable in site surveys due to the timing of the surveys (October). The OEH database search for the project area returned 3 records of *Digitaria porrecta* in one location in farmland (elevation 635m) 15km north of Coolah. This area is outside the Wind Farm Study Area. If this species occurs in the project area it is likely to be confined to basalt derived soils in the Wind Farm Study Area.

The population of this species is estimated to be 200 000 individuals with 75% occurring near Premer (approximately 41 500 individuals) and Tambar Springs (114 000 individuals) in NSW (Commonwealth Department of the Environment 2008c).

The majority of groundcover vegetation within the nominated survey envelope will not be impacted by the development of the wind farm and will continue to provide potential marginal habitat for this grass. It is unlikely that the Proposed development would result in a significant impact on this species should it occur in the Wind Farm Study Area.

Conclusion

The proposal has the potential to result in the removal of up to 0.8 ha of the Box Gum Woodland CEEC causing a localised reduction in the occurrence of this community. This assessment has considered that the worst case scenario would be the total loss of this vegetation type however, in reality, the actual impact is likely to be considerably less as vegetation within this area is open woodland and groundcover vegetation would only be affected where footings and a maintenance track is required. The proposal will not impact on the broader extent of the CEEC within the Project Area. Localised disturbance to hydrological patterns that support the CEEC may result from the proposal but are unlikely to be substantial. The risks associated with the ingress of invasive species and disease and potential impacts from chemicals and fertilizers are considered to be acceptable if the recommendations included within Section 12 of this report are adhered to.

Offsetting is recommended by this report to maintain and improve the biodiversity values associated with the CEEC within the Project Area. Additionally, provisions are given within the offset strategy to comply with the Commonwealth offset policy for this community. Large areas potentially exist within the Project Area that if properly managed can assist with the recovery of this community, arresting existing threats and managing the land for biodiversity outcomes.

With the implementation of the controls and recommendations of this report the proposal is considered unlikely to have a significant impact on the EPBC-listed Box Gum Woodland CEEC.

For the Large-eared Pied Bat, the Proposed development (including wind farm and transmission line components) is unlikely to reduce the area of occupancy of the local population, fragment this population, adversely affect critical habitat, disrupt the breeding cycle or modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.

APPENDIX E MAPS

E.1 LOCATION OF PROJECT AREA

E.2 SURVEY EFFORT

E.3 SURVEY RESULTS

E.4 CONSTRAINT MAPS

APPENDIX F OFFSET STRATEGY

F.1 INTRODUCTION

The objective of offsetting is to ensure that an overall ‘maintain or improve’ outcome is met for the project; where impacts cannot be avoided, or sufficiently minimised, the residual impact will be offset in perpetuity.

The biodiversity offset principles developed by the former DECCW (now DOE) would guide the selection and management of the offset site, namely:

- Impacts must be avoided first by using prevention and mitigation measures.
- All regulatory requirements must be met.
- Offsets must never reward ongoing poor performance.
- Offsets will complement other government programs.
- Offsets must be underpinned by sound ecological principles.
- Offsets should aim to result in a net improvement in biodiversity over time.
- Offsets must be enduring - they must offset the impact of the development for the period that the impact occurs.
- Offsets should be agreed prior to the impact occurring.
- Offsets must be quantifiable - the impacts and benefits must be reliably estimated.
- Offsets must be targeted.
- Offsets must be located appropriately.
- Offsets must be supplementary.
- Offsets and their actions must be enforceable through development consent conditions, licence conditions, conservation agreements or a contract.

The proponent commits to the preparation of an Offset Strategy, developed with input from OEH and the CMA and finalised prior to any construction impacts.

Further, the proponent commits to the preparation of an Offset Plan, developed with input from OEH and the CMA prior to operation, demonstrating the suitability of the final offset site and providing detailed management actions specific to the site.

An Offset Strategy outline is provided below, to provide certainty around:

1. How offsets will be identified
2. How offsets will be managed
3. How offsets will be secured

These issues are outlined below.

F.1.1 Background

The DGRs for this proposal require that an Offset Package be developed where the proposal cannot adequately avoid or mitigate impacts on biodiversity. While measures have been taken to minimise impacts (refer to mitigation strategies set out in Section 9), residual impacts remain and therefore an Offset Package is considered to be required.

The following commitments are made by the proponent to address this requirement:

1. The proponent commits to the preparation of an **Offset Strategy**, developed with input from OEH and the CMA and finalised prior to any construction impacts.
2. Further, the proponent commits to the preparation of an **Offset Plan**, developed with input from OEH and the CMA prior to operation, demonstrating the suitability of the final offset site and providing detailed management actions specific to the site.

The wording of the above commitments ensures that prior to any impact, the offset site, the offset ratios, the management measures in place and the means to secure the site have been developed with input from OEH and the CMA.

In order to better understand their requirements regarding offsets for this project consultation was undertaken with OEH on 12 March 2013, following submission of the draft BA for validation and prior to public exhibition. The following discussion provides additional information specifically addressing the issues raised by OEH in this meeting and their detailed comments provided as part of BA validation.

The strategy proposed in this document is based on similar strategies undertaken in consultation with OEH for renewable energy projects in NSW.

F.1.2 Scope and aim of this Draft Offset Strategy

The key aim of the provision of this information is to demonstrate, prior to project approval that the offsets required can be achieved and will be acceptable to the impact proposed. Furthermore, it sets out a clear pathway to implementation of the offsets, to provide certainty regarding the outcomes for all parties involved.

Because of the different nature of the impacts of wind farms versus transmission lines and the scale of the project, two separate biodiversity assessments have been prepared for the Liverpool Range Wind Farm project. However, it is proposed that one Offset Package be produced to offset the residual biodiversity impacts. Hence, this appendix is duplicated in each Biodiversity Assessment.

Specific to issues raised by OEH, offsets for the Liverpool Wind Farm Project would:

- Be supported by a suitable metric. *Standardised survey techniques used.*
- Addresses the Department's 'Principles for Biodiversity Offsets in NSW'. *These are addressed below.*
- Ensure that offset sites are located remote from the influence of wind turbines (and any habitat modification that could be expected in nearby habitat). *Location criteria are included in the offset guidelines.*
- Be governed by conservation mechanisms to ensure long-term protection and management of the site, including funding arrangements. *One Conservation Property Vegetation Plan (CPVP) proposed for each private property offset site.*
- Include a management plan to ensure management measures are appropriate. *Guidance on development of appropriate management measures is provided below.*
- Be able to be demonstrated prior to the impact occurring (including precise quantification of impact vs offset lands and their locations). *Commitment to upfront ratios put a limit on clearing allowed. Commitment to validate actual clearing and ensure this is offset is provided.*
- Be able to ensure a maintain or improve outcome. *Ratios proposed are in line with guidance documents and*

consultants experience, as set out below.

Specific to key components of this outline, it is noted that:

In advance of project approval, allowances have to be made for changes in the infrastructure layout. The movement of infrastructure within the development envelope is termed ‘micro-siting’. Limits are placed on micro-siting by the draft standard conditions for wind farms developed by the NSW Department of Planning and Infrastructure (a location allowance of 100 metres radius for development components as long as impacts remain consistent with that assessed - <http://www.planning.nsw.gov.au/standard-and-model-conditions>). These changes may also affect the landowners involved in the project and therefore the ability to use suitable areas of their property in the Offset Package. In response to this issue, a ‘criteria approach’ has been adopted in the development of this offset outline. The criteria and methods set out below are intended to guide the finalisation of the Offset Package whilst allowing the project the flexibility it requires to be developed.

While a Biobanking offset methodology is not proposed, the *Part 3A Transitional Project Biobanking Guidance for Offset Ratios* has been referenced where relevant below.

F.2 IMPLEMENTATION OVERVIEW

The following stages of implementing the Offset Package are proposed:

Stage	Timing
1. Offset Strategy	Draft Strategy pre project approval (this document). Final Strategy endorsed by agencies, prior to any impact.
a. Estimation of loss of habitat required for the project.	
b. Calculation of the required offsets, using predetermined offset ratios.	
c. Consultation and endorsement of CMA and OEH to finalise the Offset Strategy.	
2. Offset Plan	Prior to any impact.
a. Selection of offset sites	
b. For each offset site:	
o Establishment of baseline data.	
o Documentation of key biodiversity risks, opportunities and relevant local initiatives.	
o Refinement of management actions specific to the site (with input from the landowner), including monitoring regime and reporting requirements.	
o Consultation and endorsement of CMA and OEH to finalise the Offset Plan (could be documented separately for each site or in one combined document).	
3. Verification of the actual area of native vegetation clearing of the constructed wind farm and transmission line.	After construction.
4. Formalisation of the offset on the title of each involved property by way of a CPVP, including the inclusion of the management plan and its required management actions and land use restrictions.	Prior to operation.

These stages are detailed further in the sections below.

F.3 OFFSET STRATEGY

F.3.1 Estimation of loss of habitat

The Biodiversity Assessment estimates the impact area for the proposal through calculation of habitat loss on a worst case scenario. This information is contained in Section 7 and provides an upper limit on the clearing proposed for the project and therefore required to be offset. Vegetation and habitat loss is currently grossly overestimated by the inclusion of large buffers around infrastructure and tracks (e.g. 20m buffer allowed for underground powerlines and tracks). In reality clearing for tracks will be much less and some tracks are already cleared. Similarly, where infrastructure is being placed in areas of degraded grassland/pasture these areas will not require clearing.

F.3.2 Calculation of required offsets

The proponent commits to determining an offset ratio with reference to:

- The conservation status of the vegetation (EECs would be offset at a higher ratio than common vegetation types)
- The condition of the vegetation (a standard metric has been used to collect condition data and would be used to ensure vegetation in better condition is offset at a higher ratio than degraded vegetation²)
- Habitat values (important habitat elements or verified threatened species habitat would be offset at a higher ratio)

The offset ratios are proposed to be via negotiated agreement with OEH, rather than using the Biometric Assessment Methodology. A large amount of biodiversity survey work has been undertaken onsite. The intention is to supplement rather than redo this survey work in the calculation of offset areas. Using the Biometric Assessment Methodology at this time would duplicate survey effort.

The proposed ratios below have been developed based on **ngh**environmental's experience with the Biobanking calculator in similar vegetation types as well as in negotiations with OEH for similar renewable energy projects. They are proposed as a starting point for a negotiated agreement. They have the benefit of being transparent to the proponent and the consent authority, facilitating an upfront understanding of the offset requirements for the project in advance of impacts occurring. Where multiple factors apply and their ratios are contradictory (i.e. threatened species habitat and low condition vegetation) it is proposed that the highest offset ratio would apply. Hollow-bearing tree requirements (HBT) are supplementary to area offsets. While the Biometric Assessment Methodology has the advantage of being more clear cut, we propose a negotiated agreement that is flexible to achieving an overall beneficial outcome and is better suited to the many individual sites that are likely to be included in the final offset plan.

² This is a five class condition categorisation, documented within the BA and able to be easily related to the Biometric two-class condition categories.

Proposed offset ratios

Condition class	Biometric condition ³	Vegetation <u>NOT</u> <u>OF</u> conservation significance	Vegetation <u>OF</u> conservation significance	Threatened species habitat	HBT removed: nest box
Poor	Low	1 : 1	1 : 2	1 : 2	1 : 1
Poor-moderate	Moderate- Good	1 : 1	1 : 2	1 : 2	1 : 1
Moderate	Moderate- Good	1 : 1	1 : 5	1 : 5	1 : 1
Moderate-good	Moderate- Good	1 : 1	1 : 10	1 : 10	1 : 1
Good	Moderate- Good	1 : 1	1 : 20	1 : 20	1 : 1

Justification of these ratios is based on the following:

- In a recent project with Dubbo OEH office, a 1:5 ratio was endorsed by OEH for all native vegetation to be impacted; that being the ratio for the Grey –Crowned Babbler, considered to be the key significant species to be impacted. The ratios above are lower than this for degraded vegetation and higher than this for vegetation in moderate to good quality, achieving a comparative offset.
- In a recent project with Queanbeyan OEH office, a 1:10 ratio was suggested by OEH for Box Gum Woodland EEC with tree cover and 1: 5 ratio for EEC derived pasture. The ratios above are lower than this for degraded vegetation and higher than this for vegetation in good quality, achieving a comparative offset.
- In a recent project with South West OEH office, a 1:1 ratio was endorsed by OEH for a common vegetation type. The offset site included better habitat values than the development site. The ratios above include 1:1 for common vegetation types and higher ratios for threatened species habitat values, achieving a comparative offset.
- In several Biobanking Assessments undertaken using the BioBanking calculator, EECs in moderate to good biometric condition have returned ratios averaging 1:6. This can be verified as required.
- The Part 3A Transitional Project Biobanking Guidance for Offset Ratios allow a Tier 2 ‘no net loss’ option rather than an ‘maintain or improve’ option, whereby lesser ratios are accepted if ‘maintain or improve’ cannot be achieved. This pathway must consider whether feasible alternatives to the clearing exist and the value of the resource (in this case wind energy). It is considered that the location of turbines and associated infrastructure is necessarily restricted to sites with suitable wind speed and that a lesser goal of ‘no net loss’ may be applicable to this project.

F.4 SELECTION OF OFFSET SITES

The proponent would establish offsets within the private land holdings of the project site. This is an area of over 7000 hectares.

Epuron have lease agreements with all involved landholders (where infrastructure is proposed to be located). These contracts stipulate that the land may be considered for biodiversity offsets. The intention is to select offset lands impacted from within the project boundary in areas that will not be. Broad scale mapping for the site identifies that the vegetation is representative of that that would be cleared and

therefore allows a like for like offset criteria to be targeted. Additional criteria that would be used to select offset sites that will together make up the Offset Package include:

- Of sufficient combined size to achieve the set ratios above (or as negotiated with OEH)
- Complying with *Principles for the use of biodiversity offsets in NSW* guidance document (refer below for explicit reference to these principles)
- Will include provisions for offsetting Commonwealth listed EEC to demonstrate compliance with the Commonwealth offset policy.
- Selected to minimize:
 - Edge area
 - Number of land holdings
- Selected to maximize:
 - Landscape connectivity
 - Preservation of declining habitat types and resources
- Located no closer than 500 m from a wind turbine (to minimise any indirect impacts of the wind farm)

Any areas of ambiguity will be clearly stated so that a decision can be made about the overall suitability of the site. For example, it may be that exact ratios and types are not achieved but the overall package is still considered to achieve an overall neutral or beneficial outcome. If so, this will be identified and justified.

While specific sites have yet to be identified, there are large amounts of land of suitable type and condition within the project boundaries to demonstrate that offsets are achievable. In principle, agreements with landholders are in place.

F.5 FOR EACH OFFSET SITE:

F.5.1 Establishment of baseline data

The following baseline data would be collected for all sites within the Offset Package:

Desktop assessment

Evaluation of potential for threatened species to occur onsite, with reference to prior field work and database searches, below:

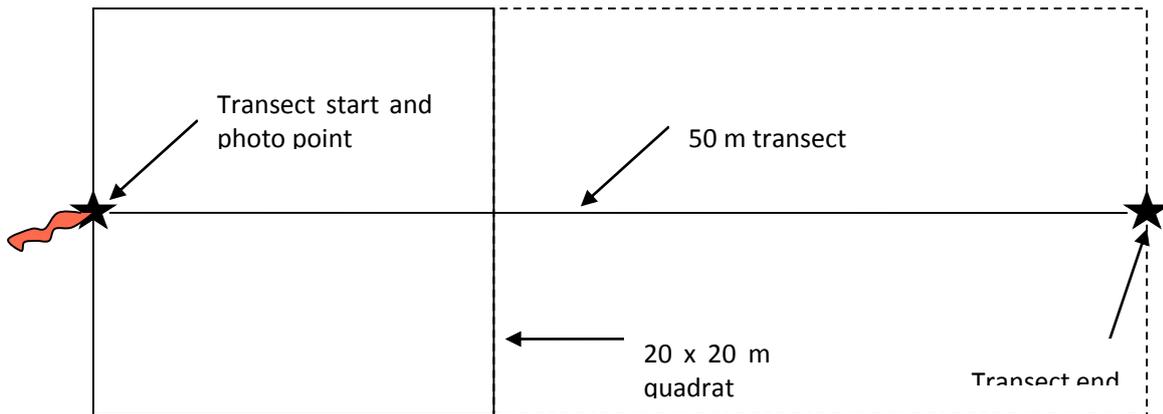
- The OEH threatened species database to identify species listed as threatened under the NSW *Threatened Species Conservation Act 1995* (TSC Act).
- The DSEWPC protected matters search tool to identify species listed as threatened or migratory under the Commonwealth *Environment Protection Biodiversity Conservation Act 1999* (EPBC Act).

Field survey

A field survey would be undertaken by an ecologist. This would include:

- Mapping of vegetation types and condition
- Establishment of monitoring plots
- Onground validation / assessment of habitats for threatened species with the potential to occur at the site

BioBanking plots would be established in accordance with the BioBanking Assessment Methodology (BBAM, DECC 2009) to collect baseline data on vegetation structure and quality. The location of the plots would be marked using 1650 mm star pickets to facilitate the replication of the plots. The ends of the star pickets would be painted white to enable easy identification in the field. Star pickets would be placed at the start and end of the 50 metre transect required by the BBAM and their co-ordinates recorded. To delineate the start point of transects, orange flagging tape would be tied to the top of the appropriate picket. The 20 x 20 metre quadrat required by the BBAM would be conducted within an area bounded by the first 20 metres of the transect and extending 10 metres either side as shown below. Photo points would be established at each of the start points of the transects, with views along the length of the transect.



Monitoring plot layout

Data evaluation

Data recorded from the BioBanking monitoring plots would be compared with the benchmark data for the vegetation type as provided in the BioBanking vegetation types benchmark database (DECC 2008). Monitoring plot data would also be entered into the BioBanking Credit Calculator (BBCC) version 2 to obtain a baseline site value score for dominant vegetation formations at each site.

F.5.2 Key biodiversity risks, opportunities and relevant local initiatives

As a background to the development of appropriate management actions for the site, key biodiversity risks, opportunities and relevant local initiatives for each site would be documented.

F.5.3 Site specific management actions

Offset site management measures are required to be specific to each area in question. These measures aim to result in an improvement in the biodiversity values of the site and are designed to be adaptive (informed by a monitoring regime). These management measures would be incorporated into a detailed management plan for each offset site (one plan per landowner).

Management measures would be developed with reference to the Biobanking Management Plan template and with input from the CMA. Examples of likely measures are included below.

Example offset site management measures

Management measure	Objective	Justification	Action	Timing
Exclusion of stock	To prevent overgrazing and encourage regeneration of native vegetation. Any exclusion fencing must take into account access to macropods to enable natural levels of grazing to continue, requirements of threatened flora species and fire regimes.	Grazing would be likely to degrade habitat.	<ul style="list-style-type: none"> Install stock proof fencing around the perimeter of the Offset Site (consider access for Macropods). 	<ul style="list-style-type: none"> At establishment of the Offset Site. Ongoing repairs as required.
Weed control	To minimise the occurrence of weeds within the Offset Site particularly Weeds of National Significance (WoNS) and listed noxious weeds.	Weeds compete with native species and degrade habitats.	<ul style="list-style-type: none"> Survey to identify target locations for weed control. Weed control using appropriate methodologies considering target species and landscape context. 	<ul style="list-style-type: none"> At establishment of the Offset Site. Ongoing as required.
Exclusion of feral pigs	To exclude feral pigs.	Feral species can degrade habitat, compete for resources with native fauna and introduce disease.	<ul style="list-style-type: none"> Install and maintain preventative fencing suitable for the target species. Remove pigs (by trapping or other means) if detected within the Offset Site. 	<ul style="list-style-type: none"> At establishment of the Offset Site. Ongoing as required.
Rabbit control	To minimise the risk of the Offset Site becoming a refuge for rabbits.	<p>Increased rabbit numbers can reduce native regeneration and support higher numbers of pest animals such as cats and foxes.</p> <p>Competition and grazing by the feral European rabbit is listed as a key threatening process (KTP) under the TSC Act and EPBC Act.</p>	<ul style="list-style-type: none"> Monitor for presence of rabbits. Conduct baiting or controlled grazing to reduce the ability of the site to act as a refuge to rabbits. Where possible, coordinate baiting with adjacent landowners to maximise effects 	<ul style="list-style-type: none"> Consideration given to action on the basis of monitoring results.
Fox control	To minimize the impacts of foxes on native fauna	<p>Numerous native species are potentially at risk of becoming threatened as a result of fox predation.</p> <p>Predation by the European Red Fox is listed as a KTP under the TSC Act and EPBC Act.</p>	<ul style="list-style-type: none"> Conduct fox baiting in coordination and with the assistance of LHPA and/or CMA 	<ul style="list-style-type: none"> March and April are considered the most effective months in which to carry out control programs when foxes are dispersing and finding new territory (LHPA) Ongoing as required

Management measure	Objective	Justification	Action	Timing
Goat control/exclusion	To exclude goats and/or control numbers	Feral species can degrade habitat, compete for resources with native fauna and introduce disease. Competition and habitat degradation by feral goats is listed as a KTP under the TSC Act and EPBC Act.	<ul style="list-style-type: none"> • Install and maintain preventative fencing suitable for the target species. • Control goat numbers in coordination and with the assistance of LHPA and/or CMA 	
Monitoring	To determine the effectiveness of management measure	Monitoring is required to determine whether current management is effective and to inform ongoing management.	<ul style="list-style-type: none"> • Conduct monitoring as detailed for this site. • Adapt management measures where required 	<ul style="list-style-type: none"> • Every two years

F.5.4 Requirement to monitor the offset site

In order to ensure that biodiversity improvement is occurring within the offset sites (and therefore that a ‘maintain or improve outcome’ can be met over time), monitoring is required.

Monitoring is recommended to be repeated initially, every two years. As a part of monitoring surveys, a report would be prepared to document the success or otherwise of management and adaptations required to obtain better results.

Reporting is proposed every two years to the Department of Planning and Infrastructure, until such time as this is deemed acceptable to cease. The reports would also be submitted to OEH for comment.

A decision to reduce or continue reporting every two years may also be made by DPI or OEH following submission of each report. A final report should be prepared prior to decommissioning of the project, to verify that a ‘maintain or improve’ outcome is being met and that residual management actions can largely coincide with routine agricultural land management.

F.6 VERIFICATION OF THE ACTUAL AREA OF NATIVE VEGETATION CLEARING

Verification of the actual area of impact of the constructed wind farm and transmission line is required to be verified, prior to finalising the CPVPs. This provides an incentive throughout construction to minimise impacts and thereby reduce the offset requirement for the project. It also verifies that the actual amount and type of clearing undertaken is offset, as required.

It is expected that a detailed Flora and Fauna Management Plan would be prepared to guide construction. This would contain updated vegetation mapping specific to the final infrastructure layout (refer to note on micro-siting above). Verification of the actual area of native vegetation clearing can be undertaken as an audit after construction. (Incentives to minimize clearing would be an appropriate stipulation in EPC contracts).

F.7 FORMALISATION OF INDIVIDUAL CPVPS AND FUNDING ARRANGEMENTS

Offsets would be governed by conservation mechanisms to ensure long-term protection and management of the site, including funding arrangements.

A Conservation Property Vegetation Plan (CPVP) would be implemented on each involved private land holding. The process would be driven by Epuron, with input from each landholder. The CPVP would include management actions associated with the offset area that would apply in perpetuity.

To ensure that the CPVP is binding on successors in title, an abstract of the CPVP would be registered with the Land and Property Management Authority under the *Real Property Act 1900*. The CPVP would be a legally binding agreement under both the *Native Vegetation Act 2003* and the *Threatened Species Conservation Act 1995*. The terms of the CPVP would not be affected by any changes to local or state planning rules or new listings of threatened species. A CPVP can be varied at the landholder's request, provided the variation would still improve or maintain environmental outcomes.

As the CPVP is attached to the land title, the landowner is ultimately responsible for funding the management actions required at the Offset Site and monitoring the effectiveness of their implementation.

However the Proponent would take responsibility for management and would ensure the landowner has sufficient resources and information to implement the management actions for the operational life of the project, as management of offsets would form a condition of the project's consent.

Even though a CPVP is binding in perpetuity, it is acknowledged that there is less incentive to manage the offset site after the decommissioning of the wind farm. Therefore, it is proposed that the bulk of the management actions be focused in the early years of the project. Monitoring and reporting, as outlined above, would demonstrate whether this is being satisfactorily achieved and allow a point for the consent authority to intervene.

F.8 MAINTAIN OR IMPROVE

With the effective implementation of the stages outlined above, a 'maintain or improve' outcome would be achieved for the project. By the coordinated selection of offset sites over such a large area, and their management for biodiversity improvement, a regional scale beneficial biodiversity impact is anticipated. Benefits are expected to include:

- Incentive to minimize clearing during the detailed design and construction phases of the wind farm project
- Targeted and coordinated weed and feral animal management, informed by ecologists working with landowners
- Retention of declining habitat resources including hollows, fallen timber and logs, riparian habitats
- Protection of specific habitat linkages and wildlife corridors
- Improved infrastructure to assist management including fencing and access

F.9 'PRINCIPLES FOR BIODIVERSITY OFFSETS IN NSW'.

The biodiversity offset principles developed by the former DECCW (now OEH) would guide the selection and management of the offset site, namely:

Impacts must be avoided first by using prevention and mitigation measures. *The BA sets out mitigation measure to minimise impacts. The aim of the offset package is to ensure that where impacts cannot be avoided, or sufficiently minimised, the residual impact would be offset in perpetuity.*

All regulatory requirements must be met. *Offset land is required as part of the approval conditions for the project. The proposed offsets would not be used to satisfy approvals or assessments under other legislation.*

Offsets must never reward ongoing poor performance. *Monitoring would be required as part of the implementation of management actions for the offset site.*

Offsets will complement other government programs. *The Offset Package would be finalised in consultation with OEH and the CMA, allowing any local programs or initiatives to be considered and included.*

Offsets must be underpinned by sound ecological principles.	<i>Selection criteria have been developed to ensure the location of offset sites is appropriate. Management measures have been outlined by an ecologist. Specific management plans would accompany each CPVP, developed in consultation with the CMA and the proponent.</i>
Offsets should aim to result in a net improvement in biodiversity over time.	<i>Management actions would be developed specific to each offset site (one per private property).</i>
Offsets must be enduring - they must offset the impact of the development for the period that the impact occurs.	<i>Native vegetation clearing impacts are deemed permanent and therefore the offset sites would be preserved and managed in perpetuity.</i>
Offsets should be agreed prior to the impact occurring.	<i>The offset criteria set out in this document form part of the proposal. If approved, the commitment is carried over as a condition of consent. The commitment includes consultation with OEH and the CMA to ensure the final offset package is acceptable, prior to construction impacts.</i>
Offsets must be quantifiable - the impacts and benefits must be reliably estimated.	<i>An estimation of impact has been provided based on GIS mapping. Criteria have been proposed that provide clear quantification of offsets, based on the actual area cleared.</i>
Offsets must be targeted.	<i>Refer to selection criteria.</i>
Offsets must be located appropriately.	<i>Refer to selection criteria.</i>
Offsets must be supplementary.	<i>Offsets would be comprised of private land not currently under any form of biodiversity conservation protection. In this way the land would be additional to government reserves and programs. Refer to selection criteria.</i>
Offsets and their actions must be enforceable through development consent conditions, licence conditions, conservation agreements or a contract.	<i>A CPVP would be attached to the title of the offset land (one per landowner). To ensure that the CPVP is binding on successors in title, an abstract of the CPVP would be registered with the Land and Property Management Authority under the Real Property Act 1900. The CPVP would be a legally binding agreement under both the Native Vegetation Act 2003 and the Threatened Species Conservation Act 1995. The terms of the CPVP would not be affected by any changes to local or state planning rules or new listings of threatened species. A CPVP can be varied at the landholder's request, provided the variation would still improve or maintain environmental outcomes.</i>

APPENDIX G TEAM QUALIFICATIONS AND EXPERIENCE

Role, staff member	Pencil portrait
Authors	
Manager Biodiversity Dr. Jacqueline Coughlan	<p>Jacqui’s practical ecological skills in terrestrial and freshwater ecology have been developed over 20 years in several states. She has conducted and managed numerous fauna and flora surveys in New South Wales, ACT, Queensland and Western Australia and has a thorough working knowledge of State and Commonwealth legislation related to flora and fauna. She has a broad knowledge base of ecological issues and is able to provide clients with sound and practical advice regarding environmental legislation and assessment protocols. Jacqui provides both project management and mentoring advice for the biodiversity team as well as personally contributing vital technical expertise to environment projects. Jacqui joined ngh environmental in 2008 after five years as Principal Ecologist at ERM. She has a PhD in Bird Ecology, a Graduate Diploma in Environmental Law and is an accredited Biobanking Assessor.</p>
Senior ecologist (fauna) Deb Frazer	<p>Deb holds a bachelor degree in Applied Science (Biodiversity Management) and an honours degree. Deb has over 8 years experience as an Ecologist and within biodiversity assessment, including several wind farm assessment. Deb’s positions have included management and senior roles, as well as educational and research assistant positions. Deb has experience in impact assessment and fauna survey projects throughout southern NSW and South Australia. Deb has broad knowledge and demonstrated skills in environmental management; coordinating and delivering environmental programs / plans; assessment of development proposals; preparation of biodiversity and management plans and monitoring programs. In particular Deb is skilled in interpretation and application of legislation and statutory controls; stakeholder, contractor, and client consultation; design and execution of field work; data collection and analysis; and reporting (verbal and written).</p>
Principal ecologist (fauna) Mark Free	<p>Mark holds a bachelor degree in Applied Science (Coastal Management) and an honours degree in Geography and has over 15 years experience as an Ecologist. Formerly with the Commonwealth Government’s Australian Nature Conservation Agency, Mark has for the last 12 years worked as a flora and fauna consultant based on the NSW Far North Coast. Since 2003 Mark has been the Manager and Principal consultant of Blackwood Ecological Services Pty Ltd.</p> <p>Mark has extensive experience in impact assessment and fauna survey projects throughout northern NSW, southern Queensland and further afield. He has provided professional services to all levels of government, natural resource managers, industry, private landowners and community organisations, working on projects for a broad range of clients including the NSW National Parks and Wildlife Service, NSW Department of Public Works, NSW Department of Education, Qld Murray Darling Committee, NSW Roads and Traffic Authority, Consolidated Rutile Limited, Conics, Broken Head Quarry and Birds Australia.</p> <p>Mark has undertaken fauna surveys and completed Ecological assessment reports for linear infrastructure projects including the Pacific Highway Upgrade (Woodburn to Ballina section), PNG to Queensland Gas Pipeline, Lismore Southern Trunk Water Main and Lennox Head to Ballina Coastal walk and Shared path.</p>

Role, staff member	Pencil portrait
<p>Bat Specialist Dr. Greg Richards</p>	<p>Greg holds a PhD that focused on forest bat ecology. Greg has been an ecological consultant specialising in bat fauna for 16 years. Prior to this Greg spent 27 years with CSIRO in the Wildlife and Ecology Division. Greg has experience in Australia, Papua New Guinea and Pacific, and Southeast Asia.</p> <p>Greg’s specialty is in bat fauna assessments, development and execution of bat monitoring programs, and experience in legal reviews and challenges. He is also author of several major bat books and scientific papers.</p> <p>As an ecological consultant, Greg provides specialist bat fauna advice to industry and Government, contributing to EIA and SIS, particularly for wind farm assessments.</p>
<p>Co-author Ecologist Kelly Simpson</p>	<p>Kelly is a senior botanist at Blackwood Ecological Services and has managed a number of botanical projects and undertaken numerous field surveys across NSW. Kelly holds a Bachelor of Science and a Graduate Certificate in Natural Resources.</p> <p>Kelly’s field survey experience includes a variety of large scale infrastructure projects and the surveying of vegetation communities over a broad area particularly for linear projects such as powerlines, pipelines and roads. She worked on the Queensland to Hunter Gas Pipeline including the co-ordination of the botanical teams and the surveying of vegetation communities along the proposed 630km pipeline. Following the surveys Kelly assisted with the preparation of the report with regards to key flora constraints and vegetation mapping. She also had a key role in the Silverton Wind Farm and proposed powerline to Red Cliffs, Victoria. Kelly was involved with the management of the botanical component of this project which included detailed background research, vegetation mapping, survey design, vegetation surveys and targeted surveys for threatened species, constraints mapping and reporting.</p> <p>Recently Kelly has undertaken botanical surveys and impact assessment for the proposed Coastal recreational path from Lennox Head to Ballina. These projects included identification and mapping of significant species and Endangered Ecological Communities and identification of mitigation measures to manage potential impacts on vegetation within the study areas.</p>
<p>Co-author Ecologist (Flora) Jackie Miles</p>	<p>Jackie holds bachelor degree in Zoology and has since gone on to specialise in botany. Jackie has worked on a number of large scale assessments involving botanical surveys for vegetation mapping and targeted species searches. Past projects include Comprehensive Region Assessment (CRA) full floristics surveys, field validation for NPWS Vegetation Map for South East Forests, vegetation mapping for all NSW ski resort areas and surveys of significant remnant grassy vegetation in the Bega Valley.</p> <p>Jackie has co-authored a number of papers and factsheets on threatened species and ecological communities, regularly contributes information to the NSW Scientific Committee and has provided training for Council planning and works staff on conservation significant remnant vegetation. Jackie also has extensive experience in fauna surveys, including fauna surveys across the alpine region for the CRA. Jackie’s expertise extends throughout south-eastern NSW.</p>

Role, staff member	Pencil portrait
Co-author Ecologist (flora & fauna) Brenton von Takach Dukai	<p>Brenton is a botanist and ecologist with nghenvironmental's biodiversity team, and performs flora and fauna assessments for a wide variety of projects. Brenton has been involved with developments ranging from large-scale wind farms and dam upgrades to minor road upgrades. He is familiar with a broad array of monitoring and survey techniques for both flora and fauna, and has conducted surveys in a number of biogeographic regions of NSW. As a result, he is familiar with many of the vegetation types and communities found throughout the state.</p> <p>Brenton's work requires knowledge of and experience in the management of threatened species and communities as well as a solid understanding of legislative requirements at both State and Commonwealth levels. Prior to joining nghenvironmental he worked for the <i>Australian Wetlands and Rivers Centre</i> at the University of NSW, conducting survey trips across Australia to undertake vegetation assessments and fauna trapping programs. He has been involved in fauna monitoring programs with OEH and radio tracking fauna for the Australian Wildlife Conservancy. Brenton is a very capable field ecologist with excellent reporting skills.</p>
Field Team	
Ecologist (fauna) Freya Gordon	<p>Freya Gordon is a senior ecologist with extensive field experience. She holds a Bachelor of Science with Honours from Monash University, Melbourne. Projects she has managed and implemented include a microbat monitoring program for the Holbrook Bypass (RMS); a Squirrel Glider monitoring program for the Albury Bypass (Conneq); and multiple ecological assessments and constraints analyses for Stockland, RMS, Lake Coal, Epuron, and local councils. Freya has completed an Environmental Assessment for a Solar Farm in western NSW including a detailed investigation of the status of the Grey-crowned Babbler on the site and surrounding study area. Her work requires experience in Commonwealth and State environmental legislation, policies and standards. Prior to joining nghenvironmental she worked for the Institute of Wildlife Research, The University of Sydney, designing, managing and implementing survey programs for a range of species. She has managed large scale field programs in the Simpson Desert for the University of Sydney Desert Ecology Research Group.</p>
Ecologist (fauna) George Madani	<p>George Madani is a freelance wildlife ecologist and has an extensive background in wildlife ecology with ten years of field survey skills and practical research and applied management experience. He has conducted fauna surveys and field studies across various regions and habitats in Australia. His work has taken him into remote areas as the Kimberley, Cape York, Simpson and Strzelecki Deserts as well across a range of temperate sclerophyll woodlands and rainforests along the East Coast and inland into the WA Goldfields, Victorian Mallee Country and rangelands of Western NSW. He has comprehensive knowledge of and experience with the identification, distribution, habitat and ecology of terrestrial vertebrate fauna, especially reptiles, amphibians and avifauna. George has a Masters in Wildlife Health and Population Management from the University of Sydney. He has worked with various State and Federal Government departments, universities, environmental consultancies and NGO's on projects ranging from wildlife monitoring, baseline inventory surveys to impact based assessments.</p>

Role, staff member	Pencil portrait
Ecologist Rena Gaborov	Rena holds a Bachelor of Arts (Geography) and a Master of Natural Resources. Rena has been working as a field ecologist with Wildlife Unlimited since 2008 while she concurrently completed a Master in Natural Resources. She has been involved with a number of management and conservation projects as part of her work with Wildlife Unlimited as well as with government, university and community groups. She has also led a number of projects. Her masters research involved a mark recapture population study on the threatened long-nosed potoroo and its reactions to fragmentation. Rena also coordinated a baseline vertebrate fauna survey of Palm Island, Northeast Queensland in 2009.
Ecologist Frank Bird	Frank completed a Diploma, Conservation and Land Management in 2006 and a Certificate III and IV Conservation and Land Management in 2005. He has been working with Wildlife Unlimited Pty Ltd on several field based projects including setting up monitoring plots for introduced deer species, feral cat trapping at Mt Buller, threatened orchid surveys and biodiversity assessments of northern savannah woodlands (Kimberley WA). In 2009 Frank was part of a team that undertook terrestrial vertebrate surveys on Palm Island, North Queensland. Mammal, bird, reptile and amphibians were all surveyed across the island. Survey methods included funnel and pitfall trapping, active searching, Elliot trapping, Harp trapping, remote infrared cameras, hair tubing and diurnal bird. Frank has volunteered for numerous conservation expeditions and projects across Australia, in arid and temperate regions, to gain invaluable field experience.
Ecologist Paul Shipway	Paul has an Associate Degree in Applied Science (Environmental Resource Management) from Southern Cross University. Paul has undertaken several field surveys with Blackwood Ecological Services, including Land for Wildlife fauna surveys in Stanthorpe, a Squirrel glider radio-tracking program at Forster and the Lismore Southern Trunk Main project for Lismore City Council. Paul worked for several years on rainforest restoration projects with Rous Water and currently works as a freelance ecologist and bush regenerator.
Senior review	
Senior review Brooke Marshall (CEnvP)	Brooke has an honours degree in Natural Resources from the University of New England (UNE) where she specialised in wildlife management and ecosystem rehabilitation. Since joining nghenvironmental, Brooke has undertaken environmental impact assessment, biodiversity survey and assessment, environmental management documentation and community consultation. Brooke has worked on large scale infrastructure projects and project managed the input of specialists, as required. She is a specialist in wind farm assessment. Brooke is an accredited Biobanking Assessor and Certified Environmental Practitioner.