BIODIVERSITY ASSESSMENT

NYNGAN SOLAR PLANT

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nghenvironmental is a registered trading name of **ngh**environmental Pty Ltd; ACN: 124 444 622.
ABN: 31 124 444 622

suite 1, 216 carp st (po box 470) bega nsw 2550 australia t 61 2 6492 8333

www.nghenvironmental.com.au e ngh@nghenvironmental.com.au

unit 17, 27 yallourn st (po box 1037)
fyshwick act 2609 australia
t 61 2 6280 5053 f 61 2 6280 9387

unit 18, level 3, 21 mary st
surry hills nsw 2010 australia
t 61 2 8202 8333

suite 1, 39 fitzmaurice st (po box 5464)
wagga wagga nsw 2650 australia
t 61 2 6971 9696 f 61 2 6971 9693

suite 7, 5/18 griffin dr (po box 1037)
dunsborough wa 6281 australia
t 61 8 9759 1985

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ACRONYMS AND ABBREVIATIONS

AC	Alternating current
Cwth	Commonwealth
DBH	Diameter at breast height
DECCW	Refer to OEH
DoPI	(NSW) Department of Planning and Infrastructure
EEC	Endangered ecological community – as defined under relevant law applying to the Proposal
EIA	Environmental impact assessment
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Cwth)
EP&A Act	*Environmental Planning and Assessment Act 1979* (NSW)
ha	Hectares
km	Kilometre
kV	Kilovolts
LEP	Local Environment Plan
LGA	Local Government Area
m	Metres
MNES	Matters of National environmental significance under the EPBC Act (*c.f.*)
MW	Megawatt
NSW	New South Wales
OEH	(NSW) Office of Environment and Heritage, formerly Department of Environment, Climate Change and Water
PV	Photovoltaic
SEPP	State Environmental Planning Policy (NSW)
DSEWPaC	(Cwth) Department of Sustainability, Environment, Water, Population and Communities
sp/spp	Species/multiple species
TSC Act	*Threatened Species Conservation Act 1995* (NSW)
V	Volts

1 INTRODUCTION AND BACKGROUND

1.1 PURPOSE OF THIS REPORT

AGL Energy Limited (AGL) proposes to construct a solar photovoltaic (PV) plant of up to approximately 106 megawatt (MW) capacity approximately 10 kilometres west of Nyngan in central western New South Wales (the subject site). This Biodiversity Assessment examines biodiversity values and likely impacts associated with the proposed solar plant and a proposed transmission line to connect to the existing grid.

The Biodiversity Assessment:

- Provides a summary description of the proposed works.
- Outlines the environmental and planning context of the Proposal with respect to biodiversity.
- Identifies, describes and maps the biodiversity values at the subject site, including threatened species and communities.
- Identifies and assesses the significance of the potential impacts to biodiversity values.
- Provides a series of recommended measures designed to avoid and mitigate impacts to biodiversity values, where possible.
- Recommends measures to achieve a 'improve or maintain biodiversity outcome' for the Proposal, where residual impacts cannot be avoided.

The Biodiversity Assessment is intended to meet the assessment requirements under Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act), the *Threatened Species Conservation Act 1995* (TSC Act) and the Commonwealth *Environment Protection Biodiversity Conservation Act 1999* (EPBC Act), the Director-General's Requirements for the project issued by the Department of Planning and Infrastructure (DoPI) (refer to Appendix A) and the Draft Guidelines for Threatened Species Assessment (DEC, 2004).

1.2 PROJECT DESCRIPTION

1.2.1 Location of the activity

The Proposal site is located approximately 10 kilometres west of Nyngan NSW, within the Cobar Peneplain Bioregion. Nyngan is approximately 460 kilometres northwest of Sydney. The site is within the Central West Catchment Management Authority (CMA) and Bogan Shire Local Government Area (LGA). The local area is comprised of rural activities on large holdings. Population density is low.

The key infrastructure components proposed include a solar plant consisting of multiple PV arrays (and associated infrastructure), a substation and an electricity transmission line. The solar plant would be located on one land parcel (Lot 34, DP751328) to the north of the Barrier Highway. The land parcel has an area of approximately 460 hectares, of which approximately 300 hectares of land would be required for the solar plant. The site has an elevation of approximately 175 to 178 metres Australian Height Datum (AHD) and is currently cropped and grazed for agricultural production purposes. A farm dam and a water tank are located onsite. No other significant infrastructure is currently located at the site.

The transmission line would be approximately 3 kilometres in length and would connect the solar plant to the existing Nyngan – Cobar 132 kilovolt (kV) transmission line. Five land parcels would be traversed by the line: three private rural land holdings (Lots 24 and 34 in DP751328 and Lot 8, DP724628), one Crown Land parcel (Lot 7300, DP1156652) and the Barrier Highway Road Reserve.

Refer to Figure 1-1 for a map of the site and surrounding area.

1.3 INFRASTRUCTURE COMPONENTS

1.3.1 Layout

The project would comprise the installation of a solar plant with a capacity of up to approximately 106 MW and would include the following elements:

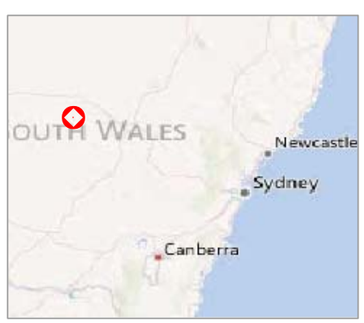
- Photovoltaic (PV) modules using cadmium telluride (CdTe) thin film technology.
- Inverters and step-up transformers to convert direct current (DC) electricity produced by the PV modules into alternating current (AC) capable of being connected to the electrical grid.
- Aboveground and underground electrical conduits and cabling to connect the modules to the inverters and transformers.
- Marshalling switchgear to collect the power from the modules.
- 33kV/132kV transformer substation and switchgear.
- A site office and maintenance building.
- A main access road from the Barrier Highway to the solar plant for construction and operational access.
- Internal access tracks to allow for site maintenance.
- Perimeter security fencing and landscaping.
- 132kV transmission line to connect into existing electrical network.

An indicative infrastructure layout and detailed discussion of infrastructure components is provided below (Figure 1-1).

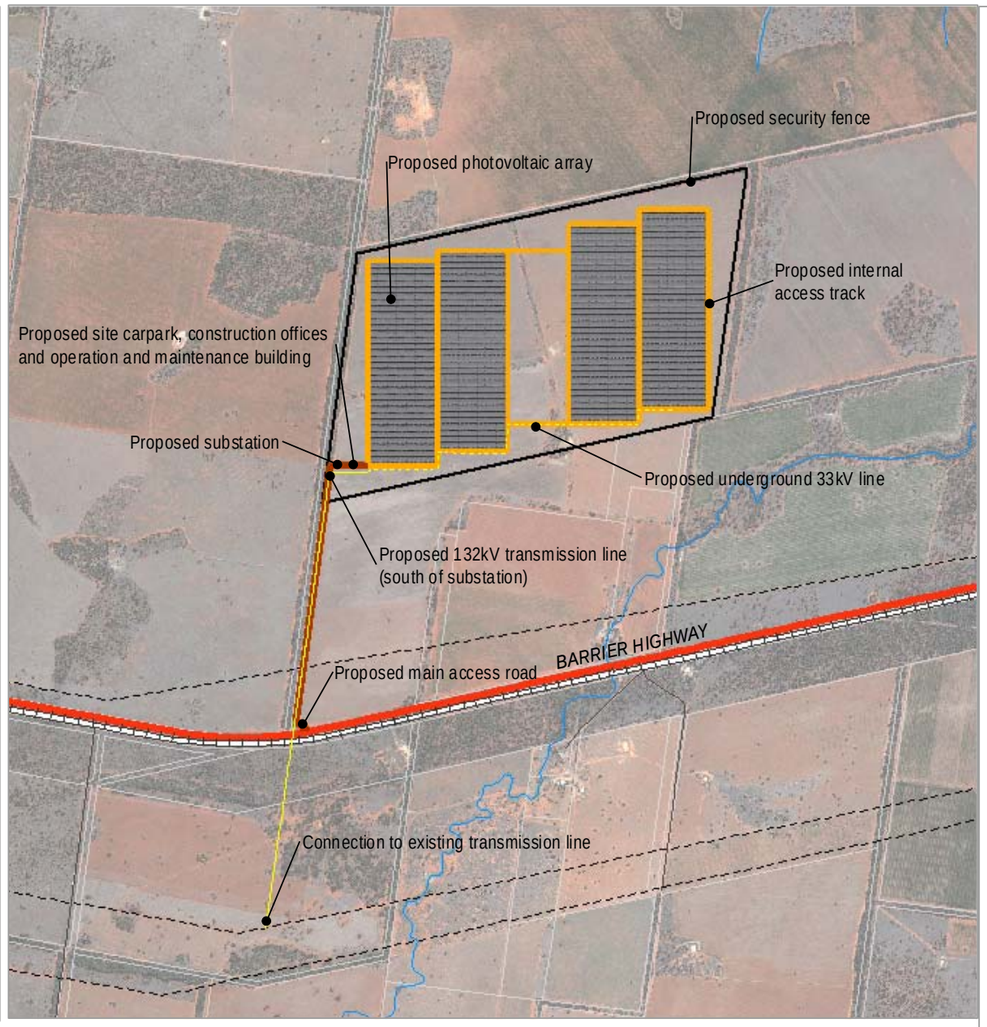
SITE LOCATION RELATIVE TO NYNGAN

0 5 10 20 Kilometres

Notes:
- Infrastructure locations are approximate only
- Other base layers from LPI, accessed 2012
- Aerial base layer from Bing (ESRI Online) accessed 2012



SITE LAYOUT



0 0.5 1 2 Kilometres

Notes:
- Infrastructure locations are approximate only
- Other base layers from LPI, accessed 2012
- Aerial base layer from Microsoft Virtual Earth accessed 2012

Proposed transmission line
- 132 kV
- Underground 33 kV

Proposed roads and tracks
- Internal access track
- Main access road
- Development site (fenced)
- Rail
- Highway
- Built up area (Nyngan)
- Road
- Existing transmission line

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Figure 1-1 Location and indicative layout of the proposed solar plant.

1.3.2 Power generation

The PV modules would be connected in series to form strings and then the strings would be connected together in parallel into inverters. The inverters convert the direct current (DC) output from the PV modules into alternating current (AC). Medium voltage transformers step up the AC output from the inverters, and then the power is transmitted to the project substation, where a high voltage transformer steps up the voltage to 132kV for connection into the grid.

1.3.3 Transmission

The project would be connected to the electricity grid via a new grid extension. The grid extension would comprise a double circuit 132 kV transmission line. Each circuit would comprise three sets of conductors (wires), plus earth wire and potentially communications cables. The transmission line would be approximately 3 kilometres long, between the solar plant and the existing 132 kV transmission line that connects Nyngan Substation to Cobar. An easement would need to be established along the route of the transmission line.

1.3.4 Description of infrastructure

Solar Plant

The solar plant would comprise a series of solar PV modules, mounted on a steel racking frame supported by posts driven into the ground, installed in regular arrays of approximately 1.26 MW (AC) in size and aggregated to a combined plant capacity of up to 106 MW (AC).

Additional infrastructure components are described below.

Underground cabling

All underground cabling would be installed in trenches, generally measuring approximately 800mm deep by 600mm wide. A sand bed would be placed under the cabling. Once the cables are installed, the cables would be covered by a layer of sand and the trench backfilled with existing fill.

Substation

The substation would be located in the southwest corner of the project area. It would include a busbar, circuit breakers, current transformers, voltage transformers, and a 33/132kV transformer. It would be surrounded by security fencing and gravel to restrict vegetation growth.

Site buildings and amenities

A permanent operations and maintenance building would be installed at the south-western corner of the solar plant site. The building would be a prefabricated steel ATCO hut or similar. It would incorporate a rigid base frame to support the building structure. The building would be placed on concrete foundations to provide appropriate elevation. A septic system would be installed and maintained, in accordance with Council requirements.

Site fencing

The site boundary would be protected by perimeter security fencing. The fencing would be expected to have top and bottom rails and three barbed wires along the top.

Access and car parking

A 6 metre wide main access road would be located within the proposed transmission line easement and would service both construction and operational traffic. An existing farm track is present in this location, and would be improved with capping material (unsealed all weather compacted crushed rock). The location and form of the main access road intersection with the Barrier Highway would be determined in consultation with the Roads and Maritime Services (RMS). The intersection is likely to be located approximately 50 metres east of the southwest corner of Lot 24, DP751328.

Internal access tracks would be required to access the modules onsite for maintenance. These would be approximately 6 metre wide unsealed tracks and would be maintained throughout the operation of the facility.

The car park would be located within site boundaries and of sufficient size for all staff vehicles and equipment during peak construction phase. It would be unsealed all weather compacted crushed rock.

Transmission easement

The transmission line would be a double circuit 132kV line with each circuit comprising three sets of conductors (wires), earth wire and potentially communications cables. Conductors would be attached to spun concrete poles approximately 25 metre high and spaced approximately 150 - 250 metres apart. Vegetation within the electricity easement would be maintained to manage fire risk and allow maintenance. The easement would be 40 metres wide.

1.4 POTENTIAL BIODIVERSITY IMPACTS OF THE PROPOSAL

Potential impacts to biodiversity during the construction phase of the Proposal relate to site preparation, operation of vehicles and machinery and the installation of infrastructure. This would involve earthworks for tracks, trenches, footings and pylons, associated vegetation clearing and pollution risks from chemicals used onsite as well as potential for mobilised sediment.

The operation of solar plants is generally considered to generate low environmental impact, with regard to biodiversity values (Kaygusuz 2009). The components are non-moving, the surface non-reflective and the panels release no emissions. The potential environmental impacts of PV solar plants depend on the size and nature of the project and are frequently site specific (Gekas *et al.* 2002). Biodiversity impacts are likely to be dependent on the specific biodiversity values of the site and their sensitivity to vegetation removal, soil disturbance, noise and the erection of barriers, etc. Vehicle access for operation and maintenance would also have minor impacts.

In their summary of potential environmental impacts of PV solar plants, Gekas *et al.* (2002) include the following issues relevant to biodiversity:

- **Land use and ecosystem impacts** – these depend on specific factors such as topography, the area and the type of the land covered by the system, the distance from areas of natural beauty or sensitive ecosystems and the biodiversity of the area. Impacts are mostly related to construction and transport movements. Projects can 'reserve' soils for future uses.

- **Pollution** - emissions into soil and groundwater of poorly stored materials, abnormal plant operations, damaged panels or fire. The project would utilise First Solar cadmium telluride (CdTe) thin film modules, which have passed the Underwriters Laboratories standard UL1703 (which includes flammability tests) and do not pose a pollution risk in the event of fire. CdTe panels are also able to be recycled at the end of their useful life.
- **Air pollution** - minor emissions associated with transport of the modules.

These issues have been considered in assessing the potential impacts of the Nyngan Solar Plant.

2 ENVIRONMENTAL AND PLANNING CONTEXT

2.1 ENVIRONMENTAL CONTEXT

2.1.1 Interim Biogeographic Regionalisation of Australia (IBRA)

Bioregions are relatively large areas that share similar characteristics in terms of landscape-scale natural features, environmental processes and ecosystems. There are 17 IBRA bioregions in NSW and each is broken into subregions. Subregions are based on finer scale geophysical and ecological commonalities (DECC 2008a).

The study area falls into the Cobar Peneplain Bioregion, and the Canbelego Downs IBRA subregion. The characteristic landforms of this subregion are an undulating plateau with low stoney ridges, stoney rises and wide valleys. Soils are dominated by loams with minor sand deposits. Vegetation is dominated by woodlands with occasional riparian and swamp communities along creeks and drainage lines.

2.1.2 Catchment Management Authority and subregions

Catchment Management Authorities (CMAs) have been established across NSW and are responsible for managing natural resources at the catchment scale. There are 13 CMAs in NSW. There are a number of subregions within each of the CMAs and these are broadly based on an overlay of the CMA and IBRA subregion boundaries.

The study area lies within the Central West CMA and close to the boundary between the Bogan-Macquarie and the Canbelego Downs catchment subregions:

These subregions have high biodiversity due to the confluence of different landforms including plains, ranges and waterways. However, much of the native vegetation has been cleared for agriculture with many of the largest remnants now held within state tenure, such as state forests, national parks and travelling stock reserves. Some vegetation communities in the subregions are overcleared (more than 70% of what existed pre-European arrival has been cleared) and poorly reserved. These include Box-Gum Woodland and Myall Woodland communities. Across the two subregions, there are six ecological communities, seven flora species and 51 fauna species listed as threatened under the NSW *Threatened Species Conservation Act 1995* (TSC Act).

2.1.3 Important Bird Areas

The southern portion of the Macquarie Marshes Important Bird Area (IBA) begins approximately 63km east of the site, near the town of Warren, and extends northward. This IBA protects a number of water birds including Australasian Bittern and Sharp-tailed Sandpiper (Birds Australia 2009). The Macquarie Marshes Nature Reserve protects some of this area (the nature reserve is located over 100km north-east of the site).

2.1.4 District assessment

The proposed solar plant site is located within the Bogan Local Government Area (LGA) and is zoned 1(a) General Rural under the Local Environmental Plan (LEP). The Bogan LGA covers an area of approximately

14,610 square kilometres with an estimated population of 3,220 of which 2,500 are in the town of Nyngan (Bogan Shire Council 2012).

The main land use in the area is agriculture, predominantly cropping (largely found to the west of the Bogan River) and grazing of cattle and sheep (Bogan Shire Council 2012).

The vegetation and fauna communities in the district have been highly modified by past agricultural activities, including clearing and ploughing. There are pockets of remnant and regrowth vegetation in the district. The Bogan River (a major tributary of the Darling River) and associated riparian vegetation are local environmental features, running north-south approximately 7km east of the site.

There are several state conservation areas within the district including Thorndale State Forest (20km west), Miandetta State Forest (20km west) and Quanda Nature Reserve (40km south-west).

2.1.5 Locality assessment

A locality-scale review of habitats was conducted with reference to aerial photography and topographic maps and vehicle-based surveys. For the purposes of this report, the locality is defined as the area surrounding the subject site over a radius of 15 kilometres. Most of this area is substantially cleared and modified. Key conservation values in the district include:

- The Bogan River and associated wetlands and floodplains.
- Remnant woodland and other native vegetation communities, including roadside corridors.
- Records for thirteen threatened fauna species listed under the TSC Act.

The riparian zone along the Bogan River is vegetated and would provide habitat, a drought refuge and a corridor for movement of wildlife. Open woodland remnants, loosely linked through a grazed agricultural matrix by remnant trees, provide connectivity to this riparian woodland from land to the east. Thin remnant woodland strips are present and provide for linear corridors between cropped paddocks, to the west of the river. The subject site is situated within these linear corridors.

2.2 SITE DESCRIPTION

The site consists of approximately 460 hectares of flat terrain, characteristic of the alluvial floodplains of the Nyngan locality. The solar plant site is largely cleared with linear strips and some patches of remnant native vegetation and scattered trees. It has been highly modified by past agricultural activities including clearing, cultivation and grazing.

The proposed transmission corridor traverses cultivated areas north of the Barrier Highway and some intact native vegetation south of the Barrier Highway.

2.3 POLICY AND LEGISLATION

The project would be assessed under Part 4 of the EP&A Act. It would be classed as State Significant Development (SSD) under State Environmental Planning Policy (State and Regional Development) 2011.

Section 5A of the *Environmental Planning and Assessment Act 1979* (EP&A Act) specifies factors to be taken into account in deciding whether a development is likely to significantly affect threatened species, populations or ecological communities, or their habitats. Impacts to threatened species and communities are addressed in Section 4.2.4 and 4.3.7 of this report.

The Office of Environment and Heritage (OEH), which administers the *Threatened Species Conservation Act 1995,* have been consulted by the DoPI regarding potential impacts to NSW threatened species. DoPI have issued Director-General's Requirements to guide the form and content of the impact assessment of the Proposal (refer to Appendix A).

The provisions of the *Noxious Weeds Act 1993* apply and are discussed further in Section 4.2.4.

The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* provides for an assessment and approvals system for actions that may have a significant impact on 'Matters of National Environmental Significance' (MNES). These matters include World Heritage properties, wetlands of international importance and Commonwealth listed threatened species and ecological communities. Proposals which would significantly affect a matter of national environmental significance must be referred to the Commonwealth Environment Minister for approval. Matters of National Environmental Significance that relate to biodiversity are addressed in Section 4.4 of this report.

The Central West CMA is responsible for administering the Central West Catchment Action Plan (CAP) (Central West CMA 2007). In relation to biodiversity, the CAP has one catchment target and four management targets that aim to result in an improvement in biodiversity over the longer term. The Proposal is not inconsistent with these targets.

The CAP has recently been updated (Central West CMA 2011-12) with an increased focus on resilience in the landscape and building the adaptive capacity of physical and social systems to the impacts of change. The proposal represents a land use change, and monitoring and adaptation are relevant to such as change. The proposal, via mitigation measures, builds in adaptive mechanisms to monitor and respond to biodiversity changes as a consequence of the proposal. These relate to:

- Monitoring groundcover beneath panels.
- Micrositing transmission lines to avoid threatened species, should they occur.
- Installation and monitoring of nest boxes.
- Establishment, monitoring and management of offset areas for biodiversity outcomes.

3 ASSESSMENT APPROACH AND METHODOLOGY

3.1 APPROACH

This Biodiversity Assessment includes:

- A desktop review of research literature, online databases and other sources to determine regional and local biodiversity values and assist field survey planning and design.
- Field flora and fauna surveys and habitat assessments.
- Analysis and assessment of data to establish the conservation values and significance of proposed impacts in relation to relevant environmental legislation.
- Development of measures to reduce the risks and identified impacts, focussing on avoidance and mitigation and offsets where avoidance is not feasible.

3.2 PRELIMINARY ASSESSMENTS

A preliminary biodiversity constraints report was provided to AGL early in the Proposal planning phase, after the completion of desktop review and field surveys. Based on the biodiversity constraints identified, the Proposal was modified with the aim of avoiding areas of high biodiversity value and therefore minimising impacts to biodiversity. This biodiversity assessment assesses the revised layout.

Online database searches of threatened and migratory species were undertaken for the Central West CMA catchment, Canbelego Downs and Bogan-Macquarie sub-catchments using the NSW OEH Wildlife Atlas (as the subject site occurs close to the boundaries of these sub-catchments) and over a 10 kilometre radius using the Commonwealth EPBC Act Protected Matters search tool. Other online resources included the Atlas of Living Australia, the PlantNET database of the Royal Botanical Gardens Herbarium and threatened species databases (OEH and DEWHA). Topographic maps and air photographs were used to prepare a preliminary stratification for the survey based on topography and interpreted vegetation cover.

Predictive vegetation mapping (OEH 2012) was also consulted to identify threatened species and associated habitats for targeting during the survey. The likelihood of identified threatened species occurring within the study area and their potential to be impacted by the Proposal was assessed using a preliminary version of the evaluation included in Appendix B.

3.3 BACKGROUND REVIEW

3.3.1 Database searches

Prior to undertaking field investigations, background searches were carried out to identify the threatened species or communities known to, or potentially occurring in the locality based on previous records. This approach increases the probability of considering the presence of, and possible impacts on, all known and likely native species, particularly any species that are of regional, state or national conservation significance that are not identified during the field survey. The background searches and literature review included the following:

- Database search using the OEH Wildlife Atlas database for threatened flora and fauna species and populations within the Central West CMA catchment, Canbelego Downs and Bogan-Macquarie sub-catchments and Bogan Shire LGA.

- A search of the EPBC Protected Matters search tool to determine which threatened species and populations have potential habitat within a 10km radius of the site.
- Database search using the Atlas of Living Australia search tool for threatened flora and fauna species within the Bogan Shire LGA.

3.3.2 Literature review

Literature relevant to this study was also reviewed and included:

- OEH Threatened Species Profiles.
- Department of Sustainability, Environment, Water, Population and Communities (DSEWPC) EPBC Act Species Profiles and Threats Database (SPRAT).
- Topographic maps, air photographs and previous surveys conducted in the area.

3.4 FIELD SURVEY

3.4.1 The study area

For the purposes of field work, the study area included all areas within the site boundary and included areas along and immediately adjacent to the proposed routes of the access track and transmission line easement to the south (refer Figure 1-1).

3.4.2 Flora survey

The flora surveys were conducted by two botanists (refer to Appendix I for personnel qualifications and experience). The flora survey was undertaken on 16 – 18 May and 1 June 2012, using informal transects (random meander after Cropper 1993), inspection points and targeted surveys. A total of 33 person hours was spent on the flora component of the survey. Floristics, structural data, vegetation condition and site physical values were recorded. This approach allows vegetation type and condition to be characterised, while providing the areal coverage required for a project of this scale. The field survey targeted areas of potential habitat for significant or sparsely distributed plant species. Detailed survey methodology is outlined below. The survey effort is shown on Figure 3-1.

The vegetation of the subject site has been classified using the NSW Vegetation Classification and Assessment (NSWVCA) system (Benson *et al.* 2006) which provides the most recent and comprehensive classification for the NSW Western Plains.

Detailed survey methodology

Random meanders

Formal random meanders (after Cropper 1993) within relatively homogeneous vegetation of up to 30 minutes duration and covering up to 1 hectare were undertaken at a number of sites in each vegetation type, recording floristics, with structural and physical data. This method improves comprehensiveness in terms of the number of species and variation within vegetation types by covering a broad area, and improves opportunities for detecting significant or sparsely distributed plant species.

Inspections and targeted searches

In addition to the traverse and plot-based survey sites, the majority of the subject site was inspected on foot or by vehicle to confirm vegetation types, map the distribution of vegetation communities and search for threatened species. Areas of natural vegetation in better condition were given particular attention. Dominant species occurring at the sites were recorded to adequately confirm the vegetation type and condition where necessary. Dedicated searches in specific habitat areas were undertaken for threatened species which were assessed as having at least a moderate potential to be present at the site.

Candidate areas of heavily disturbed habitats or areas carrying mainly exotic species, such as improved pasture and cultivated paddocks, were surveyed to record general species composition. Because of their low likely conservation significance, these highly modified areas were not inspected in detail.

Understorey condition assessment

Condition assessment was applied to all survey points within the development envelope that may be impacted by the Proposal to adequately quantify impacts by both vegetation type and condition. This included all random meander and inspection points.

Vegetation surveyed was rated according to a four-point condition class scale, focusing on floristic integrity in the understorey. Condition classes were based on the ratio of native species to exotics as per below:

Exotic	Groundlayer dominated by exotics (exotics > natives), no native overstorey present.
Poor	Groundlayer dominated by exotics, native overstorey present (>25% of benchmark)
Moderate	Some exotics present in the groundlayer but mostly native dominated (low diversity).
Good	Groundlayer dominated by native species (high diversity), few exotics present.

With the exception of the 'exotic', the remaining classes would all fall within the 'moderate to good' definition specified within the OEH Biobanking Assessment Methodology[1] due to the dominance of native vegetation in the ground layer or having a native overstorey with a percent foliage cover greater than 25% of the lower value of the over-storey percent foliage cover benchmark of that vegetation type. The exotic class would equate to 'low' condition vegetation under these guidelines.

[1] The Biobanking Assessment Methodology was developed by OEH and classes vegetation condition more broadly in only two categories: low and moderate – good.

Figure 3-1 Flora survey effort.

3.4.3 Fauna survey

Fauna surveys aimed to:

1. Assess fauna habitat including identification of fauna habitat features important to threatened species, such as hollow-bearing trees.
2. Survey targeted groups of threatened species through nocturnal and diurnal surveys.

The fauna surveys were conducted by a senior ecologist (refer to Appendix I for personnel qualifications and experience).

The fauna survey was undertaken on 3-4 May, 16-18 May and 1 June 2012. Additional targeted surveys were undertaken from 20-23 August for the Grey-crowned Babbler (TSC-V). A total of 46 person hours was spent on the fauna component of the survey.

Detailed survey methodology

Habitat assessment, opportunistic surveys, nocturnal surveys and targeted searches were the primary fauna survey methods. The fauna survey effort is shown on Figure 3-2 and is discussed below.

Habitat assessment

Habitat assessments described the extent and condition of habitat for threatened species on site, including searching for species signs (scratches on and around trees, scats and nests). An assessment of the presence of hollow-bearing trees, fallen logs, leaf litter and nests was also conducted.

Microbat survey

Two Anabat detectors were placed at four locations over the two nights (16-17 May). Devices were placed in locations to maximise the potential for detecting multiple species of bats within the study area and included suitable flyways, areas adjacent to woodland patches, and one location near a dam within the study area. Each device was set to record calls from dusk until after dawn.

Anabat analysis

Microbat calls detected by the Anabat devices were analysed by Narawan Williams, an ecologist trained in Anabat call analysis.

Nocturnal survey

Call Playback

Call playback was undertaken over two nights (16-17 May) following the methods of the DEC (2004), targeting Powerful Owl, Barking Owl, Sooty Owl and Masked Owl. Surveys were conducted in the early evening. This included an initial listening period of 10 minutes, then playing each call followed by a 5 minute listening period. The first survey was conducted for a total time of 45 minutes. The second survey was conducted for a total time of 50 minutes. The spotlighting surveys followed the call playback surveys.

Spotlighting

Spotlighting surveys were undertaken by two observers over two nights (16-17 May) using hand-held 12V 50W spotlights. One survey was undertaken on foot along a track to the south of the site, south of the Barrier Highway (adjacent to the proposed eastern transmission line route) for a total survey time of 40

minutes (80 person minutes). The second spotlighting survey was undertaken from a vehicle using the existing roads on the subject site for a total time of 90 minutes (180 person minutes).

Opportunistic records

All opportunistic sightings of fauna within the study area were recorded during the field surveys. Additionally the following was recorded by hand-held GPS to assist spatial analysis:

- All threatened species sightings.
- All habitat features of significance.

Targeted survey: Grey-crowned Babbler

The Grey-crowned Babbler, listed as Vulnerable under the TSC Act, was observed during the initial surveys in May and June 2012. Nests and a family group were recorded within Area 3, an east-west strip of vegetation planned for removal (see Figure 4-1 and Table 4-1). In order to adequately assess the impact of the Proposal on this species, additional surveys were undertaken to determine the abundance of Grey-crowned Babblers and their nests, both on site and in surrounding areas.

Seven walking transects to detect family groups and nest sites were conducted by two ecologists for a total survey time of 21.25 person hours. One transect was conducted along Area 3, and the remaining six transects were conducted in woodland corridors adjacent to the site (including Area 1 and the TSR to the south of the Barrier Highway). A map of survey effort is displayed in Figure 3-3. Observations of Grey-crowned Babbler family groups were recorded, including the number of individuals and a habitat description. Nest sites were also recorded, including their height above ground, species of tree in which they occurred and whether nests were active (chicks present), where possible.

3.4.4 Survey limitations

Competency	Suitably qualified and licensed individuals carried out the survey work; refer to Appendix I for staff qualifications and experience.
Timing	The field surveys were undertaken in late autumn and early winter which is considered unsuitable for detecting a number of target species. The precautionary approach outlined below has been utilised where timing was not optimal for a particular species.
Scope	The fauna survey focussed on habitat assessment to identify areas that may harbour threatened species, rather than undertaking a comprehensive survey program. This was considered appropriate to the large degree of previous disturbance and clearing at the site and limited area of available habitat.
Precautionary approach	As it is difficult to rule out the presence of any particular species without extensive surveys, a precautionary approach has been adopted. That is, if suitable habitat is present and desktop assessment has determined the species could occur in the area, the species has been assumed to have potential to utilise habitat within the study area.

3.5 GIS MAPPING

Field data (point and lines) were obtained during the site surveys using hand-held Garmin GPS units. Vegetation mapping was ground truthed but developed by hand digitising layers over aerial imagery (sourced from Bing online 2012). All mapping was carried out using ESRI's ArcGIS software (ArcView 10) and based on the GDA 94 datum.

Note: mapped drainage lines and waterbodies are sourced from topographic map layers and are known to be ephemeral.

Figure 3-2 Fauna survey effort (May 2012).

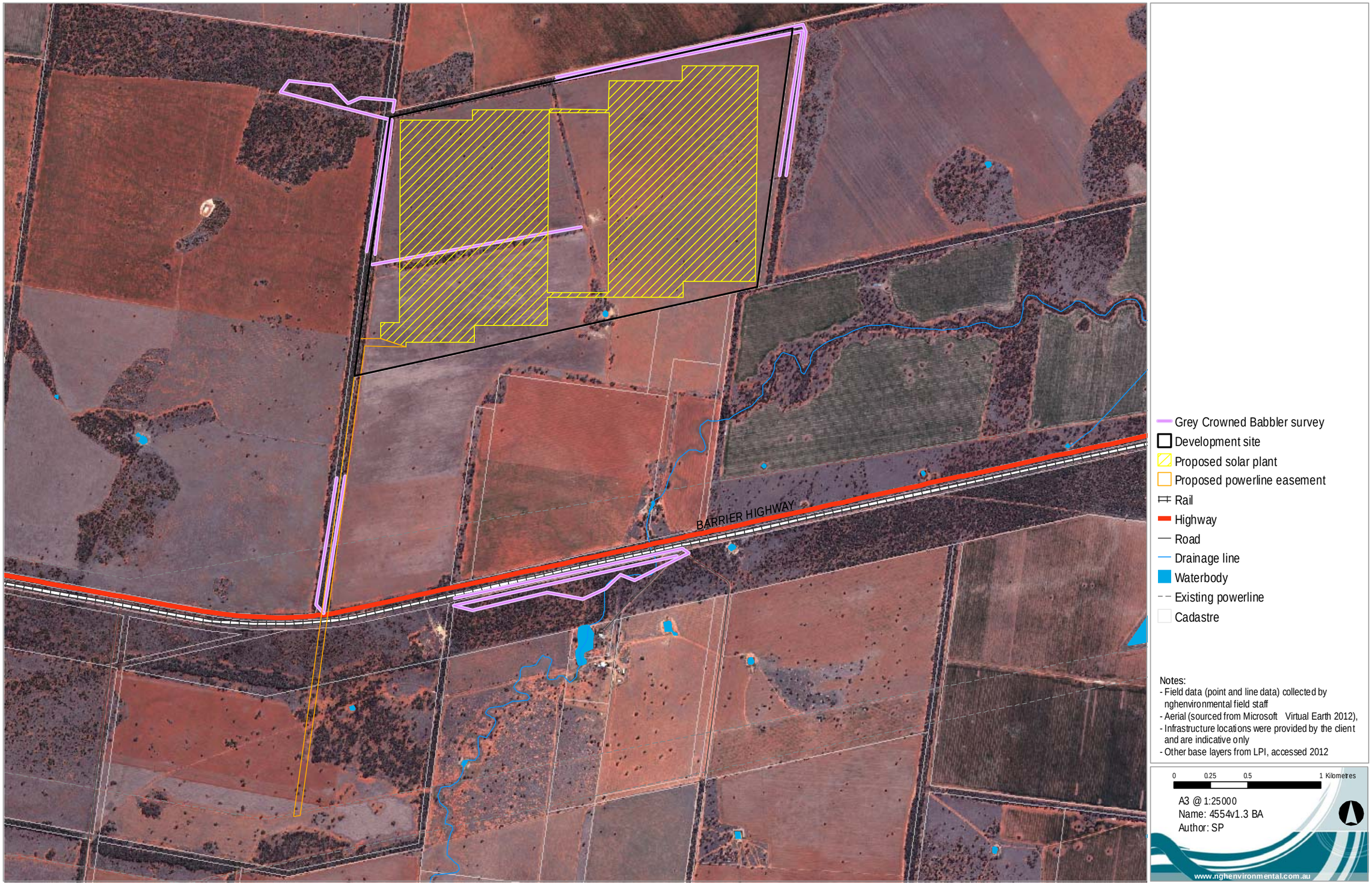

Figure 3-3 Grey-crowned Babbler survey effort (August 2012).

4 RESULTS

4.1 HABITAT AREA DEFINITION

From the results of field survey, four distinct areas were defined on the basis of the different resources and habitats they provide (described below and indicated on Figure 4-1). These areas are referred to in the subsequent results and impact assessment sections of this assessment.

Table 4-1 Defined habitat areas at the Proposal site.

Area	Description
1	Native vegetation that surrounds the perimeter of the solar plant site, north of the Barrier Highway.
2	The north-south oriented strip of native vegetation that runs through the centre of the solar plant site.
3	The east-west oriented strip of native that runs through the western half of the solar plant site.
4	Relatively undisturbed native vegetation that occurs within the proposed transmission line easement, south of the Barrier Highway.

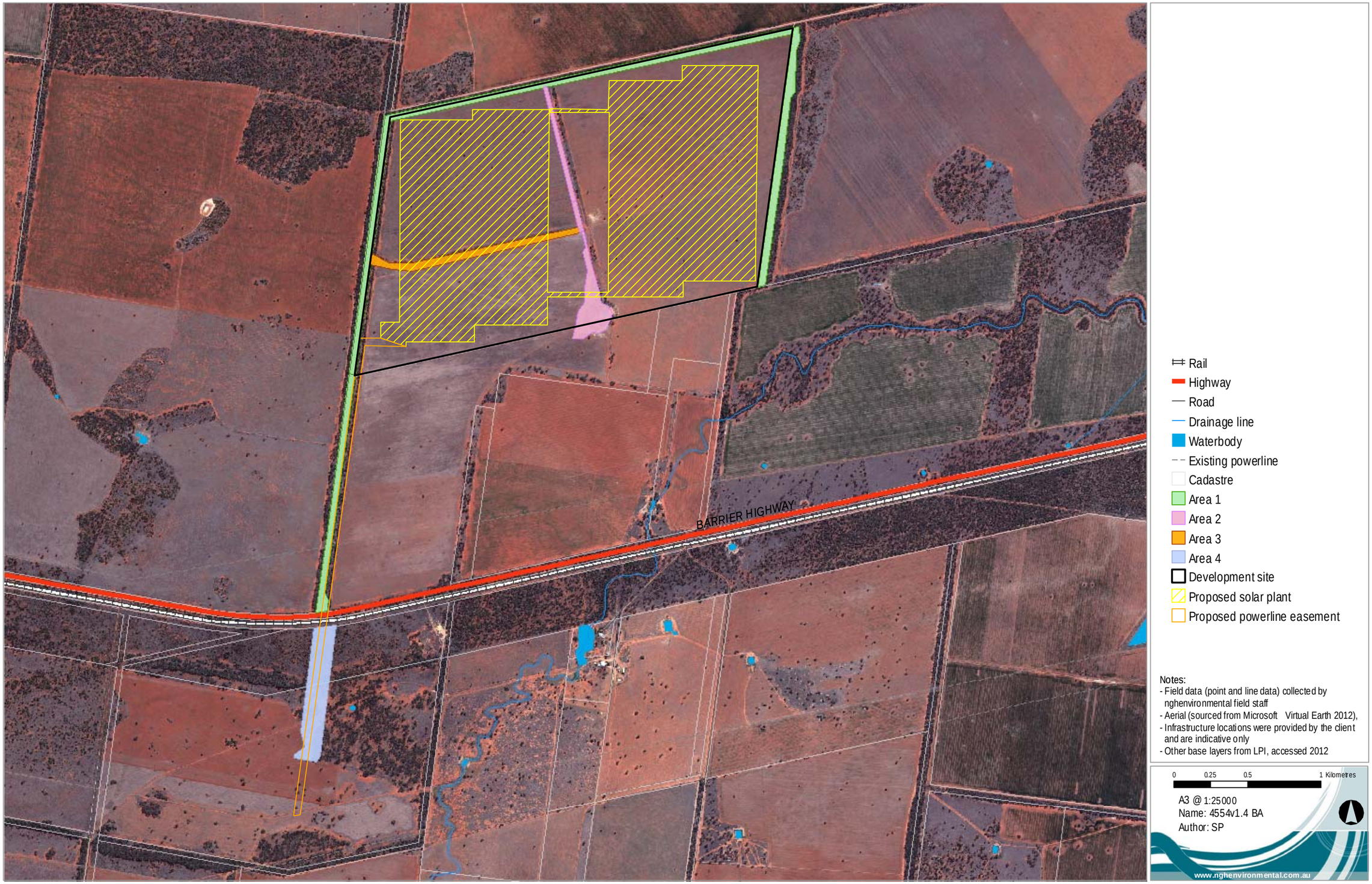

Figure 4-1 Habitat areas defined during the survey at the Proposal site.

4.2 FLORA

4.2.1 Background review

NSW Wildlife Atlas database searches for threatened species listed on the TSC Act identified 29 species within the Central West CMA catchment, Canbelego Downs and Bogan-Macquarie sub-catchments and Bogan Shire LGA and one species listed on the EPBC Act (Appendix B). In addition, the likelihood of all threatened flora species to occur at the site has been assessed in relation to their known habitat requirements and availability of suitable habitat within the study area. These results are tabulated in the threatened species habitat evaluation included as Appendix B. This evaluation concluded that two threatened flora species have the potential to occur within the study area:

- Pine Donkey Orchid (*Diuris tricolor*) TSC-V
- Red Darling Pea (*Swainsona plagiotropis*) TSC-V, EPBC-V

These species were targeted during the field survey.

4.2.2 Vegetation Communities

Native vegetation within and surrounding the study area consists of, or is derived from, a single vegetation type: Poplar Box - Gum-barked Coolabah - White Cypress Pine shrubby woodland (Veg ID 103) (Benson *et al.* 2006) (Figure 4-2 & Figure 4-3). The vegetation at the site is characteristically dominated by Poplar Box (*Eucalyptus populnea* subsp. *Bimbil*) and co-dominated by White Cypress Pine (*Callitris glaucophylla*) with scattered individuals of Gum-barked Coolibah (Inland Red Box, *E. intertexta*). Ironwood (*Acacia excelsa*) forms a strong component in the vegetation south of the highway. The small tree layer is dominated by Wilga (*Geijera parvifolia*) and Budda (*Eremophila mitchellii*). A diverse ground cover consisting of various small shrubs, forbs and grasses occurs, particularly south of the highway with Galvanised Burr (*Sclerolaena birchii*) and Grey Copper Burr (*S. diacantha*) tending to dominate the more disturbed areas. A complete list of species recorded at the site is provided in Appendix C.

Figure 4-2 Poplar Box - Gum-barked Coolabah - White Cypress Pine shrubby woodland at the site.

This vegetation community is not listed as threatened under state or Commonwealth legislation, however, with continued clearing, it is considered near-threatened and may become Vulnerable (Benson *et al.* 2006). Clearing, woody native shrub regrowth, grazing by stock, goats and other feral animals and sheet erosion are the main threats to this community (Benson *et al.* 2006). Applying the general JANIS

reservation target of 15% of the original extent for each forest type (JANIS 1997), the vegetation within the study area is under-represented in the conservation reserve system within the Bioregion (refer Table 4-2). Under JANIS criteria, 60% of the remaining stands of vulnerable types and 100% of endangered types should be reserved or otherwise protected.

Table 4-2 Conservation status of vegetation at the subject site (after Benson 2006).

Vegetation type	Pre-1750 extent (ha)	Extant area (ha)	Reserved in Bioregion (ha)
Vegetation ID 103 Poplar Box - Gum-barked Coolabah - White Cypress Pine shrubby woodland	800,000 ±30%	500,000 ±30% (62.5% of 1750 extent)	12,995 (1.62% of 1750 extent)

The majority of native vegetation within the study area is in moderate to poor condition. Vegetation in good condition occurs south of the highway (within the transmission easement, Area 4) and within Area 2 (Figure 4-3).

The cleared paddock areas consist of mostly exotic species and are no longer representative of any native vegetation type. These areas are dominated by Lucerne with dense patches of Stinkgrass (**Eragrostis cilianensis*) scattered across these areas. The disturbance-tolerant native Yellow Burr-daisy (*Calotis lappulacea*) occurs infrequently in these areas.

4.2.3 Biometric status

Red flag areas

Under the NSW OEH Biobanking Assessment Methodology (DECC 2008a), 'red flag' areas are important for biodiversity conservation and cannot easily be replaced. They include:

- Over-cleared vegetation (>70%) in moderate to good condition.
- EEC in moderate to good condition.
- Threatened species records (where species cannot withstand further loss in the CMA).

There are no Red Flag Areas within the study area.

Biometric condition

According to the BioMetric 2.0 Operations Manual (DECC 2008b) definitions for native vegetation in low condition are:

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.

All the native vegetation at the site would be considered to be in moderate to good condition under the biometric definition.

Figure 4-3 Vegetation types and condition at the subject site.

4.2.4 Disturbance and weeds

Solar Plant

The woodland vegetation north of the highway has been largely cleared to provide areas for pasture. Intact woodland vegetation is restricted mainly to narrow strips across the paddocks and along fence lines with isolated paddock trees occurring across the broader cleared areas. The cleared areas have been cultivated and planted with Lucerne (**Medicago sativa*) for fodder. The site was being actively grazed by sheep at the time of the survey. Past clearing and agricultural use have produced a range of direct and indirect impacts to flora habitats, including removal of vegetation, altered microclimate, loss of pollinator and dispersal fauna, altered hydrological regimes and elevated soil nutrients.

The disturbance at the site has led to the colonisation of a range of introduced plant species. Minor pasture weed species were common across the majority of the study area. Two noxious weeds declared for the Bogan Shire Council Area under the *Noxious Weeds Act 1993* were recorded at the subject site Bathurst Burr (**Xanthium spinosum*) and Hunter Burr (**Xanthium italicum*). These species occur as isolated individuals, widespread across the study area in pastures north of the highway. Dense colonies of Bathurst Burr occur around the dams in the south of Area 2 (Figure 4-4). These weeds are listed as Class 4 noxious weeds, meaning that the growth and spread of these plants must be controlled according to the measures specified in the management plan published by the local control authority (Bogan Shire Council).

Figure 4-4 Bathurst Burr around the dam within the proposed solar plant area.

Transmission line

The northern section of the proposed transmission line traverses disturbed exotic pasture similar to that found on the solar plant site. Common pasture weeds are widespread. On the southern side of the barrier highway the line traverses relatively undisturbed vegetation within the road and railway easements and weed species are infrequent, being mostly restricted to the more disturbed areas immediately adjacent to access tracks. The most southern portion of the proposed transmission line crosses an area that was actively being cultivated at the time of the survey.

4.2.5 Plant species and communities of conservation significance

Groundwater dependent ecosystems

Groundwater dependent ecosystems (GDEs) are ecosystems which have their species composition and their natural ecological process determined by groundwater (NOW 2002). There are several types of GDE with six types conventionally recognised in Australia (NWC 2010). Three of these are likely to occur locally:

- Terrestrial vegetation that relies on the availability of shallow groundwater.
- River base flow systems where a groundwater discharge provides a baseflow component to the river's discharge.
- Terrestrial fauna, both native and introduced, that rely on groundwater as a source of drinking water.

The subject site is located on the floodplain of Whitbarrow Creek, which is an ephemeral tributary of the Bogan River. However, the vegetation type observed at the site is not indicative of terrestrial vegetation which may depend on the availability of shallow groundwater associated with the river system.

No groundwater extraction at the subject site is planned as part of the Proposal. The installation of the solar plant and infrastructure would not affect the net amount of water reaching the surface of the ground during rain or flooding events nor its ability to infiltrate and replenish groundwater systems. As such the Proposal is unlikely to have an impact on GDEs or other natural systems that depend upon groundwater resources.

Endangered ecological communities

None of the vegetation within the study area meets the definition of an Endangered Ecological Community listed under the TSC or EPBC Acts.

Listed threatened species

No threatened flora species were detected during the surveys. Based on the results of the desktop assessment, two threatened flora species have the potential to occur at the site, the Red Darling Pea and Pine Donkey Orchid. The timing of the field survey was not considered suitable for the detection of these species. As a precautionary approach, without further survey, it has been assumed that these species may occur in areas of better quality habitat such as the good condition Poplar Box Woodland in Area 4 and the north of Area 2.

4.3 FAUNA

4.3.1 Background review

The NSW Wildlife Atlas database searches for threatened species listed on the TSC Act identified 57 species within the Central West CMA catchment, Canbelego Downs and Bogan-Macquarie sub-catchments and Bogan Shire LGA. The EPBC Act protected matters search tool revealed seven threatened fauna species, 11 migratory species, and five invasive species with the potential to occur within the Bogan Shire LGA (Appendix B).

All threatened species were targeted during the fauna survey through an assessment of suitable habitat. The likelihood of threatened fauna species being present at the site has been assessed in relation to their

known habitat requirements and availability of suitable habitat within the study area. These results are tabulated in Appendix B. The study area contains confirmed habitat for two threatened birds, potential habitat for 36 threatened and migratory species and marginal habitat for three threatened and migratory species.

4.3.2 Field survey results

A moderate diversity of fauna species were recorded during field surveys. A list is provided in Appendix C categorised by survey type or opportunistic observation.

A total of twenty-four species of bird were observed during field surveys. All were native species. Many of the bird species observed were common and widespread (for example, Noisy Miner, Australian Raven, Australian Magpie, Apostlebird, Blue Bonnet) (refer Appendix C). The Grey-crowned Babbler, listed as Vulnerable under the TSC Act, was recorded across the site where habitat was suitable (refer Figure 4-9). The Superb Parrot (listed as Vulnerable under both the TSC and EPBC Act) was also observed during opportunistic surveys (refer Figure 4-9).

Two native mammal species were recorded (the Eastern Grey Kangaroo (*Macropus giganteus)* and an unidentified glider (*Petaurus* spp.). Three exotic mammal species were found to be very common at the site and included the European Rabbit (*Oryctolagus cuniculus)*, Red Fox (*Vulpes vulpes)*, and Domestic Cat (*Felis catus)*.

Microbat survey

Overall, 12 species and/or genus of microbat were detected during the Anabat surveys (Table 4-3). The most number of calls detected was from the South-eastern Freetail Bat (*Mormopterus* sp. 4). This species is not listed as threatened.

The Yellow-bellied Sheathtail Bat (*Saccolaimus flaviventris*), listed as Vulnerable under the TSC Act, was detected by three of the detectors. The Little Pied Bat (*Chalinolobus picatus),* also listed as Vulnerable under the TSC Act, was detected by all four Anabat detectors. Both of these species were identified with a moderate level of confidence.

Five calls of the Inland Forest Bat (*Vespadelus baverstocki*)*,* listed as Vulnerable under the TSC Act, were detected by three Anabat detectors. This species is difficult to identify and calls were identified with a low level of confidence however, the calls have been assigned to this species as a precautionary approach.

No other threatened species were identified.

Table 4-3 Results of Anabat analysis.

Common Name	Species Name	Anabat 1	Anabat 2	Anabat 3	Anabat 4	Total
		(Bega 16/05/12)	(Sydney 16/05/12)	(Bega 17/05/12)	(Sydney 17/05/12)	
South-eastern Freetail Bat	*Mormopterus sp.* 4	0	37	57	34	128
Little Broad-nosed Bat	*Scotorepens greyii*	0	2	6	31	39
White-striped Freetail Bat	*Tadarida australis*	3	14	11	5	33
Little Forest Bat	*Vespadelus vulturnus*	1	18	3	0	22

Common Name	Species Name	Anabat 1	Anabat 2	Anabat 3	Anabat 4	Total
		(Bega 16/05/12)	(Sydney 16/05/12)	(Bega 17/05/12)	(Sydney 17/05/12)	
Inland Forest Bat*	*Vespadelus baverstocki*	4	0	12	1	17
Little Pied Bat*	*Chalinolobus picatus*	4	3	5	3	15
Yellow-bellied Sheathtail Bat*	*Saccolaimus flaviventris*	0	1	3	1	5
	Vespadelus sp.	0	1	3	0	4
Gould's Wattled Bat	*Chalinolobus gouldii*	0	1	1	1	3
Long-eared Bat	*Nyctophilus sp.*	1	0	1	0	2
Western Broad-nosed Bat	*Scotorepens balstoni*	0	0	2	0	2
	Chalinolobus sp./Mormopterus sp.	1	0	0	0	1
Unidentified calls (eg. insect, clutter)		8	31	70	14	123
To send for verification		0	7	0	1	8

*** denotes threatened species**

Nocturnal survey

Call Playback

No species were identified during call playback surveys. That is, no calls from nearby Powerful Owl, Barking Owl, Sooty Owl or Masked Owl were elicited.

Spotlighting

The first spotlighting survey, undertaken south of the Barrier Highway, detected Eastern Grey Kangaroos (*Macropus giganteus)* and an unidentified species of glider, either a Sugar or Squirrel Glider (*Petaurus* spp.). According to the ALA database, one Sugar Glider (*Petaurus breviceps)* specimen was collected from the Bogan Shire LGA in 2009 by the Australian Museum. The closest record of a Squirrel Glider is from two specimens collected in the Warren LGA in 1999 (also provided by the ALA), approximately 75 km north-east of the study area. The Squirrel Glider is listed as Vulnerable under the TSC Act.

During the second spotlighting survey two Red Foxes (*Vulpes vulpes),* three cats *(Felis catus)* and three rabbits (*Oryctolagus cuniculus*) were observed.

Targeted survey: Grey-crowned Babbler

Refer to Section 4.3.7 for results of Grey-crowned Babbler surveys.

4.3.3 Fauna habitat

Habitat in the project area can be defined as open Poplar Box Woodland. The structure of woodland is generally simple with the open canopy dominated by eucalypts, a grassy groundcover with fallen timber

and leaf litter. Habitat condition depends on the availability of micro-habitat resources, such as hollow-bearing trees, and habitat extent and connectivity to other areas.

Generally the fauna habitat quality was higher in the southern portion of the study area (south of the Barrier Highway, where the transmission easement is located) where patches of open woodland with some connectivity exist. North of the Barrier Highway, the site is more degraded due to past and present land management practices. A history of disturbance is evident across the majority of the site with vast paddocks of cleared land and existing vehicle tracks. Good to moderate quality woodland remnants occur along roadside corridors. The majority of habitat available for fauna across the study area occurs along the fringes of the site in these corridors and in patches to the south of the Barrier Highway. These areas contain an abundance of leaf litter, dead wood, and hollow-bearing trees.

Nests, consisting of grass, sticks or mud, were abundant in the roadside corridors in both trees and large shrubs. Stick nests are typically used by Grey-crowned Babblers (refer to Section 4.3.7), but Babbler nests are also used by other bird species (The Bush Lover 1933).

Figure 4-5 Grey-crowned Babbler nest.

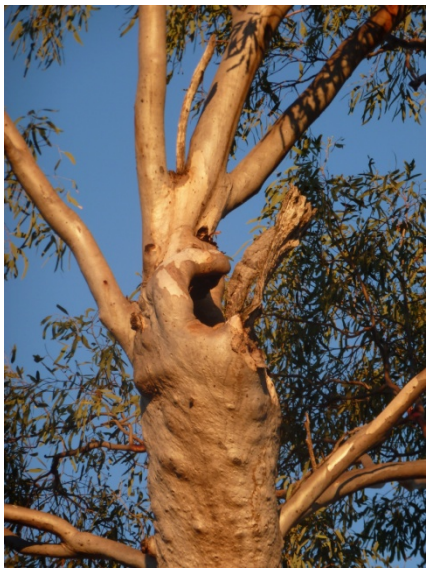

Figure 4-6 Example of a hollow-bearing tree (outside of the area to be impacted)

One dam occurs on site. It provides poor habitat due to stock access (including trampling of vegetation and stirring up sediments and defecation). Being a small water body, the quality of habitat is expected to vary, changing with the grazing regime and seasonal rainfall. Dams provide habitat for species with the capacity to disperse between water bodies.

4.3.4 Hollow-bearing trees

Hollow-bearing trees (HBTs) were abundant along roadside verges and woodland areas. Tree heights ranged from 6 metres to 15 metres with DBH (Diameter at Breast Height) ranging from 30 cm up to 120 cm. Hollows were found across a range of sizes (Appendix D). HBT locations are shown on the map included as Figure 4-7. Details of HBTs including number and size of hollows, tree species, height, DBH and waypoint number are shown in Appendix D.

Hollow bearing trees represent a constraint as they provide potential habitat for a range of hollow-dependent fauna including threatened species such as Superb Parrots (*Polytelis swainsonii)*, Squirrel

Gliders (*Petaurus norfolcensis*) and Pink Cockatoos (*Lophochroa leadbeateri*). Hollows generally do not form in trees younger than 100 years old (Lindenmayer *et al.* 1997) so loss of HBTs represents long term habitat loss for threatened species.

4.3.5 Koala feed trees

No Koalas or evidence of Koalas were observed during field surveys.

Poplar Box (*Eucalyptus populnea)* is listed as a secondary feed tree species for the Western Slopes and Plains and Poplar Box is listed on Schedule 2 of SEPP 44. However, the Bogan Shire is not listed in Schedule 1 of SEPP 44 therefore this policy does not apply to the study area.

Figure 4-7 Fauna habitats at the subject site.

4.3.6 Habitat connectivity

Habitat 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). The study area contains mostly low quality habitat that has been impacted by human disturbance with evidence of ongoing clearing and grazing, and the presence of vehicle tracks. However, roadside corridors/verges provide important connectivity throughout the locality. These areas are mostly of high quality, as they are known to provide habitat for threatened fauna, specifically, the Grey-crowned Babbler.

The roadside corridors within and adjacent to the site provide connectivity to both Thorndale and Miandetta State Forests to the east. Miandetta State Forest is located approximately 24km west of the township of Nyngan.

4.3.7 Fauna species of conservation significance

A total of five threatened species were identified during field surveys, including two species of threatened bird (Superb Parrot and Grey-crowned Babbler), and three species of microbat (Yellow-bellied Sheathtail Bat, Little Pied Bat and Inland Forest Bat).

Superb Parrot

Three Superb Parrots (listed as Vulnerable under both the TSC Act and EPBC Act) were observed on June 1, in the vicinity of the proposed transmission route (Figure 4-8 and Figure 4-9). This species was identified as having low potential to be impacted by the works (Appendix B, Table B.2), and therefore an Assessment of Significance was not considered necessary for this species. The site is on the edge of this species distribution and is not identified breeding habitat. This species would most likely be utilising the site outside of the breeding season as foraging habitat only.

Figure 4-8 Superb Parrots observed in the vicinity of the proposed transmission line route.

Grey-crowned Babbler

During surveys in May/June 2012, a total of seven groups of Grey-crowned Babblers (TSC-V) were recorded across the site (Figure 4-9), specifically in wooded areas. Groups of individuals may have been counted more than once, therefore family group sightings (Figure 4-9) give an indication of habitat usage, and nest sites (Figure 4-7) give an indication of the breeding habitat of this species.

Targeted Grey-crowned Babbler surveys undertaken in August 2012 both on and off site recorded approximately 16-17 family groups. To avoid double counting of groups, note was made of the direction of movement of a group away from an observer, and two observers worked simultaneously through an area, so that regular cross referencing could be made about group sightings. Thus the results give a representation of the minimum number of groups present. When mapped, the results show approximately 16-17 family groups occur within the study area (Figure 4-9). The number of individuals within each group ranged from two to ten. One family group was observed within Area 3, and is probably the same group recorded during the previous survey in May 2012.

A total of 61 nests were recorded within the surveyed areas during August 2012 (Figure 4-9). Seven of these appeared old and disused. Two nests within the TSR (to the south of the Barrier Highway) were confirmed as active (with chicks).

Four areas of Grey-crowned Babbler habitat on site have been identified as highly constrained and align with the habitat areas shown in Figure 4-1. They are described below:

- **Area 1:** includes the vegetated areas around the perimeter of the Solar Plant. High quality and structurally diverse vegetation occurs here. It provides connectivity to the remaining three areas. Two Grey-crowned Babbler family groups (Figure 4-9) and two nest sites (Figure 4-7) were recorded here.
- **Area 2:** includes the north-south strip of vegetation in the middle of the Solar Plant envelope. This is a narrow corridor of remnant vegetation which contains small to medium-sized shrubs which enhances its structural diversity. It provides connectivity from Area 1 to Area 3. Two family groups and two nest sites were recorded here.
- **Area 3:** includes the east-west strip of vegetation in the middle of the Solar Plant envelope. This area is the least diverse structurally, and is regarded as a degraded woodland remnant. However the vegetation here provides connectivity between Area 1 and Area 2. One family group and one nest site were recorded here.
- **Area 4:** includes the habitat to the south of the Barrier Highway, including the transmission line easement. Overall, the vegetation here is an extension of Area 1, and is high quality and structurally diverse. One family group and one nest site were recorded here, however the nest site was not located within the transmission line easement envelope.

Potential impacts of the Proposal on the Grey-crowned Babbler are discussed further in Section 5.

Pink Cockatoo

Pink Cockatoos were not identified during the field surveys, although this species has previously been recorded nesting in a large stag on the Barrier Highway between Nyngan and Hermidale (Shelly, 2000). Data from the Western Australian wheatbelt indicates that Pink Cockatoos nest in hollows with an average entrance width of 18 cm (Cameron, 2007). Of the six hollow-bearing trees to be impacted within the Solar Plant envelope, only two contain medium to large-sized hollows that could provide potential

habitat for the Pink Cockatoo. Within the transmission line easement envelope, all four trees have large and medium sized hollows with the potential to provide nesting habitat for the Pink Cockatoo.

Literature suggests nests of this species are at least 1 km apart, with no more than one pair every 30 square kilometres (OEH, 2012), therefore no more than one breeding pair is likely to be impacted by the proposal. Furthermore, considering that 46 person hours were spent surveying the areas to be impacted by the solar plant and transmission line easement without detecting the Pink Cockatoo, and the abundance of hollow-bearing trees with medium to large sized hollows that occur outside of the impact areas (Figure 4-6 and Figure 4-7), the proposal is considered unlikely to have a significant impact on this species.

Glider (unidentified)

An unidentified glider (Squirrel Glider or Sugar Glider) was observed during the first spotlighting survey in the woodland to the south of the Barrier Highway (east of the proposed transmission line). The Squirrel Glider is listed as Vulnerable under the TSC Act.

The closest record of a Squirrel Glider is over 70 km north-east of the site and no Squirrel Gliders have been recorded in the area since 1980. Therefore it is more likely that a Sugar Glider was observed.

Habitat to the north of the highway is not considered suitable for Squirrel Gliders. However, assuming a precautionary approach, it is possible that the habitat south of the highway could be used by the Squirrel Glider. Measures have been included within this assessment (refer Section 6) to ensure that potential impacts to Squirrel Gliders are managed. These include preclearance surveys prior to felling hollow-bearing trees and the salvage of hollows from felled trees and their installation in adjacent habitat to preserve this resource. The installation of artificial nest boxes is also recommended. Squirrel Gliders have been observed to make use of artificial nest boxes (Freya Gordon pers. comm. 13.11.12) and it is considered likely that they would also make use of salvaged hollows.

Threatened microbats

Three threatened microbats were identified from the Anabat surveys: Yellow-bellied Sheathtail Bat, Little Pied Bat, and Inland Forest Bat, all listed as Vulnerable under the TSC Act. These species were identified as having moderate potential to be impacted by the works (Appendix B, Table B.2) and therefore an Assessment of Significance was not required. The works would remove up to 10 hollow-bearing trees that have the potential to provide habitat for microbats. There is an abundance of suitable and better quality habitat adjacent to the site and in the study area. Therefore the proposed works are unlikely to impact these species.

Figure 4-9 Fauna species of conservation significance recorded at the site.

4.4 EPBC MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE

Matters of National Environmental Significance (MNES) listed under the EPBC Act within 10km of the subject site were investigated using the EPBC Act Protected Matters search tool. MNES relating to biodiversity include species and communities listed as threatened or migratory under the EPBC Act. As the works would not occur near permanent water and would not affect creeks or rivers, only terrestrial species and communities are considered further in this report (aquatic species, such as the Murray Cod, would not be affected and are not considered).

Endangered Ecological Communities

Three Commonwealth listed Endangered Ecological communities were identified as having the potential to occur in the area:

- Coolibah- Black Box Woodlands of the Darling Riverine Plains and the Brigalow Belt South Bioregions
- Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia
- Weeping Myall Woodlands

The potential for these communities to be impacted by the Proposal was considered in Appendix B, Table B.1. None of these endangered ecological communities would be impacted by the proposed works.

Threatened flora

No Commonwealth listed threatened flora species were returned from the Protected Matters search. However, the Red-Darling Pea (listed as Vulnerable under the TSC and EPBC Act) was identified as having the potential to occur within the transmission line easement, through searches pertaining to the TSC Act.

A pre-construction survey will be conducted for this species. If this species is found to occur at the site, it is considered likely that it could be easily avoided by micrositing infrastructure such as power poles and tracks. It is considered unlikely that a significant impact to the species would occur. Any impacts on habitat for this species would be offset as part of the offset plan for the proposal (refer to mitigation measures, in Section 6).

Threatened terrestrial fauna

Threatened terrestrial fauna species returned from the search included:

- Australasian Bittern (*Botaurus poiciloptilus*)
- Red Goshawk (*Erythrotriorchis radiatus*)
- Malleefowl (*Leipoa ocellata)*
- Superb Parrot *(Polytelis swainsonii)*
- Australian Painted Snipe *(Rostratula australis)*
- South-eastern Long-eared Bat *(Nyctophilus corbeni)*
- Brush-tailed Rock-wallaby (*Petrogale penicillata)*
- Koala *(Phascolarctos cinereus).*

The potential for these species to be impacted by the Proposal is considered in Appendix B, Table B.2. All species are rated as either no or low potential to be impacted by works.

The Superb Parrot is rated as having low potential to be impacted despite its confirmed presence at the site. The site is on the edge of this species distribution and is not identified breeding habitat. This species would most likely be utilising the site outside of the breeding season as foraging habitat only. An Assessment of Significance was not considered warranted for this species. The surrounding habitat and local records suggest that the majority of preferred habitat would be retained at the site, and there is abundant habitat available in the study area.

Migratory fauna

Non-threatened species and/or migratory species returned from the search include:

- Fork-tailed Swift (*Apus pacificus*)
- Great Egret (*Ardea alba*)
- Cattle Egret (*Ardea ibis)*
- White-bellied Sea-Eagle (*Haliaeetus leucogaster*)
- Rainbow Bee-eater (*Merops ornatus)*
- Latham's Snipe *(Gallinago hardwickii)*
- Painted Snipe *(Rostratula benghalensis)*
- Malleefowl (*Leipoa ocellata)*

The potential for these species to be impacted by the Proposal is considered in Appendix B, Table B.2. The assessment also includes other species known from the area and considered to be at risk. A species would be considered to have a high potential to be impacted if it were known from the area and could be considered to depend on the site (for either foraging or breeding).

The White-bellied Sea-eagle, Malleefowl and Rainbow Bee-eater were the only listed migratory species categorised as having low potential to be impacted by the Proposal. Given the low potential for impact, no specific mitigation measures are considered necessary for these species. No other migratory species were categorised as having the potential to be impacted.

Conclusion

The proposal is unlikely to have a significant impact on any MNES relating to biodiversity including EECs, threatened flora and fauna species and migratory species. Accordingly, no referral under the EPBC Act is required for the Proposal. The proponent may, however, consider lodging a referral to seek agency confirmation that the Proposal is not a controlled action.

5 ASSESSMENT OF POTENTIAL IMPACTS

5.1 SOLAR PLANT

The Proposal would involve the construction, operation and eventual decommissioning of PV infrastructure, tracks, site buildings and fencing. Potential impacts are detailed in Table 5-1 and discussed in more detail below.

Table 5-1 Potential impacts of the proposed solar plant

	Construction and decommissioning	Operation phase
Vegetation	• Clearing and disturbance during construction and installation of the array and associated infrastructure. • Total footprint of approximately 300 ha of which 5.7 ha (1.9%) is native Poplar Box Woodland vegetation. • Risk of noxious and environmental weed introduction and spread.	• Microclimate impacts under the PV array (shading, temperature, humidity). • Weed growth and spread.
Fauna	• Clearing of habitat for construction and installation of the solar plant and associated infrastructure (such as tree food sources, tree hollows, rock habitats). Includes loss of habitat connectivity and nest sites. • Potential entrapment of fauna from trenching. • Disturbance to local fauna from noise, light and vibration. • Vehicle collision risks to fauna.	• Loss of or alteration to grassland habitat for macropods, birds, reptiles and insects due to shading, changed microclimate and reduced productivity. • Movement barrier and collision hazard created by perimeter fencing. • Habitat avoidance due to presence of infrastructure. • Vehicle collision risks to fauna.

5.1.1 Construction and decommissioning impacts

Loss of vegetation and habitats during construction

Groundlayer vegetation

Groundlayer vegetation over an estimated maximum area of approximately 300 hectares would be impacted for the operating life of the solar plant. In general approximately 40% of the vegetation under the solar module arrays would be permanently shaded with the remaining 60% partially shaded. The works would mostly affect exotic pasture with no conservation value. Impacts to native groundcover vegetation would be limited to the area within the east-west strip (Area 3) to be cleared for array infrastructure (5.7 ha). This represents a very small proportion of the total area to be impacted (1.9%).

The north-south running strip of vegetation within the central area of the solar plant site (Area 2) would be retained by the Proposal. This area provides the only habitat for threatened flora at the solar plant site and as it would not be impacted by the Proposal, impacts to threatened flora are considered to be unlikely.

Hollow bearing trees

A total of six hollow bearing trees (out of a total 10 to be impacted, see Appendix D for a list of hollow bearing trees within the development envelope) would be removed for the establishment of the Solar Plant. The removal of hollow-bearing trees would remove potential habitat for both threatened and non-threatened hollow-dependant species such as birds and arboreal mammals. However, this area is highly modified and greater densities of hollow-bearing trees are present in the roadside verges. Considering the abundance of high quality hollow-bearing trees surrounding the site, the loss of these trees is unlikely to impact threatened fauna.

Vegetation clearing guidelines, including hollow-bearing tree removal, should be adopted to minimise impacts to resident fauna. Example guidelines are provided in Appendix E.

Connectivity impacts

The central area of the Proposal site contains a degraded remnant woodland corridor running in an east-west direction (Area 3, Figure 4-1) that would be removed as a result of the proposed works (approximately 5.7 ha). This may provide fauna with a means of dispersal despite a history of stock grazing and clearing. The loss of this fragmented corridor is unlikely to reduce the ability of species to disperse, although species such as the Grey-crowned Babbler are known to use this area for both breeding and foraging (Figure 4-7 and Figure 4-9). The corridors along the existing boundary fences (Area 1) provide more optimal habitat and retain connectivity in the study area.

Threatened species

The Grey-crowned Babbler has the potential to be impacted by the Proposal due to loss of breeding and foraging habitat. During the May/June surveys, a total of five nest sites and five family groups were recorded within the Solar Plant site (Areas 1, 2 and 3). In the vicinity of the transmission line easement (Area 4), a total of one nest site and one family group were recorded. During the targeted surveys in August a total of 54 nest sites and 23 family groups were recorded both on and off site.

Based on population viability analysis in Victoria, a viable population is likely to contain more than 10 family groups, while populations with less than 10 groups are likely to have a high rate of extinction (Parsons Brinkerhoff, 2005). According to the surveys conducted in August, approximately 16-17 family groups occur on site and in woodland corridors immediately adjacent to the site. Multiple observations of a family group of 6 individuals within Area 3, and 3 nest sites, indicate that this one family group would be impacted by the Proposal. A Seven Part Test has been prepared for the Grey-crowned Babbler and is included in Appendix E.

The Seven Part Test concluded a significant impact for this species is not considered likely. However, precautionary measures have been included in Section 6 to minimise and offset impacts to this species.

Potential introduction and spread of weeds

The site carries noxious weeds which would require control before and after the proposed works. Good weed hygiene would be required to prevent the movement of weeds around and off the property, and prevent the introduction of any new weeds. Safeguards have been included in Section 6 to ensure weeds are adequately controlled at the site.

With the appropriate implementation of weed controls during and following construction, weed impacts within and off the subject site are not expected to be significant.

The spacing between the PV array rows would be adequate to allow vehicles to access the site for ongoing weed control and pasture renovation, as required.

Disturbance to local fauna from noise, light and vibration

Habitat alienation is a potential impact during the construction of infrastructure. Excessive noise and vibration, increased human and vehicle activity and night work (if required) may not directly harm individual animals but it could affect feeding and breeding behaviours resulting in negative impacts on long term population viability. Disturbance impacts can be difficult to directly attribute to population level changes (Hill *et al.* 1997) however efforts have been made to minimise this impact as a precautionary approach, in Section 6 of this report.

Vehicle collision risks to fauna

Increased vehicle movements during construction may lead to collisions with native fauna. Vehicle movements should be restricted during dawn and dusk and speed limits should be enforced. Provided traffic management measures are implemented, it is unlikely that any threatened species would be put at risk by increased vehicle activity.

5.1.2 Operation of the solar plant

Alteration to microclimate and erosion potential under the array

Vegetation and ground habitats would likely be affected by reduced insolation and temperature and increased humidity underneath the solar modules. Wind speeds may also be reduced.

Shading and groundcover management under the array

In the grazed paddocks existing native and exotic pasture across the site is likely to decline initially due to shading following PV array installation. Areas of exotic pasture are of little importance in terms of biodiversity; however, a reduction in cover may lead to bare ground and susceptibility of the soil to erosion. The selection of a more suitable shade tolerant pasture species for planting would address this issue. Caution needs to be applied when choosing groundcover species to sow prior to infrastructure installation as sowing a pasture variety that has not been trialled under local conditions may lead to establishment failure or subsequent pasture decline creating management problems post construction.

The response of native vegetation to shading is hard to predict as there has been little research into the effects of pasture shading in the central west of NSW. Shade tolerant species are present onsite within the woodland remnants and may benefit from shading. A study into the effects of tree canopy shade on three Chenopod species in arid Australia showed that some were tolerant of a wide range of light and soil moisture conditions (Prider and Facelli 2004). It is likely that a native groundcover would survive onsite under the PV arrays in areas where a native groundcover currently exists.

Changes in rainfall distribution

Soil underneath the PV modules would likely receive less rainfall than surrounding soil. However, evapotranspiration losses would also be lower due to shading and reduced air movement. Lateral movement of surface and subsurface water from adjacent rain-exposed areas would be likely to occur. As such, the net amount of moisture available to vegetation under the PV modules should not be highly altered.

There could be a concentration of rainfall runoff in a strip below the lower edge of the solar panel rows. This could increase rain-splash intensity and soil erosion potential in this area during heavy rainfall events. The erosion risks should be manageable using adequate site preparation, and responsive pasture and stock management.

Loss of or alteration to grassland habitat for macropods, birds, reptiles and insects due to shading, changed microclimate and reduced productivity

It is unclear what the impact to soil moisture, soil nitrogen and subsequent vegetation composition from factors such as reduced light and near ground wind levels would be following the installation of the PV arrays. The response of local fauna to these changes is equally hard to predict and would be largely influenced by the vegetation changes that occur. An altered microclimate under the PV arrays due to shading and associated vegetation changes has the potential to affect sensitive fauna such as ants and poikilothermic species such as reptiles. Basking opportunities may be reduced, although the structure of the PV arrays may provide fauna with a degree of protection from predation, particularly from raptors and foxes. Increased soil moisture may create favourable shelter and foraging habitat for amphibians. As the PV arrays would be located in modified grazing and cropping paddocks with few fauna habitat values, there is a low probability of fauna species, particularly threatened species, being impacted by any microclimate and associated vegetation changes that may occur in these areas.

Effects on fire frequency

Although there have been isolated cases of sparks from the back of panels, the risk of this causing a grass fire is considered to be low. Vegetation under the array would be kept low by slashing or sheep grazing. Access tracks would be constructed to each inverter and around the perimeter of the farm. This network would serve to contain any fire starting at the array, to protect the array during a wildfire and to provide access for fire suppression during an event. The Proposal is unlikely to significantly affect wildfire frequency in the areas adjacent to the subject site. Fire frequency within the site boundary is already likely to be low given the high levels of modification and low fuel loads.

Natural wildfires produce noxious gases and temporary habitat changes which would affect local fauna populations over the short-medium term. Any additional releases from a fire-affected PV array are not expected to add significantly to these impacts to fauna. The First Solar modules to be used have passed the Underwriters Laboratories standard UL 1703 (which includes flammability tests) and are inflammable and do not pose a pollution risk in the event of fire.

Movement barrier and collision hazard created by perimeter fencing

Perimeter fences have the potential to impact native fauna by creating a barrier to movement and by providing a collision risk. High chainlink fences are a hazard to fast flying parrot species (Pfennigwerth 2008). Superb Parrots were recorded on site and there is some potential for this species to be impacted. Using shade cloth can increase the visibility of this type of fence to parrots (Pfennigwerth 2008). Perimeter fencing also has the potential to create a barrier to the movement of many large terrestrial fauna species. Species likely to use the Proposal site for foraging and dispersal would be capable of accessing and utilising the nearby expanses of similar modified grazing land and are unlikely to be greatly affected by the reduction of habitat brought about by fencing the Proposal site.

For species that would still have access to the habitat within the perimeter fence, for example birds, habitat modification due to microclimate changes and associated invertebrate and vegetation changes may reduce the quality of the foraging habitat. As the land is highly modified and representative of much of the farmland in the district, modification of this habitat type is unlikely to be significant. The road

verges surrounding the site would not be impacted by the works and would continue to provide optimal habitat for many species.

Habitat avoidance due to presence of infrastructure

The structure provided by the PV arrays and perimeter fence may deter species such as Grey-crowned Babblers from foraging between the PV arrays, however changes in microclimate may increase soil moisture and invertebrate numbers.

Vehicle collision risks to fauna

Vehicle movements on site should be restricted during dawn and dusk and speed limits should be enforced. Provided traffic management measures are implemented, it is unlikely that any threatened species would be put at risk by vehicle activity during the operational phase.

5.2 TRANSMISSION LINE

The Proposal would involve the establishment of a transmission line and an associated easement. Potential impacts are detailed in Table 5-2. Impacts common to the solar plant site such as disturbance to local fauna and vehicle collision risks have been discussed in Section 5.1 above. Those specific to the transmission line are discussed in more detail below.

Table 5-2 Potential impacts of the proposed transmission line

	Construction and decommissioning	Operation phase
Vegetation	• Clearing and disturbance during establishment of the easement and construction and installation of the line. • Total footprint of approximately 14 ha of which 4.2 ha (30%) is native Poplar Box Woodland vegetation. • Risk of noxious and environmental weed introduction and spread	• Vegetation maintenance within the easement • Weed growth and spread
Fauna	• Clearing of habitat for the transmission line easement (such as tree food sources, tree hollows, rock habitats). Includes loss of habitat connectivity. • Disturbance to local fauna from noise, light and vibration • Vehicle collision risks to fauna	• Movement barrier and collision hazard created by transmission lines • Vehicle collision risks to fauna

5.2.1 Construction and decommissioning impacts

Impacts to soils, vegetation and habitats

Groundlayer vegetation

Establishment of the easement and the installation of transmission line infrastructure would require the clearing of overstorey vegetation although groundcover vegetation would be mostly retained. Impacts to

ground cover vegetation would be restricted to the establishment of an access track and from disturbance associated with the installation of pole footings and line laydown during construction. The majority of the vegetation to be impacted comprises exotic pasture or cropping areas (approximately 10.5 ha within the easement); however, a small amount of good condition native groundcover vegetation (approximately 4.5 ha within the easement) would be impacted in the area immediately south of the Barrier Highway (Area 4). Assuming a maximum access track width of 5 metres, this would equate to approximately 1.2 ha of exotic vegetation and 0.5 ha of native vegetation permanently cleared within the easement.

The area of native vegetation is considered to provide potential habitat for two threatened flora species, the Red Darling Pea and Pine Donkey Orchid. The timing of the survey was not suitable for detecting these species and it is considered possible that they could occur within the proposed easement area. Given that groundcover vegetation would be largely retained, the risk to these species is considered manageable through pre-construction surveys during the appropriate survey window (spring). It is an assumption of this assessment that surveys would be undertaken to identify the absence or presence of these species and that if detected, infrastructure can be microsited to avoid them. As such, impacts to these species are considered unlikely.

Canopy vegetation and hollow bearing trees

A total of four hollow bearing trees (out of a total 10 to be impacted, see Appendix D for a list of hollow bearing trees within the development envelope) would require removal for the establishment of the powerline easement. The removal of hollow-bearing trees would remove potential habitat for both threatened and non-threatened hollow-dependent species such as birds and arboreal mammals. However, the transmission line route has been designed to avoid areas with great densities of hollow-bearing trees. There is an abundance of high quality hollow-bearing trees in the study area and therefore the loss of these four trees is unlikely to impact threatened fauna.

Vegetation clearing guidelines, including hollow-bearing tree removal, should be adopted to minimise impacts to resident fauna. Example guidelines are provided in Appendix E.

Connectivity impacts

The proposed transmission line would be located on the edge of a roadside verge to the north, through a section of low-growing shrubby habitat to the south of the Barrier Highway, and on the edge of existing woodland at the southern end (Figure 4-3). These areas are unlikely to be valuable corridors for fauna, considering the extent and quality of habitat adjacent to the site. The transmission easement, particularly where it is located on the edge of existing vegetation remnants, would not further fragment existing habitat. It is recommended that future maintenance of the transmission line easement would allow low-growing vegetation to subsist. Post-construction, the transmission line envelope would continue to provide fauna with a means of dispersal and connectivity would be maintained.

Threatened species

The Grey-crowned Babbler would be impacted by the Proposal due to loss of breeding and foraging habitat. A total of one nest site and one family group were recorded in the vicinity of the transmission line easement (Area 4).

As stated above, a viable population is likely to contain more than 5-20 family groups (DSE 2003). Based on surveys in May/June and in August, it is estimated that approximately 17 family groups occur in the study area and surrounds, over an area of approximately 70 ha. Furthermore, areas additional to those

surveyed occur adjacent to the study area and contain suitable habitat, hence this is considered a low estimate. A Seven Part Test has been prepared for the Grey-crowned Babbler and is included in Appendix E.

The Seven Part Test concluded a significant impact for this species is not considered likely. However, precautionary measures have been included for this species in Section 6, to minimise and offset impacts to this species.

Potential for introduction and spread of weeds

The area of native vegetation to the south of the Barrier Highway is relatively weed free. There is potential for the introduction of weeds, including noxious species, from outside areas such as the solar plant site. This risk is considered to be manageable through good weed hygiene and the safeguards and mitigation measures outlined in Section 6 this report.

5.2.2 Operational impacts

Impacts to soils, vegetation and habitats

Maintenance of the easement would be required to maintain clearances from vegetation necessary for the security of the transmission line infrastructure. This would be restricted to the control and suppression of overstorey species in areas of native woodland vegetation. Control measures would likely include mulching and cutting of regenerating overstorey species. No additional impacts to flora or fauna are anticipated. If threatened flora species were identified during pre-construction surveys then strict protocols to protect these areas during maintenance operations would be adhered to.

Collision risks from transmission lines

Bird injuries and mortalities may occur as a result of collisions with transmission line conductors and occasionally through electrocution (Henderson *et al*. 1996). Waterbirds are particularly susceptible to collision with transmission lines (Bevanger 1998). The closest waterways are located approximately 4 km to the south-west, and 10 km to the east. However, there are no wetlands in the study area and from an assessment of the larger area, it is unlikely that the transmission line is located on an important migratory route. As such, the transmission line for the Nyngan Solar Plant is considered to only marginally increase the risk of bird collisions. Collision and electrocution risks from overhead transmission lines can be reduced through measures such as flight diverters and insulation on conductors (DEWHA 2009).

5.3 CUMULATIVE IMPACTS

There is a requirement under Clause 228(2) of the *Environmental Planning and Assessment Regulation 2000* to take into account any cumulative environmental impacts with other existing or likely future activities. Cumulative impacts relate to the combined potential effects of different impact areas of the Proposal as well as the potential interaction with other proposals in the local area.

Key adverse cumulative impacts relating to biodiversity include the following:

- Clearing of vegetation
- Removal of habitat, particularly for threatened species (such as the Grey-crowned Babbler).

The landscape in which the Proposal is located has already been highly cleared and modified for agricultural activities. Remnant native vegetation is limited and fragmented and the Proposal would

contribute to these adverse impacts. However, the amount of vegetation (6.2 ha) to be removed by the Proposal is relatively small. Considering the value and scale of the habitat to be removed, in the context of the surrounding land uses, the cumulative impacts of the clearing of 6.2 ha of native vegetation are considered to be low.

Specific to threatened species, the Proposal would remove of 6.2 ha of known Grey-crowned Babbler habitat, as they appear to occur wherever there is an overstorey and a complex understorey with abundant leaf and wood litter. However, the Grey-crowned Babbler is relatively common in the area, being observed in local vegetation corridors surrounding the site, including the TSR to the south of the Barrier Highway. Approximately 17 family groups and 61 nests were recorded in vegetation remnants in the immediate vicinity of the site. Three nests would be removed as a result of the proposal. The remaining habitat surrounding the site would continue to provide optimal foraging and breeding habitat for the Grey-crowned Babbler, and connectivity would be maintained. As such, the cumulative impact to threatened species is considered low.

It is considered that cumulative impacts are best managed by managing each component individually. No additional safeguards are proposed.

6 RECOMMENDED SAFEGUARDS AND MITIGATION MEASURES

The following measures are required to ensure that biodiversity impacts are adequately managed and to avoid the likelihood of significant impact for any listed entity. They are ordered by project phase.

6.1 DETAILED DESIGN PHASE

Transmission line

- A supplementary survey during spring (early October) prior to the finalisation of the transmission line design is required to confirm if threatened flora species including the Red-darling Pea and Pine Donkey Orchid inhabit the higher quality woodland vegetation south of the Barrier Highway.

  If these species are identified in areas proposed for impact, transmission infrastructure would be microsited with input from an ecologist to ensure a significant impact is avoided. This may require 'no go' zones to be established to avoid the species. If unavoidable, all areas of suitable habitat within the easement would be included as additional permanent impact areas and would be added to the total area required to be offset.

- Grey-crowned Babbler nest sites on the transmission line (identified in Figure 4-7) would be protected from impact during the infrastructure siting and design process.

6.2 CONSTRUCTION PHASE

Solar plant and transmission line

- Works would avoid impacts to mature trees that are to be retained. Tree protection standards would comply with Australian standard AS 4970-2009 Protection of trees on development sites (Standards Australia, 2009). Wherever practicable, excavations and vehicle/machinery movements would occur outside the canopy dripline of large eucalypts.
- Removal of the east-west strip of vegetation must be conducted outside of the breeding season of the Grey-crowned Babbler (June to February) unless the nests have been confirmed to be inactive.
- Pre-clearance surveys would be conducted prior to felling hollow-bearing trees.
- Restoration of habitat:
    - Hollows from felled hollow-bearing trees would be salvaged and placed in retained trees or on poles in adjacent habitat. For each hollow salvaged, a nest box would also be installed to offset the loss of habitat.
    - Where it is not deemed to be a fire hazard, timber from cleared trees (coarse woody debris – CWD – including logs) is to be relocated into areas of adjacent woodland to provide foraging habitat for species such as Grey-crowned Babblers and other ground dwelling fauna. CWD would be scattered evenly across the relocation areas, not piled or windrowed.
    - Cleared native vegetation not likely to provide habitat would be mulched rather than burned.

- Within areas of native vegetation, existing tracks would be used wherever possible to avoid compaction and/or disturbance.
- Traffic management measures would be incorporated into the construction and operation phase and would address traffic flow, vehicle speed and vehicle numbers entering and leaving the site. This would aim to prevent collisions with fauna utilising the site, particularly Grey-crowned Babblers.
- Excavated topsoil would be stored separately from subsoil and replaced in a manner that replicates the original profile as closely as possible to assist rapid revegetation.
- Site stabilisation, rehabilitation and revegetation would be undertaken progressively during works, to ensure that soils are stabilised as soon as practical. This would minimise weed infestation, sedimentation and erosion, which degrade habitat.
- Disturbed areas would be identified and used preferentially for vehicle and machinery access, materials laydown, stockpiling of cleared vegetation and the deposition and retrieval of spoil whenever practicable, to minimise the footprint of the development on intact native-dominated areas.
- A weed management plan would be developed for the site including but not limited to the following outcomes:
    - The control of noxious weeds recorded on the site;
    - Preventative measures for the spread or introduction of weeds;
    - Monitoring of measures and ongoing adaptive management to control weeds;
    - Laydown sites for excavated spoil, equipment and construction materials would be weed-free or treated for weeds prior to use;
    - Sediment control materials would be weed free such as weed free hay bales or geotextiles; and
    - Imported materials such as sand and gravel would be sourced from sites which do not show evidence of noxious weeds or Phytophthora infection.
- If cyclone mesh fencing is to be used then shade cloth or other methods to increase the visibility to fast flying parrots would be incorporated.
- Where trenches are to be excavated and backfilled in well vegetated native areas, whole sods would be removed, stored in moist, shaded conditions and replaced following the works. Sod storage time would be minimised and sods would be replaced in a manner that maximises the chances of re-establishment and soil stabilisation.
- If the dam in the south of the solar plant site is removed during the works, an alternative watering point would be established to compensate for its loss to maintain similar habitat resources for native fauna.
- Trenches would be left open for the least time practical and would be inspected for trapped fauna prior to back filling. Any trench sections left open overnight would be inspected early in the morning and any trapped fauna removed.
- A groundcover management plan would be developed that would include regular monitoring of vegetation cover and composition and allow for adaptive management. The aim of the plan is to

retain vegetation cover under the panels to resist erosion and weed infestation. This would include:

- Establishment of a shade tolerant groundcover across the site to address the potential for soil erosion.
- Advice from an agronomist in relation to preferred species/varieties, establishment methods of alternative pastures and best practice management.
- Where information is lacking, trials may be required onsite.

6.3 OPERATIONAL MANAGEMENT

Solar plant

- The groundcover management plan established in the construction phase would be implemented. If localised erosion is detected, effective treatments would be applied such as hardening with mulch, reseeding and covering with an open weave jute matting, gypsum application to improve structure and infiltration, protection with geotextile fabric or localised flow dispersal and diversion structures.
- The space between the PV array rows would be kept clear to enable access by vehicles for ongoing weed control, and pasture renovation, if required.
- Nest boxes and salvaged hollows remounted during the construction phase would be routinely inspected to check the integrity of the structures and remedy them if required.

6.4 DECOMMISSIONING PHASE

- Following the operational phase of the solar plant, areas of native vegetation that were impacted by the Proposal would be rehabilitated to a level that demonstrates an increase in the environmental values of the site compared to its pre operational state. A rehabilitation plan would be prepared that includes ongoing monitoring to ensure the rehabilitation is successful for the long-term.

6.5 OFFSETTING

An Offset Plan would be prepared in accordance with the offset strategy outline included as Appendix G and finalised prior to construction. 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 would be offset in perpetuity.

An Offset Plan would be required to demonstrate the *actual* amount of native vegetation impacted was offset. This plan would therefore be implemented after construction but prior to the operation of the solar plant. Prior to finalising the Offset Site boundaries, the proponent would validate the actual areas impacted by construction to ensure that the actual, not estimated, impacted area is offset.

The Offset Plan would also set out appropriate management actions specific to the selected offset site. The outcomes of the management actions would be monitored. Monitoring results would be reported every 2 years for the duration of the project (up to 30 years) to demonstrate that a 'maintain or improve' outcome has been met.

7 CONCLUSION

The subject site is dominated by areas of exotic pasture and cultivated paddocks with small areas of native woodland vegetation in moderate to good condition. No endangered ecological communities listed under the TSC or EPBC Acts occur at the site.

Potential habitat for several threatened flora species is present along the transmission easement. While impacts are unlikely to be significant, additional survey has been recommended to minimise impact on these species should they occur.

Potential habitat for several threatened fauna species is present at the site. While the Proposal would remove up to ten hollow bearing trees (six on the solar plant site and four on the transmission easement) and may reduce foraging habitat for some species, there is an abundance of hollow bearing trees and open pasture habitats in the surrounding locality and the loss of up to ten is not considered likely to generate a significant impact for any hollow-dependent fauna. Removal of hollow-bearing trees is however a Key Threatening Process under the TSC Act and offsetting hollows to be removed has been recommended as part of the Proposal.

Ground layer vegetation over an estimated area of around 302 hectares would be impacted for the operating life of the solar plant with approximately 296 ha comprising exotic pasture and 6 ha native vegetation (approximately 5.7 ha for the establishment of the array and 0.5 ha for the establishment of an access track within the transmission easement). Most of this impact would result from shading by the array rather than direct habitat removal. Approximately 40% of ground layer vegetation would be permanently shaded and 60% partially shaded. Clearing of ground layer vegetation would predominately result from the establishment of the perimeter and internal access tracks only. Approximately 5.7 ha of overstorey vegetation would be removed within the solar plant site and 4.5 ha within the transmission easement. These impacts would not be significant in view of the condition of the vegetation, the low conservation and habitat values and the local abundance of similar vegetation in the locality.

The operational phase of the project would require careful management of pasture under the PV array to control weeds and maintain good groundcover resistant to erosion. This is considered to be readily achievable and recommendations to develop and plan and adaptively monitor results have been made.

By identifying areas of high biodiversity values early in the planning process (Biodiversity Constraints Analysis, nghenvironmental 2012) and then using this information to develop a sensitive layout design, the Proposal achieves the aim of avoiding key habitat elements. The mitigation measures in this report set out required actions to minimise and offset residual impacts to biodiversity. With the effective implementation of these measures, the Proposal is able to meet the objective of a 'maintain or improve biodiversity values' outcome.

The proposal is unlikely to have a significant impact on any MNES relating to biodiversity including EECs, threatened fauna species and migratory species. Accordingly, no referral under the EPBC Act is required for the Proposal.

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APPENDIX A DIRECTOR GENERAL'S REQUIREMENTS

The following table outlines the components of the Director-General's Requirements (DGRs) issued on the 24 July 2012 that relate to the assessment of flora and fauna impacts and details specifically how these requirements have been addressed in this assessment.

Table A-1 Director General's Requirements for the assessment of flora and fauna impacts.

Requirement	Assessment
Include an assessment of the impacts of all development components on flora and fauna (both terrestrial and aquatic, as relevant) and their habitat including details on the existing site conditions and likelihood of disturbance (including quantifying the worse case extent of impact on the basis of vegetation type and total native vegetation disturbed).	This assessment considers the impacts from the proposed development of the solar plant and transmission line on all aspects of biodiversity. It includes details of the existing site conditions (refer Sections 2.2, 4.2.2 and 4.2.4) and assumes a worst case scenario within the detailed impact assessment in Section 5.
Specifically consider impacts on threatened species and communities listed under both State and Commonwealth legislation that have been recorded on the site and surrounding land, impacts on riparian and/or instream habitat in the case of disturbance of waterways, and on biodiversity corridors.	Impacts to all threatened species and communities with the potential to occur at the subject site and surrounding land have been assessed in Section 5. The Proposal would not result in the disturbance of waterways. Impacts on biodiversity corridors have also been assessed in Section 5.
Include details of how flora and fauna impacts would be managed during construction and operation including adaptive maintenance and management protocols (including the mitigation and/or management of weeds).	Safeguards and mitigation measures for the planning, construction and operational phases of the Proposal are outlined in Section 6. These measures include adaptive protocols and outline the requirements for weed management.
Include measures to avoid, mitigate or offset impacts consistent with "improve or maintain" principles. Sufficient details must be provided to demonstrate the availability of viable and achievable options to offset the impacts of the project.	A biodiversity constraints analysis was conducted in the planning stages of the Proposal which subsequently informed the project design so as to *avoid* areas of high biodiversity value. Mitigation measures have been outlined in Section 6 to *minimise* impacts that cannot be avoided and to rehabilitate disturbed areas after decommissioning of the solar plant. The ability to *offset* the final impacts consistent with "improve or maintain" principles is discussed in Section 6.5 and a commitment to establish and maintain an offset site forms part of the development.
Take into account: • ***the Threatened Species Assessment Guidelines (DEC 2007)*** • ***the Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities (DEC 2004)*** • ***the Central West Catchment Action Plan (Central West CMA 2007),***	This assessment focussed on the potential for impact to threatened species and communities (refer Section 4.2.4 and 4.3.7 and Appendix B). Survey methodologies were guided by the *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities (DEC 2004),* with adjustments made to reflect the condition of the site. Assessments of Significance for species that are likely to be impacted by the proposed development have been completed according to *the Threatened Species Assessment Guidelines (DEC 2007).* The *Central West Catchment Action Plan* was reviewed and the Proposal is not inconsistent with the catchment and management targets that relate to Biodiversity within this plan.

APPENDIX B THREATENED SPECIES EVALUATIONS

The tables in this appendix present the habitat evaluation for threatened species, ecological communities and endangered populations listed as occurring within the Central West CMA catchment, Canbelego Downs and Bogan-Macquarie sub-catchments and Bogan LGA in the *Atlas of NSW Wildlife*[2] and those identified as potentially occurring within a 10km radius of the site according to the Commonwealth EPBC *Protected Matters Search Tool*[3].

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:

Present: Potential or known habitat is present within the study area

Marginal: Habitat present is not typical but may be suitable

Absent: No potential or known habitat is present within the study area

Likelihood of occurrence

None: Species known or predicted within the locality but no suitable habitat present within the study area

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

Possible: Suitable habitat present and the species could occur in the study area based on the proximity of nearest records

Present: Species was recorded during the field investigations

Possible to be impacted

No: The Proposal would not result in an impact to this species. No Assessment of Significance (AoS) is necessary for this species

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

Moderate: The Proposal could impact this species or its habitats. This species is considered further in this Assessment. The risk to this species is considered manageable and an AoS is not considered necessary.

High: The Proposal is likely to impact this species or its habitats. An AOS has been applied to these entities

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.

Additional threatened species, not returned from database searches, but considered to have potential for impact, are discussed within the body of this report.

[2] The *Atlas of NSW Wildlife* (Bionet) is administered by the NSW Office of Environment and Heritage and is an online database of fauna and flora records that contains over four million recorded sightings.

[3] This online tool is designed for the public to search for matters protected under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). It is managed by the Commonwealth Department of Sustainability, Environment, Water, Population and Communities.

B.1 FLORA

Species name and ecology	Presence of habitat	Likelihood of occurrence	Potential for impact
Shrubs			
Bertya opponens **Coolabah Bertya** **TSC-V, EPBC-V** Coolabah Bertya is a slender shrub to 4 m tall. Currently known from only four scattered sites in NSW: one from private property near Coolabah in western NSW and two to the south of Narrabri on the North West Slopes The fourth population was known from private property near Cobar but this population has not been seen since 1982 and is possibly now extinct. Flowering time for the western populations is July and August, although seed formation can commence as early as July, especially in Jacks Creek State Forest. The coastal populations flower slightly later and are still in seed-set around January and February. The disturbance agents of fire and mechanical disturbance appear to trigger germination and/or suckering in Coolabah Bertya. The most appropriate time interval between disturbance events is not known. Coolabah Bertya occurs in a range of habitats ranging from stony mallee ridges and cypress pine forest on red soils in the west, to coastal cliff edges in open eucalypt forest in the east. The wide variation in habitat type between the populations makes the identification of critical habitat very difficult. Consideration of disturbance regimes and grazing management are probably more important to the survival of populations in the long term. Associated species at Jacks Creek State Forest include *Eucalyptus chloroclada, Callitris glaucophylla* and *Eucalyptus fibrosa*. The Gibraltar Range habitat is recorded as a ridge crest immediately above the cliff, with *Eucalyptus campanulata, Eucalyptus notabilis* and *Allocasuarina littoralis* woodland. The Kangaroo River State Forest habitat is predominantly a dry open eucalypt forest with wetter elements existing in the sheltered gullies and creek lines. Here it grows on a rock outcrop on a cliff edge in very thin lithosol soils surrounded by open forest. The outcrop is sparsely vegetated by shrubs and herbs, other species including *Lantana camara* and *Dendrobium speciosum s.l.*	Present	Unlikely – conspicuous species not detected during the survey	Low

Species name and ecology	Presence of habitat	Likelihood of occurrence	Potential for impact
Prostanthera spinosa **Spiny Mint-bush** **TSC-V** In NSW this species is an aromatic, scrambling, prostrate shrub, to 0.5 metres high. Occurs in NSW, Victoria and South Australia. In NSW it is located within a small area to the north of Grafton in the NSW North Coast bioregion. The NSW occurrence of *P. spinosa* is very restricted and disjunct, separated by more than 1000 km from other occurrences in Victoria and South Australia, and may represent a distinct taxon. There are five populations of *Prostanthera spinosa* known from confirmed records, and possibly several other small populations from anecdotal sightings in Banyabba Nature Reserve. The confirmed records include locations within Fortis Creek National Park and Banyabba Nature Reserve. All known populations are within a linear range of 16-20 km. Grows in skeletal sandy soils of rocky areas.	Absent	None	No
Zieria covenyi **Coveny's Zieria** **TSC-E, EPBC-E** An erect shrub up to 2 m high. Has a very restricted distribution and is known only from two populations several kilometres apart on Narrow Neck Peninsula in the Blue Mountains NP, NSW. Grows in eucalypt woodland on sandy soils. Found on the Narrabeen Group Sandstones associated with the Mount Sinai soil landscape and occurs on gentle east and south-facing slopes and on ridges in shallow sandy soil. Associated vegetation includes *Eucalyptus sieberi, Leptospermum attenuatum, Telopea speciosissima, Banksia serrata, Hakea dactyloides, Olearia erubescens* and *Brachyloma daphnoides.* Flowers are borne in summer, from October to December.	Absent	None	No

Species name and ecology	Presence of habitat	Likelihood of occurrence	Potential for impact
Zieria granulata **Illawarra Zieria** **TSC-E, EPBC-E** An erect and bushy shrub, to 6 m high. Restricted to the Illawarra region where it is recorded from a number of sites. The species primarily occupies the coastal lowlands between Oak Flats and Toolijooa, in the local government areas of Shellharbour and Kiama. This is a range of approximately 22 kilometres. The typical habitat is dry ridge tops and rocky outcrops on shallow volcanic soils, usually on Bumbo Latite. Less frequently found on the moist slopes of the Illawarra escarpment and in low-lying areas on Quaternary sediments. Associated vegetation includes Bracelet Honey-myrtle *Melaleuca armillaris* scrub, Forest Red Gum *Eucalyptus tereticornis* woodland and rainforest margins, although the species has been recorded from a number of other vegetation types. Much of the natural habitat for the species has been removed and many sites now occupy road verges and paddock edges and dense thickets of Lantana. Flowering occurs between early spring and summer. Observed to coppice from damaged stems in response to physical disturbance including grazing and slashing, although the age at which the species is capable of this is not known. White flowers occur August to October, or between late spring to summer, with fruiting specimens observed in summer.	Absent	None	No
Forbs			

Species name and ecology	Presence of habitat	Likelihood of occurrence	Potential for impact
Diuris tricolor **Pine Donkey Orchid** **TSC-V** The Pine Donkey Orchid (formerly known as *Diuris sheaffiana*) is a terrestrial species that has a flower stalk 20-40 cm high. It is sporadically distributed on the western slopes of NSW, extending from south of Narrandera all the way to the far north of NSW. Localities include the Condobolin-Nymagee road, Wattamondara towards Cowra, Cooyal, Adelong, Red Hill north of Narrandera, Coolamon, near Darlington Point, Eugowra, Girilambone, Dubbo, Muswellbrook, and several sites west of Wagga Wagga. Disturbance regimes are not known, although the species is usually recorded from disturbed habitats. Associated species include *Callitris glaucophylla, Eucalyptus populnea, Eucalyptus intertexta*, Ironbark and *Acacia* shrubland. The understorey is often grassy with herbaceous plants such as *Bulbine* species. Flowers from September to November or generally spring. The species is a tuberous, deciduous terrestrial orchid and the flowers have a pleasant, light sweet scent. It is found in sandy soils, either on flats or small rises. Also recorded from a red earth soil in a Bimble Box community in western NSW. Usually recorded as common and locally frequent in populations, however only one or two plants have also been observed at sites. The species has been noted as growing in large colonies.	Present	Possible	Low – Potential habitat in solar plant area avoided by Proposal. Potential to microsite within transmission easement should this species occur.

Species name and ecology	Presence of habitat	Likelihood of occurrence	Potential for impact
Lepidium hyssopifolium **Aromatic Peppercress** **TSC-E, EPBC-E** An erect perennial herb growing 30 to 50 cm tall. In NSW, there is a population consisting of 6 plants near Bathurst, a population near Bungendore and Crookwell both on the Southern Tablelands. The species was also recorded near Armidale in 1945 and 1958 however it is not known whether it remains in this area. A specimen collected in the Cooma area about 100 years ago may also be Aromatic Peppercress. The species occurs in a variety of habitats including woodland with a grassy understorey and grassland. Appears to respond to disturbance, having appeared after soil disturbance at one site. It's cryptic and non-descript nature (appearing like several weed species) makes it hard to detect. Almost all remaining populations of Aromatic Peppercress occur in heavily modified, non-natural environments, usually amongst exotic pasture grasses and weed species, sometimes with an overstorey of introduced tree species. Soils are light to heavy, often friable, clay loams. Most sites are on roadsides, on fringes of developed agricultural land or occur in small reserves within an agricultural landscape.	Marginal	Unlikely	Low

Species name and ecology	Presence of habitat	Likelihood of occurrence	Potential for impact
Maireana cheelii **Chariot Wheels** **TSC-V, EPBC-V** Perennial forb to about 20 cm high. Restricted to the southern Riverina region of NSW, mainly in the area between Deniliquin and Hay. Also has a limited distribution in Victoria where very rare. NSW collections have mainly been from the Moulamein, Deniliquin and Hay districts, including Tchelery and Zara Stations. There is an outlying record from "Wangareena east of Wanaaring". Usually found on heavier, grey clay soils with *Atriplex vesicaria* (Bladder Saltbush). Recorded on the Hay Plain in *Atriplex vesicaria, Maireana aphylla* and *Acacia homalophylla* shrublands. Soils include heavy brown to red-brown clay-loams, hard cracking red clay, other heavy texture-contrast soils. Tends to grow in shallow depressions, often on eroded or scalded surfaces, and does not extend to the higher soils in the habitat. It has been found on the edges of bare, windswept claypans, in shallow depressions of eroded surfaces where rainwater collects and on a "shelf" in the crabhole complex of heavy grey soils. Associated species include *Atriplex vesicaria, Maireana pentagona, M. excavata, M. ciliata, Cressa cretica, Avena fatua Acacia homalophylla*. Flowering time is mostly spring to summer. Bears fruits mostly from September to November. The species is never common, with small localised occurrences in scattered localities. It has been recorded as common, dense and very abundant in its localised populations.	Marginal	Unlikely	Low

Species name and ecology	Presence of habitat	Likelihood of occurrence	Potential for impact
Monotaxis macrophylla **Large-leafed Monotaxis** **TSC-E** An erect herb to 25 cm tall. Large-leaf Monotaxis is recorded from several highly disjunct populations in NSW: eastern edge of Deua NP (west of Moruya), Bemboka portion of South East Forests National Park, Cobar area (Hermitage Plains), the Tenterfield area, and Woodenbong (near the Queensland border). It is also in Queensland. A recent record from the eastern spur of the Nandewar Range is in the Namoi catchment. The distribution and supposed rarity of *Monotaxis macrophylla* within NSW is related to the occurrence of fire. At least within NSW, the species has not been found in the absence of fire. There is a great diversity in the associated vegetation within NSW (less though in Queensland), encompassing coastal heath, arid shrubland, forests and montane heath from almost sea level to 1300 m altitude. Germination is stimulated by the passage of fire, individual plants have a short life span, a large biomass is produced in a short period of time, flowering occurs shortly after germination, and populations do not persist in the absence of fire. Flowers in August. Plants have a short life span and do not seem to persist longer than six months. Plants germinate, attain heights of up to 50 cm and reach flowering stage within 2 to 3 months. Many hundreds of plants have been observed growing with *Muehlenbeckia costata* on recently burnt rock outcrops. In the northern NSW sites, *Monotaxis macrophylla* was locally abundant on outcrops especially where burnt. Grows on rocky ridges and hillsides.	Absent	None	No

Species name and ecology	Presence of habitat	Likelihood of occurrence	Potential for impact
Pterostylis cobarensis **Greenhood Orchid** **TSC-V, EPBC-V** Terrestrial orchid with flower stems to 40cm high. Known chiefly from the Nyngan-Cobar-Bourke district in the far western plains of New South Wales. Recorded districts include Narrabri, Nyngan, Cobar, Nymagee, Mt Gundabooka, Mt Grenfel and Mutawintji National Park. There are also records from the Darling Downs district of Queensland. Habitats are eucalypt woodlands, open mallee or *Callitris* shrublands on low stony ridges and slopes in skeletal sandy-loam soils. Associated species include *Eucalyptus morrisii, E. viridis, E. intertexta, E. vicina, Callitris glaucophylla, Geijera parviflora, Casuarina cristata, Acacia doratoxylon, Senna* spp. and *Eremophila* spp. Flowers from September to November. Plants are deciduous and die back to the large, underground tubers after seed release. New rosettes are produced following soaking autumn and winter rains. The group includes some of the most drought tolerant orchids in Australia. Have a tendency to grow in sites of litter accumulation and near rocks where run-off is concentrated.	Absent	Unlikely	No

Species name and ecology	Presence of habitat	Likelihood of occurrence	Potential for impact
Swainsona plagiotropis **Red Darling Pea** **TSC-V, EPBC-V** A small, prostrate to decumbent perennial herb to 30 cm tall. Endemic to the riverine plains of inland south-eastern Australia, in Victoria and New South Wales. Populations in NSW are concentrated around Jerilderie, with an outlier 250 km to the north-west in the Willandra National Park (all within the Riverina bioregion) and a recently discovered population near Warren, 480 km north-east of Jerilderie (Darling Riverine Plain bioregion). Occurs within the 350–450mm average annual rainfall band on flat grassland and in heavy red soil, often on roadsides and especially in table drains. Soils are derived from quaternary sediments and are usually red-brown clay-loams. The species is absent from black low-lying soils. Recorded from roadsides, rail reserves, stock routes and areas of lightly grazed unimproved pasture comprising *Austrodanthonia, Enteropogon acicularis* and *Austrostipa* grassland communities. Associated species include *Austrostipa aristiglumis, A. nodosa, A. setacea, Homopholis proluta, Chloris truncata, Austrodanthonia caespitosa, A. duttoniana, Enteropogon acicularis, Hordeum* spp., *Lolium rigidum, Rhodanthe corymbiflora, Calotis scabiosifolia, Microseris lanceolata* and *Chrysocephalum apiculatum*. *Swainsona plagiotropis* appears to be an indicator species of *Enteropogon* and *Austrostipa* grasslands, communities which are poorly known and almost extinct. Flowering is from August to November, with fruit maturing in November. The species is a perennial, but the lifespan is unknown. Plants die back over summer and remain dormant over several months as a subterranean woody root. When temperatures drop and sufficient rains have fallen towards autumn end, the roots begin to resprout. Some form of disturbance (for example, light grazing at appropriate times, occasional soil disturbance or periodic fire) appears to be necessary to reduce competition and enhance seedling growth of *Swainsona plagiotropis* within grassy swards. As with most other hard-seeded pea species, it is likely to require fire, prolonged wet conditions or soil disturbance to break the water-impermeable testa of the seed and allow germination.	Present	Possible	Low – Potential habitat in solar plant area avoided by Proposal. Potential to microsite within transmission easement should this species occur.

Species name and ecology	Presence of habitat	Likelihood of occurrence	Potential for impact
Swainsona recta **Small Purple-pea** **TSC-E, EPBC-E** A slender, erect perennial plant with few stems 20 - 30 cm high. The range of *S. recta* has contracted to two disjunct clusters in NSW, one between Wellington and Mudgee, and the other from Canberra and Queanbeyan south to Williamsdale. The largest known population has about 3,400 plants, scattered along 22 km of narrow railway easement in NSW from Tralee (south of Queanbeyan) to south of Williamsdale. Occurs in grassland and open woodland, often on stony hillsides, dominated by one or more of the following: *Callitris endichleri, C. glaucophylla*, *Eucalyptus blakelyi, E. bridgesiana*, *E. dives*, *E. melliodora, E. microcarpa, E. nortonii and E. polyanthemos.* Requires a forb-rich grassy groundlayer dominated by *Themeda triandra, Poa sieberiana* var. *sieberiana or Austrostipa* spp. Resprouts in autumn and winter from a woody root. It flowers in spring, peaking over two to three weeks in October	Absent	Unlikely	No
Ferns			
Cheilanthes sieberi* subsp. *Pseudovellea **TSC-E** Perennial fern covered with entire brown scales, with a creeping wiry underground stem (rhizome). Only one NSW specimen is recorded, from Mount Foster NW of Warren, collected in 1952. In other states the taxon has been recorded from Mount Olga, and the Kimberley, MacDonnell and Musgrave Ranges. This fern grows in soil pockets in rocky areas of arid mountain ranges. Specific habitats include shaded rock crevices, under rock ledges and between boulders in damp, shallow soils. The fern is usually common where it grows.	Absent	None	No
Grasses and sedges			

Species name and ecology	Presence of habitat	Likelihood of occurrence	Potential for impact
Dichanthium setosum **Bluegrass** **TSC-V, EPBC-V** Bluegrass is an upright grass less than 1 m tall. Occurs on the New England Tablelands, North West Slopes and Plains and the Central Western Slopes of NSW, as well as in Queensland and Western Australia. It occurs widely on private property, including in the Inverell, Guyra, Armidale and Glen Innes areas. Flowering time is mostly in summer. Associated with heavy basaltic black soils. Often found in moderately disturbed areas such as cleared woodland, grassy roadside remnants and highly disturbed pasture. (Often collected from disturbed open grassy woodlands on the northern tablelands, where the habitat has been variously grazed, nutrient-enriched and water-enriched). It is open to question whether the species tolerates or is promoted by a certain amount of disturbance, or whether this is indicative of the threatening processes behind its depleted habitat. Associated species include *Eucalyptus albens, Eucalyptus melanophloia, Eucalyptus melliodora, Eucalyptus viminalis, Myoporum debile, Aristida ramosa, Themeda triandra, Poa sieberiana, Bothriochloa ambigua, Medicago minima, Leptorhynchos squamatus, Lomandra* aff. *longifolia, Ajuga australis, Calotis hispidula* and *Austrodanthonia, Dichopogon, Brachyscome, Vittadinia, Wahlenbergia* and *Psoralea* species. Locally common or found as scattered clumps in populations.	Absent	None	No

Species name and ecology	Presence of habitat	Likelihood of occurrence	Potential for impact
Eleocharis obicis **Spike-Rush** **TSC-V, EPBC-V** This small sedge is a tufted perennial with very short underground stem. Found near Condobolin and Hay, as well as being known from an old collection from the Barrier Range near Broken Hill. The later collection was made on the Lachlan River floodplain at Micabil, near Condobolin. Grows in ephemerally wet situations such as roadside mitre drains and depressions, usually in low-lying grasslands. Sites include depressions with heavy clay soils on the Lachlan River floodplain, with *Eragrostis australasica, Atriplex vesicaria and A. nummularia* shrublands, low-lying claypans near an irrigation channel, and a shallow open ditch on a low ridge with *Eucalyptus populnea* in red sandy soil over clay. Recorded as flowering in November. Found to be locally frequent to abundant in western NSW populations. The distribution of this species overlaps with the "Buloke Woodlands of the Riverina and Murray-Darling Depression Bioregions" EPBC Act-listed threatened ecological community.	Absent	Unlikely	No
EECs			
Artesian Springs Ecological Community **TSC-E** Naturally restricted to the artesian springs of the Great Artesian Basin in north-western NSW. The springs occur where artesian water emerges at the surface through fault-lines in the overlying rock and produce mounds from the salts and sediments as the water evaporates. The vegetation within the community frequently consists of sedges or similar vegetation, however, trees and shrubs may be adjacent to the springs or nearby. Occurs at the edges of the Great Artesian Basin. Mostly found in Queensland and South Australia, however, a few occur in the Mulga Lands, Darling Riverine Plains and Cobar Peneplain Bioregions of New South Wales. Flow rates, water depth, water temperature and chemistry vary within and between springs; this provides a variety of habitat types. Vegetation structure and floristics may be influenced by grazing pressure; the persistence of some species is dependent upon grazing by native herbivores to control competitors.	Absent	None	No

Species name and ecology	Presence of habitat	Likelihood of occurrence	Potential for impact
Brigalow within the Brigalow Belt South; Nandewar and Darling Riverine Plains Bioregions **TSC-E, EPBC-E** The Brigalow community is a low woodland or forest community dominated by Brigalow Acacia harpophylla, with pockets of Belah Casuarina cristata and Poplar Box Eucalyptus populnea subsp. bimbil. The canopy tends to be quite dense and the understorey and ground cover are only sparse. Occurs as scattered remnants on the North West Slopes and Plains and Darling River Plains in NSW; also in Queensland. The largest patches of brigalow are distributed south and west of Narrabri and north-east of Moree. Small areas are also found in Pilliga East State Forest. Outliers also occur in the Darling Riverine Plains Bioregion, on the Liverpool Plains, and at Mt Misery in the upper Hunter Valley. In New South Wales, the listed Brigalow ecological community occurs on undulating plains or sandplains in the western areas and on flat or gentle rises on alluvial plains or undulating peneplains in eastern areasUsually occurs on heavy clay soils. This community has been extensively cleared for agriculture, with most surviving remnants along roadsides and paddock edges. It provides important habitat for rare native wildlife such as the Black-striped Wallaby.	Absent	None	No

Species name and ecology	Presence of habitat	Likelihood of occurrence	Potential for impact
Coolibah-Black Box woodland of the northern riverine plains in the Darling Riverine Plains and Brigalow Belt South bioregions **TSC-E** A woodland community of flora and fauna found on the grey, self-mulching clays of periodically waterlogged floodplains, swamp margins, ephemeral wetlands, and stream levees. The structure of the community may vary from tall riparian woodlands to very open 'savanna like' grassy woodlands with a sparse midstorey of shrubs and saplings. Typically these woodlands form mosaics with grasslands and wetlands, and are characterised by Coolibah (Eucalyptus coolabah) and, in some areas, Black Box (E. largiflorens). Other tree species may be present including River Cooba (Acacia stenophylla), Cooba (A. salicina), Belah (Casuarina cristata) and Eurah (Eremophila bignoniiflora). Occurs on the northern riverine plains in the Darling Riverine Plains and Brigalow Belt South bioregions. Currently known from parts of the local government areas of Brewarrina, Central Darling, Cobar, Coonamble, Moree Plains, Narrabri, and Walgett, but it may occur in other local government areas elsewhere.	Absent	None	No

Species name and ecology	Presence of habitat	Likelihood of occurrence	Potential for impact
Fuzzy Box on alluvials of South West Slopes, Darling Riverine Plains and the Brigalow Belt South **TSC-E** Tall woodland or open forest dominated by Fuzzy Box Eucalyptus conica, often with Grey Box Eucalyptus microcarpa, Yellow Box Eucalyptus melliodora, or Kurrajong Brachychiton populneus. Buloke Allocasuarina luehmannii is common in places. Shrubs are generally sparse, and the groundcover moderately dense, although this will vary with season. Found on alluvial soils of the South West Slopes, Brigalow Belt South and Darling Riverine Plains Bioregions. Mainly found in the Dubbo-Narromine-Parkes-Forbes area. Community occurs on brown loam or clay, alluvial or colluvial soils on prior streams and abandoned channels or slight depressions on undulating plains or flats of the western slopes. Community often occurs upslope from River Red Gum communities above frequently inundated areas of the floodplain. It also occurs on colluvium soils on lower slopes and valley flats. Less than 5% of the original extent is estimated to remain. Shrubs include Wilga, Deane's Wattle, Hop Bush, Cassia, Water Bush and Sifton Bush.	Absent	None	No

Species name and ecology	Presence of habitat	Likelihood of occurrence	Potential for impact
Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-Eastern Australia **TSC-E, EPBC-E** Predominantly occurs on the drier edge of the temperate grassy eucalypt woodland belt and ranges from central New South Wales through northern and central Victoria into South Australia. Relatively less well studied and understood in comparison with other grassy woodland systems in south-eastern Australia. The ecological community also occupies a complex position in the landscape. For example, in NSW it can be transitional between the temperate lower slopes and tablelands occupied by, e.g. the EPBC Act-listed White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland ecological community, and the semi-arid floodplain communities. Generally occurs in landscapes of low-relief such as flat to undulating plains, low slopes and rises and, to a lesser extent, drainage depressions and flats. The ecological community may extend to more elevated hillslopes on the fringes of its range where it intergrades with other woodland or dry sclerophyll forest communities. often occurs on productive soils derived from alluvial or colluvial materials but may occur on a range of substrates. Soils include: duplex soils; red-brown earths; gradational soils; non-calceric and calceric browns with variable textures including sandy clay loam, clay loam, sandy loam, loam, heavy clay; and loams with quartzite surface stones and rocky outcroppings in the Mount Lofty Ranges. Gilgai topography may be present. The mean annual rainfall associated with the distribution of the ecological community lies in the range 375-700 mm/year. The typical structure of ecological community is a woodland to open forest with a canopy dominated by eucalypts and an understorey with a moderately dense to sparse shrub layer and a ground layer of perennial and annual native forbs and graminoids. Tussock grasses dominate the ground layer vegetation, though other graminoids or forbs may be common. Chenopods also may be present in the ground layer. The tree canopy is dominated (≥ 50% canopy crown cover) by *Eucalyptus microcarpa* (Grey Box). Widespread associated tree species that may be present include: *Allocasuarina luehmannii* (Buloke), *Brachychiton populneus* (Kurrajong), *Callitris glaucophylla* (White Cypress Pine), *Eucalyptus albens* (White Box), *E. camaldulensis* (River Red Gum), *E. conica* (Fuzzy Box), *E. leucoxylon* (Yellow Gum, SA Blue Gum), *E. melliodora* (Yellow Box) and *E. populnea* (Bimble Box, Poplar Box). Derived grasslands are a special state of the ecological community, whereby the canopy and mid layers have been mostly removed to <10% crown cover but the native ground layer remains largely intact, with 50% or more of the total vegetation cover being native.	Absent	None	No

Species name and ecology	Presence of habitat	Likelihood of occurrence	Potential for impact
Weeping Myall Woodlands **TSC-E, EPBC-E** The Weeping Myall Woodlands occurs on the inland alluvial plains west of the Great Dividing Range in NSW and Queensland, with one small outlying patch in northern Victoria. It occurs in the Riverina, NSW South Western Slopes, Darling Riverine Plains, Brigalow Belt South, Brigalow Belt North, Murray-Darling Depression, Nandewar and Cobar Peneplain IBRA Bioregions. Occurs in a range from open woodlands to woodlands, generally 4-12 m high, in which Weeping Myall (*Acacia pendula*) trees are the sole or dominant overstorey species. Other common names for Weeping Myall include Myall, Boree, Balaar, Nilyah, Bastard Gidgee, and Silver Leaf Boree. Weeping Myall trees often occur in monotypic stands, however other vegetation may also occur in the ecological community, though not as dominant species. These include: Western Rosewood (*Alectryon oleifolius* subsp. *elongatus*); Poplar Box (*Eucalyptus populnea*); or Black Box (*Eucalyptus largiflorens*). Grey Mistletoe (*Amyema quandang*) commonly occurs on the branches of Weeping Myall trees throughout the ecological community's range. The understorey of Weeping Myall Woodlands often includes an open layer of shrubs above an open ground layer of grasses and herbs, though the ecological community can exist naturally either as a shrubby or a grassy woodland. Generally occur on flat areas, shallow depressions or gilgais on raised (relict) alluvial plains. These areas are not associated with active drainage channels and are rarely if ever flooded. The ecological community occurs on black, brown, red-brown or grey clay or clay loam soils. The Weeping Myall Woodlands provide important habitat for a range of animals such as the Superb Parrot (*Polytelis swainsonii*), Painted Honeyeater (*Grantiella picta*) and the Bush Stone-curlew (*Burhinus grallarius*).	Absent	None	No

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Species Name and Ecology	Presence of habitat	Likelihood of occurrence	Potential for impact
Amphibians			
Crinia sloanei **Sloane's Froglet** **TSC-V** A small ground-dwelling frog. 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. At a number of sites where records are verified by museum specimens, the species has not been subsequently detected during more recent frog surveys in the vicinity (e.g. Holbrook, Nyngan, Wagga Wagga and Tocumwal). The low number of sites, low number of recorded individuals per site, and the low proportion of records of this species in regional surveys all indicate that a moderately low number of mature individuals exist. This indicates that this is not just a rare or uncommonly encountered species, but that there has been a reduction in population size and range. It is typically associated with periodically inundated areas in grassland, woodland and disturbed habitats. Typically breeds in ephemeral wetlands, or periodically inundated areas of permanent wetlands, in grasslands, woodlands, and disturbed environments. Shelters in any vegetation, ground debris, or cracks in the soil that would provide suitable refuge. Best detected in winter after 60mm of rain.	Absent	Unlikely	No
Birds			

Species Name and Ecology	Presence of habitat	Likelihood of occurrence	Potential for impact
Anseranas semipalmata **Magpie Goose** **TSC-V** 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. Mainly found in shallow wetlands (less than 1 m deep) with dense growth of rushes or sedges. Equally at home in aquatic or terrestrial habitats; often seen walking and grazing on land; feeds on grasses, bulbs and rhizomes. Activities are centred on wetlands, mainly those on floodplains of rivers and large shallow wetlands formed by run-off; breeding can occur in both summer and winter dominated rainfall areas and is strongly influenced by water level; most breeding now occurs in monsoonal areas; nests are formed in trees over deep water; breeding is unlikely in south-eastern NSW. Often seen in trios or flocks on shallow wetlands, dry ephemeral swamps, wet grasslands and floodplains; roosts in tall vegetation.	Absent	Unlikely	No
Ardeotis australis **Australian Bustard** **TSC-E** Mainly occurs in inland Australia and is now scarce or absent from southern and south-eastern Australia. In NSW, they are mainly found in the north-west corner and less often recorded in the lower western and central west plains regions. Occasional vagrants are still seen as far east as the western slopes and Riverine plain. Breeding now only occurs in the north-west region of NSW. 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.	Marginal – only occasionally seen in pastoral areas	Possible – foraging habitat only	Low

Species Name and Ecology	Presence of habitat	Likelihood of occurrence	Potential for impact
Botaurus poiciloptilus **Australasian Bittern** **TSC-E** **EPBC-E** In NSW, this species occurs along the coast and is frequently recorded in the Murray-Darling Basin, notably in floodplain wetlands of the Murrumbidgee, Lachlan, Macquarie and Gwydir Rivers. Occurs in permanent freshwater wetlands with tall, dense vegetation. Favours permanent and seasonal freshwater habitats, particularly those dominated by sedges, rushes and/or reeds (e.g. *Phragmites, Cyperus, Eleocharis, Juncus, Typha, Baumea, , Bolboschoenus*) or cutting grass (*Gahnia*) growing over muddy or peaty substrate. Hides during the day amongst dense reeds or rushes and feed mainly at night on frogs, fish, yabbies, spiders, insects and snails. Feeding platforms may be constructed over deeper water from reeds trampled by the bird; platforms are often littered with prey remains. Breeding occurs in summer from October to January; nests are built in secluded places in densely-vegetated wetlands on a platform of reeds; there are usually six olive-brown eggs to a clutch. In Australia, the Bittern occurs with the Australian Painted Snipe *Rostratula benghalensis australis.*	Absent	Unlikely	No
Burhinus grallarius **Bush Stone-curlew** **TSC-E** The Bush Stone-curlew is found throughout Australia except for the central southern coast and inland, the far south-east corner, and Tasmania. Only in northern Australia is it still common however and in the south-east it is either rare or extinct throughout its former range. Inhabits open forests and woodlands with a sparse grassy groundlayer and fallen timber. Largely nocturnal, being especially active on moonlit nights. Feed on insects and small vertebrates, such as frogs, lizards and snakes. Nest on the ground in a scrape or small bare patch. Two eggs are laid in spring and early summer.	Present	Possible	Low – area to be impacted would not be important habitat for this species. May use roadside verges on occasion.

Species Name and Ecology	Presence of habitat	Likelihood of occurrence	Potential for impact
Calyptorhynchus banksii samueli **Red-tailed Black-Cockatoo (Inland subspecies)** **TSC-V** The Red-tailed Black-Cockatoo is the most widespread of the Black Cockatoos, ranging broadly across much of northern and western Australia as well as western Victoria. In NSW, it is fragmented into two subspecies, one in northeastern NSW and an inland subspecies. The Red-tailed Black Cockatoo (inland subspecies) is known to occur around watercourses and overflows of the Darling, Paroo, Bogan, Macquarie and Barwon Rivers extending in an arc along the Darling River from Wentworth in the south to Bourke and thence through to Brewarrina in the north. It extends east to Walgett and perhaps Boggabilla on the Barwon and south through to the Macquarie Marshes. Red-tailed Black-Cockatoos are found in a wide variety of habitats. Prefer Eucalyptus forest and woodlands, particularly river red gum and coolabah lined water courses. In the arid zone usually occur mainly near eucalypts along larger watercourses and associated acacia and casuarina woodlands nearby. Also utilise grasslands, scrublands, wetlands and vegetation on floodplains.	Present	Possible – foraging	Low – area to be impacted would not be important habitat for this species.
Calyptorhynchus lathami **Glossy Black-cockatoo** **TSC-V** The species is uncommon although widespread throughout suitable forest and woodland habitats, from the central Queensland coast to East Gippsland in Victoria, and inland to the southern tablelands and central western plains of NSW, with a small population in the Riverina. An isolated population exists on Kangaroo Island, South Australia. Dependent on large hollow-bearing eucalypts for nest sites. One or two eggs are laid between March and August. 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 (*Allocasuarina littoralis*), Forest She-oak (*A. torulosa*) or Drooping She-oak (*A. verticillata*) occur. In the Riverina area, inhabits open woodlands dominated by Belah (*Casuarina cristata*). Feeds almost exclusively on the seeds of several species of she-oak (Casuarina and Allocasuarina species), shredding the cones with the massive bill.	Absent	Unlikely	No

Species Name and Ecology	Presence of habitat	Likelihood of occurrence	Potential for impact
Certhionyx variegatus **Pied Honeyeater** **TSC-V** Widespread throughout acacia, mallee and spinifex scrubs of arid and semi-arid Australia. Occasionally occurs further east, on the slopes and plains and the Hunter Valley, typically during periods of drought. Inhabits wattle shrub (primarily Mulga, *Acacia aneura*), mallee, spinifex and eucalypt woodlands, usually when shrubs are flowering; feeds on nectar, predominantly from various species of emu-bushes (*Eremophila* spp.); also from mistletoes and various other shrubs (e.g. *Brachysema* spp. and *Grevillea* spp.); also eats saltbush fruit, berries, seed, flowers and insects. Highly nomadic, following the erratic flowering of shrubs; can be locally common at times. Constructs a relatively large cup-shaped nest, usually robust, although occasionally loose, constructed of grasses and fine twigs, bound with spider webs, in the fork of a shrub or tree up to 5 m above the ground.	Present	Possible	Low – very small amount of potential habitat to be impacted. Abundant suitable habitat in roadside verges and surrounding areas.

Species Name and Ecology	Presence of habitat	Likelihood of occurrence	Potential for impact
Chthonicola sagittata **Speckled Warbler** **TSC-V** The Speckled Warbler has a patchy distribution throughout south-eastern Queensland, the eastern half of NSW and into Victoria, as far west as the Grampians. The species is most frequently reported from the hills and tablelands of the Great Dividing Range, and rarely from the coast. There has been a decline in population density throughout its range, with the decline exceeding 40% where no vegetation remnants larger than 100ha survive. The Speckled Warbler lives in a wide range of Eucalyptus dominated communities that have a grassy understorey, often on rocky ridges or in gullies. Typical habitat would include scattered native tussock grasses, a sparse shrub layer, some eucalypt regrowth and an open canopy. Large, relatively undisturbed remnants are required for the species to persist in an area. The diet consists of seeds and insects, with most foraging taking place on the ground around tussocks and under bushes and trees. Pairs are sedentary and occupy a breeding territory of about ten hectares, with a slightly larger home-range when not breeding. The rounded, domed, roughly built nest of dry grass and strips of bark is located in a slight hollow in the ground or the base of a low dense plant, often among fallen branches and other litter. A side entrance allows the bird to walk directly inside. Some cooperative breeding occurs. The species may act as host to the Black-eared Cuckoo. Speckled Warblers often join mixed species feeding flocks in winter, with other species such as Yellow-rumped, Buff-rumped, Brown and Striated Thornbills.	Present	Possible – in larger undisturbed remnants only	Low – majority of the site is disturbed, therefore this species is unlikely to rely on the existing habitat

Species Name and Ecology	Presence of habitat	Likelihood of occurrence	Potential for impact
Circus assimilis **Spotted Harrier** **TSC-V** The Spotted Harrier occurs throughout the Australian mainland, except in densely forested or wooded habitats of the coast, escarpment and ranges, and rarely in Tasmania. Individuals disperse widely in NSW and comprise a single population. Occurs in grassy open woodland including acacia and mallee remnants, inland riparian woodland, grassland and shrub steppe. It is found most commonly in native grassland, but also occurs in agricultural land, foraging over open habitats including edges of inland wetlands. Builds a stick nest in a tree and lays eggs in spring (or sometimes autumn), with young remaining in the nest for several months. Preys on terrestrial mammals (eg bandicoots, bettongs, and rodents), birds and reptile, occasionally insects and rarely carrion.	Present	Possible	Low – may use site for foraging, however no nest sites were detected during surveys.

Species Name and Ecology	Presence of habitat	Likelihood of occurrence	Potential for impact
Climacteris picumnus victoriae **Brown Treecreeper (eastern subspecies)** **TSC-V** The Brown Treecreeper is endemic to eastern Australia and occurs in eucalypt forests and woodlands of inland plains and slopes of the Great Dividing Range. It is less commonly found on coastal plains and ranges. The western boundary of the range of *Climacteris picumnus victoriae* runs approximately through Corowa, Wagga Wagga, Temora, Forbes, Dubbo and Inverell and along this line the subspecies intergrades with the arid zone subspecies of Brown Treecreeper *Climacteris picumnus picumnus* which then occupies the remaining parts of the state. The eastern subspecies lives in eastern NSW in eucalypt woodlands through central NSW and in coastal areas with drier open woodlands such as the Snowy River Valley, Cumberland Plains, Hunter Valley and parts of the Richmond and Clarence Valleys. The population density of this subspecies has been greatly reduced over much of its range, with major declines recorded in central NSW and the northern and southern tablelands. Declines have occurred in remnant vegetation fragments smaller than 300 hectares that have been isolated or fragmented for more than 50 years. Found in eucalypt woodlands (including Box-Gum Woodland) and dry open forest of the inland slopes and plains inland of the Great Dividing Range; mainly inhabits woodlands dominated by stringybarks or other rough-barked eucalypts, usually with an open grassy understorey, sometimes with one or more shrub species; also found in mallee and River Red Gum (*Eucalyptus camaldulensis*) Forest bordering wetlands with an open understorey of acacias, saltbush, lignum, cumbungi and grasses; usually not found in woodlands with a dense shrub layer; fallen timber is an important habitat component for foraging; also recorded, though less commonly, in similar woodland habitats on the coastal ranges and plains.	Present	Possible – although the arid zone subspecies of Brown Treecreeper is more likely to occur.	Low – very small amount of potential habitat to be impacted.

Species Name and Ecology	Presence of habitat	Likelihood of occurrence	Potential for impact
Daphoenositta chrysoptera **Varied Sittella** **TSC-V** The Varied Sittella is sedentary and inhabits most of mainland Australia except the treeless deserts and open grasslands, with a nearly continuous distribution in NSW from the coast to the far west. It inhabits eucalypt forests and woodlands, especially rough-barked species and mature smooth-barked gums with dead branches, mallee and *Acacia* woodland. The Varied Sittella feeds on arthropods gleaned from crevices in rough or decorticating bark, dead branches, standing dead trees, and from small branches and twigs in the tree canopy. It builds a cup-shaped nest of plant fibres and cobweb in an upright tree fork high in the living tree canopy, and often re-uses the same fork or tree in successive years.	Present	Possible	Low – very small amount of potential habitat to be impacted.
Ephippiorhynchus asiaticus **Black-necked Stork** **TSC-E** The species is widespread across coastal northern and eastern Australia, becoming increasingly uncommon further south into NSW, and rarely south of Sydney. Some birds may move long distances and can be recorded well outside their normal range. Inhabits permanent freshwater wetlands including margins of billabongs, swamps, shallow floodwaters, and adjacent grasslands and savannah woodlands; can also be found occasionally on inter-tidal shorelines, mangrove margins and estuaries. Feeds in shallow, still water on a variety of prey including fish, frogs, eels, turtles, crabs and snakes. Breeds in late summer in the north, and early summer further south. A large nest, up to 2 m in diameter, is made in a live or dead tree, in or near a freshwater swamp. Two to four eggs are laid; incubation is by both parents.	Absent	Unlikely	No

Species Name and Ecology	Presence of habitat	Likelihood of occurrence	Potential for impact
Epthianura albifrons **White-fronted Chat** **TSC-V** The White-fronted Chat is found in damp open habitats, particularly wetlands containing saltmarsh areas that are bordered by open grasslands or lightly timbered lands (Higgins *et al.* 2001). Along the coastline, White-fronted Chats are found in estuarine and marshy grounds with vegetation less than 1 m tall. The species is also observed in open grasslands and sometimes in low shrubs bordering wetland areas. Inland, the White-fronted Chat is often observed in open grassy plains, saltlakes and saltpans that are along the margins of rivers and waterways (North 1904; Higgins *et al.* 2001; Barrett *et al.* 2003). The species is sensitive to human disturbance and is not found in built areas (Jenner 2008).	Absent	Possible – but would be a rare visitor	Low – very small amount of potential habitat to be impacted.

Species Name and Ecology	Presence of habitat	Likelihood of occurrence	Potential for impact
Erythrotriorchis radiatus **Red Goshawk** **TSC-CE, EPBC-V** 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, *Melaleuca* swamp forest and riparian *Eucalyptus* forest of coastal rivers. Adults appear to occupy territories throughout the year and breeding territories are traditionally used from year to year. Adults have large home-ranges, estimated in the Northern Territory to be as great as about 120 km2 for females and 200 km2 for males. Red Goshawks mainly eat medium to large birds, including species as large as Australian Brush-turkeys *Alectura lathami*, but they also take mammals, reptiles and insects. Red Goshawks usually hunt from concealed or, less often, exposed perches, but also fly close above or through forest or woodland searching for prey. They often hunt from perches early in the morning and late in the day and tend to hunt more on the wing at other times of the day. Breeding is likely to be in spring and summer in southern Queensland and NSW (if they breed in the state at all). The birds lay clutches of 1-2 eggs, in a stick nest in a tall tree (>20 m tall) within 1 km of a watercourse or wetland. In winter in eastern Australia, the birds appear to move from nesting sites in the ranges to coastal plains, where they are associated with permanent wetlands. The age at which Red Goshawks first breed is not known, nor is the life expectancy. Young remain with their parents for at least 70-80 days after they leave the nest and may remain with their parents for 4-5 months.	Absent – prefers wet habitats	Unlikely – very rare in NSW. Closest record is over 80km away near the Macquarie Marshes in 1956.	No

Species Name and Ecology	Presence of habitat	Likelihood of occurrence	Potential for impact
Falco hypoleucos **Grey Falcon** **TSC-E** The Grey Falcon is sparsely distributed in NSW, chiefly throughout the Murray-Darling Basin, with the occasional vagrant east of the Great Dividing Range. The breeding range has contracted since the 1950s with most breeding now confined to arid parts of the range. There are possibly less than 5000 individuals left. Population trends are unclear, though it is believed to be extinct in areas with more than 500mm rainfall in NSW. 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. Preys primarily on birds, especially parrots and pigeons, using high-speed chases and stoops; reptiles and mammals are also taken. Like other falcons it utilises old nests of other birds of prey and ravens, usually high in a living eucalypt near water or a watercourse; peak laying season is in late winter and early spring; two or three eggs are laid.	Present – foraging habitat only	Possible	Low – foraging habitat only
Grantiella picta **Painted Honeyeater** **TSC-V** The Painted Honeyeater is nomadic and occurs at low densities throughout its range. The greatest concentrations of the bird, and almost all breeding occurs on the inland slopes of the Great Dividing Range in NSW, Victoria and southern Queensland. During the winter it is more likely to be found in the north of its distribution. Inhabits Boree, Brigalow and Box-Gum Woodlands and Box-Ironbark Forests. A specialist feeder on the fruits of mistletoes growing on woodland eucalypts and acacias. Prefers mistletoes of the genus *Amyema*. Insects and nectar from mistletoe or eucalypts are occasionally eaten. Nest from spring to autumn in a small, delicate nest hanging within the outer canopy of drooping eucalypts, she-oak, paperbark or mistletoe branches**.**	Present – although mistletoe not abundant at the site.	Possible	Low – very small amount of potential habitat to be impacted.

Species Name and Ecology	Presence of habitat	Likelihood of occurrence	Potential for impact
Grus rubicunda **Brolga** **TSC-V** The Brolga was formerly found across Australia, except for the south-east corner, Tasmania and the south-western third of the country. It still abundant in the northern tropics, but very sparse across the southern part of its range. Though Brolgas often feed in dry grassland or ploughed paddocks or even desert claypans, they are dependent on wetlands too, especially shallow swamps, where they will forage with their head entirely submerged. They feed using their heavy straight bill as a 'crowbar' to probe the ground or turn it over, primarily on sedge roots and tubers. They will also take large insects, crustaceans, molluscs and frogs. The nest comprises a platform of grasses and sticks, augmented with mud, on an island or in the water. Two eggs are laid from winter to autumn.	Marginal – site is not near a wetland	Possible – species may occur occasionally	Low – may occasionally use site for foraging only.
Hamirostra melanosternon **Black-breasted Buzzard** **TSC-V** The Black-breasted Buzzard is found sparsely in areas of less than 500mm rainfall, from north-western NSW and north-eastern South Australia to the east coast at about Rockhampton, then across northern Australia south almost to Perth, avoiding only the Western Australian deserts. 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.	Present	Possible – foraging	Low – may use site for foraging, however very small amount of potential nesting habitat would be impacted.

Species Name and Ecology	Presence of habitat	Likelihood of occurrence	Potential for impact
Hieraaetus morphnoides **Little Eagle** **TSC-V** The Little Eagle is a medium-sized bird of prey that is found throughout the Australian mainland excepting the most densely forested parts of the Dividing Range escarpment. It occurs as a single population throughout NSW. 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. Lays two or three eggs during spring, and young fledge in early summer. Preys on birds, reptiles and mammals, occasionally adding large insects and carrion.	Present	Possible	Low – may use site for foraging, however very small amount of potential nesting habitat would be impacted.

Species Name and Ecology	Presence of habitat	Likelihood of occurrence	Potential for impact
Leipoa ocellata **Malleefowl** **TSC-E, EPBC-V** 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. The population in central NSW has been significantly reduced through land clearance and fox predation and now occurs chiefly in Yathong, Nombinnie and Round Hill NRs and surrounding areas, though birds continue to survive in Loughnan NR. To the south of this area the species is probably locally extinct in such reserves as Pulletop NR (last recorded 1989), Ingalba NR (1982) and Buddigower NR (1990) and the intensely studied population at Yalgogrin was, in 2003, predicted to be locally extinct by 2008 (although this has not been confirmed). Further east, a population continues to persist in the Goonoo forest near Dubbo. Outside these areas, occasional records have been made in the Pilliga forests (most recently 1999), around Cobar (1991) and Goulburn River NP (1989) though the extent and status of populations in these areas are unknown. Predominantly inhabit mallee communities, preferring the tall, dense and floristically-rich mallee found in higher rainfall (300 – 450 mm mean annual rainfall) areas. Utilises mallee with a spinifex understorey, but usually at lower densities than in areas with a shrub understorey. Less frequently found in other eucalypt woodlands, such as Inland Grey Box, Ironbark or Bimble Box Woodlands with thick understorey, or in other woodlands such dominated by Mulga or native Cypress Pine species. Prefers areas of light sandy to sandy loam soils and habitats with a dense but discontinuous canopy and dense and diverse shrub and herb layers. Although Malleefowl will occupy areas within five years of fire, they prefer older age classes, with little breeding in areas less than 20 years after fire, and in one study the highest densities recorded in long unburnt mallee (60 to 80 years post fire). A pair may occupy a range of between 50 and 500 ha, overlapping with those of their neighbours. Mainly forage in open areas on seeds of acacias and other native shrubs (*Cassia, Beyeria, Bossiaea*), buds, flowers and fruits of herbs and various shrubs, insects (cockroaches, ants, soil invertebrates), and cereals if available. Incubate eggs in large mounds that contain considerable volumes of sandy soil. The litter within the mounds must be dampened for it to decompose and provide heat for incubation of eggs. Up to 34 eggs may be laid in a single season, though usually between 15 and 24 (and clutches smaller in dry years).	Present – although not the preferred habitat type.	Possible – but due to high predator numbers occurrence may be unlikely.	Low – very small amount of potential habitat would be impacted.

Species Name and Ecology	Presence of habitat	Likelihood of occurrence	Potential for impact
Limosa limosa **Black-tailed Godwit** **TSC-V, EPBC-Marine, Migratory** 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. Individuals have been recorded in wet fields and sewerage treatment works. Forages for insects, crustaceans, molluscs, worms, larvae, spiders, fish eggs, frog eggs and tadpoles in soft mud or shallow water. Roosts and loafs on low banks of mud, sand and shell bars. Frequently recorded in mixed flocks with Bar-tailed Godwits.	Absent	Unlikely	No
Lophochroa leadbeateri **Pink Cockatoo** **TSC-V** Found across the arid and semi-arid inland, from south-western Queensland south to north-west Victoria, through most of South Australia, north into the south-west Northern Territory and across to the west coast between Shark Bay and about Jurien. In NSW it is found regularly as far east as about Bourke and Griffith, and sporadically further east than that. Inhabits a wide range of treed and treeless inland habitats, always within easy reach of water. 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. Normally found in pairs or small groups, though flocks of hundreds may be found where food is abundant. Nesting, in tree hollows, occurs throughout the second half of the year; nests are at least 1 km apart, with no more than one pair every 30 square kilometres.	Present	Possible	Low – very small amount of potential habitat would be impacted. Pre-clearance surveys would be undertaken before felling. Hollows suitable for this species would be salvaged and retained in adjacent habitat.

Species Name and Ecology	Presence of habitat	Likelihood of occurrence	Potential for impact
Lophoictinia isura **Square-tailed Kite** **TSC-V** The Square-tailed Kite ranges along coastal and subcoastal areas from south-western to northern Australia, Queensland, NSW and Victoria. In NSW, scattered records of the species throughout the state indicate that the species is a regular resident in the north, north-east and along the major west-flowing river systems. It is a summer breeding migrant to the south-east, including the NSW south coast, arriving in September and leaving by March. Found in a variety of timbered habitats including dry woodlands and open forests. Shows a particular preference for timbered watercourses. In arid north-western NSW, has been observed in stony country with a ground cover of chenopods and grasses, open acacia scrub and patches of low open eucalypt woodland. Is a specialist hunter of passerines, especially honeyeaters, and most particularly nestlings, and insects in the tree canopy, picking most prey items from the outer foliage. Appears to occupy large hunting ranges of more than 100km2. Breeding is from July to February, with nest sites generally located along or near watercourses, in a fork or on large horizontal limbs.	Present	Possible	Low – may use site for foraging, however very small amount of potential nesting habitat would be impacted.

Species Name and Ecology	Presence of habitat	Likelihood of occurrence	Potential for impact
Melanodryas cucullata cucullata **Hooded Robin (south-eastern form)** **TSC-V** The Hooded Robin is common in few places, and rarely found on the coast. It is considered a sedentary species, but local seasonal movements are possible. The south-eastern form is found from Brisbane to Adelaide throughout much of inland NSW, with the exception of the north-west. The species is widespread, found across Australia, except for the driest deserts and the wetter coastal areas – northern and eastern coastal Queensland and Tasmania. Prefers lightly wooded country, usually open eucalypt woodland, acacia scrub and mallee, often in or near clearings or open areas. Requires structurally diverse habitats featuring mature eucalypts, saplings, some small shrubs and a ground layer of moderately tall native grasses. Often perches on low dead stumps and fallen timber or on low-hanging branches, using a perch-and-pounce method of hunting insect prey. Territories range from around 10 ha during the breeding season, to 30 ha in the non-breeding season. May breed any time between July and November, often rearing several broods. The nest is a small, neat cup of bark and grasses bound with webs, in a tree fork or crevice, from less than 1 m to 5 m above the ground. The nest is defended by both sexes with displays of injury-feigning, tumbling across the ground. A clutch of two to three is laid and incubated for fourteen days by the female. Two females often cooperate in brooding.	Present	Possible	Low – very small amount of potential habitat would be impacted.

Species Name and Ecology	Presence of habitat	Likelihood of occurrence	Potential for impact
Melithreptus gularis gularis **Black-chinned Honeyeater (eastern subspecies)** **TSC-V** The subspecies is widespread, from the tablelands and western slopes of the Great Dividing Range to the north-west and central-west plains and the Riverina. It is rarely recorded east of the Great Dividing Range, although regularly observed from the Richmond River district. It has also been recorded at a few scattered sites in the Hunter, Central Coast and Illawarra regions. Occupies mostly upper levels of drier open forests or woodlands dominated by box and ironbark eucalypts, especially Mugga Ironbark (*Eucalyptus sideroxylon*), White Box (*Eucalyptus albens*), Grey Box (*Eucalyptus microcarpa*), Yellow Box (*Eucalyptus melliodora*) and Forest Red Gum (*Eucalyptus tereticornis*). Also inhabits open forests of smooth-barked gums, stringybarks, ironbarks and tea-trees. A gregarious species usually seen in pairs and small groups of up to 12 birds. Feeding territories are large making the species locally nomadic. Recent studies have found that the Black-chinned Honeyeater tends to occur in the largest woodland patches in the landscape as birds forage over large home ranges of at least 5 hectares. Moves quickly from tree to tree, foraging rapidly along outer twigs, underside of branches and trunks, probing for insects. Breeds solitarily or co-operatively, with up to five or six adults, from June to December. The nest is placed high in the crown of a tree, in the uppermost lateral branches, hidden by foliage. It is a compact, suspended, cup-shaped nest. Two or three eggs are laid and both parents and occasionally helpers feed the young.	Present – woodland patches occur adjacent to the site.	Possible – although more likely to occur in the roadside verges adjacent to the site.	Low – may utilise site on occasion, however unlikely to rely on the small amount of potential habitat to be impacted.

Species Name and Ecology	Presence of habitat	Likelihood of occurrence	Potential for impact
Neophema pulchella **Turquoise Parrot** **TSC-V** The Turquoise Parrot's range extends from southern Queensland through to northern Victoria, from the coastal plains to the western slopes of the Great Dividing Range. Lives on the edges of eucalypt woodland adjoining clearings, timbered ridges and creeks in farmland. Usually seen in pairs or small, possibly family, groups and have also been reported in flocks of up to thirty individuals. Prefers to feed in the shade of a tree and spends most of the day on the ground searching for the seeds or grasses and herbaceous plants, or browsing on vegetable matter. Forages quietly and may be quite tolerant of disturbance. However, if flushed it will fly to a nearby tree and then return to the ground to browse as soon as the danger has passed. Nests in tree hollows, logs or posts, from August to December. It lays four or five white, rounded eggs on a nest of decayed wood dust.	Present	Possible – one record from 1996.	Moderate – very small amount of potential nesting habitat would be impacted. Works may impact on foraging habitat, however there is abundant foraging habitat in the surrounding areas.
Nettapus coromandelianus **Cotton Pygmy-goose** **TSC-E** Although once found from north Queensland to the Hunter River in NSW, the Cotton Pygmy-goose is now only a rare visitor to NSW. Uncommon in Queensland. Inhabits freshwater lakes, lagoons, swamps and dams, particularly those vegetated with waterlilies and other floating and submerged aquatic vegetation. The Cotton Pygmy-goose uses standing dead trees with hollows close to water with grass and reeds for roosting and breeding.	Absent	Unlikely	No

Species Name and Ecology	Presence of habitat	Likelihood of occurrence	Potential for impact
Ninox connivens **Barking Owl** **TSC-V** Inhabits eucalypt woodland, open forest, swamp woodlands and, especially in inland areas, timber along watercourses. Denser vegetation is used occasionally for roosting. During the day they roost along creek lines, usually in tall understorey trees with dense foliage such as *Acacia* and *Casuarina* species, or the dense clumps of canopy leaves in large *Eucalypts*. Feeds on a variety of prey, with invertebrates predominant for most of the year, and birds and mammals such as smaller gliders, possums, rodents and rabbits becoming important during breeding. Live alone or in pairs. Territories range from 30 to 200 hectares and birds are present all year. Three eggs are laid in nests in hollows of large, old eucalypts including River Red Gum (*Eucalyptus camaldulensis*), White Box (*Eucalyptus albens*), (Red Box) *Eucalyptus polyanthemos* and Blakely's Red Gum (*Eucalyptus blakelyi*). Breeding occurs during late winter and early spring.	Present – probably foraging habitat only.	Possible	Low – only potential foraging habitat would be impacted.

Species Name and Ecology	Presence of habitat	Likelihood of occurrence	Potential for impact
Oxyura australis **Blue-billed Duck** **TSC-V** The Blue-billed Duck is endemic to south-eastern and south-western Australia. It is widespread in NSW, but most common in the southern Murray-Darling Basin area. Birds disperse during the breeding season to deep swamps up to 300 km away. It is generally only during summer or in drier years that they are seen in coastal areas. The Blue-billed Duck prefers deep water in large permanent wetlands and swamps with dense aquatic vegetation. The species is completely aquatic, swimming low in the water along the edge of dense cover. It will fly if disturbed, but prefers to dive if approached. Blue-billed Ducks will feed by day far from the shore, particularly if dense cover is available in the central parts of the wetland. They feed on the bottom of swamps eating seeds, buds, stems, leaves, fruit and small aquatic insects such as the larvae of midges, caddisflies and dragonflies Blue-billed Ducks are partly migratory, with short-distance movements between breeding swamps and overwintering lakes with some long-distance dispersal to breed during spring and early summer. Blue-billed Ducks usually nest solitarily in Cumbungi over deep water between September and February. They will also nest in trampled vegetation in Lignum, sedges or Spike-rushes, where a bowl-shaped nest is constructed. Young birds disperse in April-May from their breeding swamps in inland NSW to non-breeding areas on the Murray River system and coastal lakes.	Absent	Unlikely	No

Species Name and Ecology	Presence of habitat	Likelihood of occurrence	Potential for impact
Pachycephala inornata **Gilbert's Whistler** **TSC-V** Sparsely distributed over much of the arid and semi-arid zone of inland southern Australia, from the western slopes of NSW to the Western Australian wheatbelt. The species was probably once distributed almost continuously across the woodlands and mallee of southern NSW, but this range has been greatly reduced, chiefly by clearance of habitat. The eastern population extends from the central NSW mallee (Yathong, Nombinnie and Round Hill NRs), south and east through the Cocoparra Range to Pomingalama Reserve (near Wagga Wagga) then north through the South West Slopes east as far as Cowra and Burrendong Dam, to the Goonoo reserves (with scattered records as far north as Pilliga). The north western limits of this population are poorly known, with records from as far west as Cobar and recent records from Quanda NR, though records further west may be due to confusion with the Golden Whistler. In a number of reserves in this area there have been no recent records (last records from Pulletop NR 1982, Pomingalama Reserve 1995 and Ingalba NR 1999) and this species may be locally extinct. Occasional records are also made of this species in the Capertee Valley. The Gilbert's Whistler occurs in a range of habitats within NSW, though the shared feature appears to be a dense shrub layer. It is widely recorded in mallee shrublands, but also occurs in box-ironbark woodlands, Cypress Pine and Belah woodlands and River Red Gum forests, though at this stage it is only known to use this habitat along the Murray, Edwards and Wakool Rivers. In woodland habitats, the understorey comprises dense patches of shrubs, particularly thickets of regrowth *Callitris* pine. Parasitic 'cherries' (*Exocarpus* species) appear to be an important habitat component in Belah and Red Gum communities, though in the latter case other dense shrubs, such as Lignum and wattles, are also utilised. The Gilbert's Whistler forages on or near the ground in shrub thickets and in tops of small trees. Its food consists mainly of spiders and insects such as caterpillars, beetles and ants, and occasionally, seeds and fruits are eaten. Breeding takes place between August and November. Nests are usually built below about two and a half metres (but up to six metres) above the ground in the fork of dense foliage of plants such as wattles or cypress pines. At Cowra three pairs nested in a 25 ha area. The nest is either a lined cup or sometimes birds use the old nests of other species, particularly disused babblers' nests. Two, three or occasionally four eggs are laid. The movements of this species are poorly known but it is believed that generally it does not make any regular large-scale movements and pairs may hold and defend territories all year round. However, the occasional record outside the normal distribution may indicate some dispersal does occur, particularly given the difficulty in detecting this species outside the breeding season when it isn't calling.	Present – may use disused babbler nests.	Possible – although site is at the edge of its distribution.	Low – has the potential to occur, however areas with abundant babbler nests would be avoided. A small amount of potential breeding and foraging habitat would be impacted by the works.

Species Name and Ecology	Presence of habitat	Likelihood of occurrence	Potential for impact
Pandion haliaetus **Osprey** **TSC-V** Ospreys are found right around the Australian coast line, except for Victoria and Tasmania. They are common around the northern coast, especially on rocky shorelines, islands and reefs. The species is uncommon to rare or absent from closely settled parts of south-eastern Australia. There are a handful of records from inland areas. Favour coastal areas, especially the mouths of large rivers, lagoons and lakes. Feed on fish over clear, open water. Breed from July to September in NSW. Nests are made high up in dead trees or in dead crowns of live trees, usually within one kilometre of the sea. Incubation of 2-3 eggs, usually by the female, is about 40 days. Female remains with young almost until they fly, usually after about nine weeks in the nest.	Absent	Unlikely	No

Species Name and Ecology	Presence of habitat	Likelihood of occurrence	Potential for impact
Petroica phoenicea **Flame Robin** **TSC-V** The Flame Robin is endemic to SE Australia, and ranges from near the Queensland border to SE South Australia and also in Tasmania. In NSW, it breeds in upland areas and in winter, many birds move to the inland slopes and plains. It is likely that there are two separate populations in NSW, one in the Northern Tablelands, and another ranging from the Central to Southern Tablelands. Breeds in upland tall moist eucalypt forests and woodlands, often on ridges and slopes. Prefers clearings or areas with open understoreys. The groundlayer of the breeding habitat is dominated by native grasses and the shrub layer may be either sparse or dense. Occasionally occurs in temperate rainforest, and also in herbfields, heathlands, shrublands and sedgelands at high altitudes. In winter, birds migrate to drier more open habitats in the lowlands (i.e. valleys below the ranges, and to the western slopes and plains). Often occurs in recently burnt areas; however, habitat becomes unsuitable as vegetation closes up following regeneration. In winter lives in dry forests, open woodlands and in pastures and native grasslands, with or without scattered trees. In winter, occasionally seen in heathland or other shrublands in coastal areas. Birds forage from low perches, from which they sally or pounce onto small invertebrates which they take from the ground or off tree trunks, logs and other coarse woody debris. Flying insects are often taken in the air and sometimes gleans for invertebrates from foliage and bark. In their autumn and winter habitats, birds often sally from fence-posts or thistles and other prominent perches in open habitats. Occur singly, in pairs, or in flocks of up to 40 birds or more; in the non-breeding season they will join up with other insectivorous birds in mixed feeding flocks. Breeds in spring to late summer. Nests are often near the ground and are built in sheltered sites, such as shallow cavities in trees, stumps or banks. Builds an open cup nest made of plant materials and spider webs.	Present – broad habitat requirements.	Possible – although more likely to utilise better quality habitat in roadside verges.	Low – very small amount of potential habitat would be impacted.

Species Name and Ecology	Presence of habitat	Likelihood of occurrence	Potential for impact
Polytelis swainsonii **Superb Parrot** **TSC-V, EPBC-V** The Superb Parrot is found throughout eastern inland NSW. On the South-western Slopes their core breeding area is roughly bounded by Cowra and Yass in the east, and Grenfell, Cootamundra and Coolac in the west. Birds breeding in this region are mainly absent during winter, when they migrate north to the region of the upper Namoi and Gwydir Rivers. The other main breeding sites are in the Riverina along the corridors of the Murray, Edward and Murrumbidgee Rivers where birds are present all year round. It is estimated that there are less than 5000 breeding pairs left in the wild. Inhabit Box-Gum, Box-Cypress-pine and Boree Woodlands and River Red Gum Forest. In the Riverina the birds nest in the hollows of large trees (dead or alive) mainly in tall riparian River Red Gum Forest or Woodland. On the South West Slopes nest trees can be in open Box-Gum Woodland or isolated paddock trees. Species known to be used are Blakely's Red Gum, Yellow Box, Apple Box and Red Box. Because the Superb Parrots often use different habitats for different activities, the timing of their occurrence in each habitat may vary with the time of year. Between mid-January and early April, Superb Parrots do not use the River Red Gum breeding habitats on the Edward and Murrumbidgee Rivers, and their whereabouts at this time is unknown. Between April and August, they inhabit forests and woodlands dominated by River Red Gum, box-gum, White Cypress Pine (*Callitris glaucophylla*) and Boree. Nest in small colonies, often with more than one nest in a single tree. Breed between September and January. May forage up to 10 km from nesting sites, primarily in grassy box woodland. Feed in trees and understorey shrubs and on the ground and their diet consists mainly of grass seeds and herbaceous plants. Also eaten are fruits, berries, nectar, buds, flowers, insects and grain. When foraging on the ground, Superb Parrots often eat the seeds of plants such as the native Ringed Wallaby-grass (*Danthonia caespitosa*), barley-grasses (*Critesion*), as well as cereal crops including wheat, oats and canola (*Brassica napus*); and spilt grain. They also eat the seed-pods of many understorey species of wattles such as Gold-dust Wattle (*Acacia acinacea*), Silver Wattle (*A. dealbata*) and Deane's Wattle (*A. deanei*) and cultivated Cootamundra Wattle (*A. baileyana*). When foraging in the forest canopy, Superb Parrots eat the flowers and fruits of eucalypts, especially in spring and summer, the berries of mistletoe, such as Box Mistletoe (*Amyema miquelii*) and Grey Mistletoe (*A. quandang*), and, in winter, lerps from the foliage of eucalypts.	Present – foraging habitat	Present – although site is at the border of this species distribution and is unlikely to use the site during the breeding season.	Low – would impact a small amount of foraging habitat only. Abundant habitat available adjacent to the site.

Species Name and Ecology	Presence of habitat	Likelihood of occurrence	Potential for impact
Pomatostomus temporalis temporalis **Grey-crowned Babbler (eastern subspecies)** **TSC-V** The Grey-crowned Babbler has two distinctive subspecies that intergrade to the south of the Gulf of Carpentaria. West of here the subspecies *rubeculus*, formerly considered a separate species (Red-breasted Babbler) is still widespread and common. The eastern subspecies (*temporalis* occurs from Cape York south through Queensland, NSW and Victoria and formerly to the south east of South Australia. This subspecies also occurs in the Trans-Fly Region in southern New Guinea. In NSW, the eastern sub-species occurs on the western slopes of the Great Dividing Range, and on the western plains reaching as far as Louth and Balranald. It also occurs in woodlands in the Hunter Valley and in several locations on the north coast of NSW. It may be extinct in the southern, central and New England tablelands. Inhabits open Box-Gum Woodlands on the slopes, and Box-Cypress-pine and open Box Woodlands on alluvial plains. Flight is laborious so birds prefer to hop to the top of a tree and glide down to the next one. Birds are generally unable to cross large open areas. Live in family groups that consist of a breeding pair and young from previous breeding seasons. A group may consist of up to fifteen birds. Feed on invertebrates, either by foraging on the trunks and branches of eucalypts and other woodland trees or on the ground, digging and probing amongst litter and tussock grasses. Build and maintain several conspicuous, dome-shaped stick nests about the size of a football. A nest is used as a dormitory for roosting each night. Nests are usually located in shrubs or sapling eucalypts, although they may be built in the outermost leaves of low branches of large eucalypts. Nests are maintained year round, and old nests are often dismantled to build new ones. Breed between July and February. Usually two to three eggs are laid and incubated by the female. Territories range from one to fifty hectares (usually around ten hectares) and are defended all year.	Present	Present	High – the constraints analysis identified nest sites and general habitat use across the site. If these areas are avoided by the proposed works, impact is unlikely. If foraging and breeding habitat is impacted by the works, further surveys would be required to clarify the status of the local population. A 7 Part Test has been prepared.

Species Name and Ecology	Presence of habitat	Likelihood of occurrence	Potential for impact
Rostratula australis **Australian Painted Snipe** **TSC- E, EPBC-V, Marine, Migratory** Little is known of the ecology, habitat requirements and reproductive biology of Australian Painted Snipe. They feed in shallow water or at the waters' edge and on mudflats, taking seeds and invertebrates such as insects, worms, molluscs and crustaceans. Females, which are larger and more brightly coloured than males, are thought to sometimes be polyandrous, mating with several males and leaving each one to incubate and raise chicks. They lay 3-4 eggs per clutch and incubation lasts about 15-16 days. Most records of Australian Painted Snipe are from temporary or infrequently filled freshwater wetlands and although they have occurred at many sites, no site can be identified in which they are resident or regular in occurrence. This may suggest the species is nomadic but the extent to which its cryptic behaviour may contribute to this belief is uncertain. The birds are able to remain hidden in rank vegetation, but many reports are of birds not being secretive, but rather still and unobtrusive. Primarily occurs along the east coast from north Queensland (excluding Cape York) to the Eyre Peninsula in South Australia, including the majority of Victoria and NSW. In NSW, this species has been recorded at the Paroo wetlands, Lake Cowell, Macquarie Marshes and Hexham Swamp. Most common in the Murray-Darling Basin. Inhabits inland and coastal shallow freshwater wetlands. The species occurs in both ephemeral and permanent wetlands, particularly where there is a cover of vegetation, including grasses, Lignum and Samphire. Individuals have also been known to use artificial habitats, such as sewage ponds, dams and waterlogged grassland. Nests on the ground amongst tall vegetation, such as grass tussocks or reeds. Forages nocturnally on mud flats and in shallow water. Breeding is often in response to local conditions; generally occurs from September to December.	Absent	Unlikely	No

Species Name and Ecology	Presence of habitat	Likelihood of occurrence	Potential for impact
Stagonopleura guttata **Diamond Firetail** **TSC-V** The Diamond Firetail is widely distributed in NSW, with a concentration of records from the Northern, Central and Southern Tablelands, the Northern, Central and South Western Slopes and the North West Plains and Riverina. Not commonly found in coastal districts, though there are records from near Sydney, the Hunter Valley and the Bega Valley. This species has a scattered distribution over the rest of NSW. Also found in the Australian Capital Territory, Queensland, Victoria and South Australia. Groups separate into small colonies to breed, between August and January. Found in grassy eucalypt woodlands, including Box-Gum Woodlands and Snow Gum *Eucalyptus pauciflora* Woodlands. Also occurs in open forest, mallee, Natural Temperate Grassland, and in secondary grassland derived from other communities. Often found in riparian areas (rivers and creeks), and sometimes in lightly wooded farmland. Feeds exclusively on the ground, on ripe and partly-ripe grass and herb seeds and green leaves, and on insects (especially in the breeding season). Usually encountered in flocks of between five to 40 birds, occasionally more. Nests are globular structures built either in the shrubby understorey, or higher up, especially under hawk's or raven's nests. Birds roost in dense shrubs or in smaller nests built especially for roosting. Appears to be sedentary, though some populations move locally, especially those in the south. Has been recorded in some towns and near farm houses.	Present	Possible	Low – very small amount of potential habitat would be impacted.

Species Name and Ecology	Presence of habitat	Likelihood of occurrence	Potential for impact
Stictonetta naevosa **Freckled Duck** **TSC-V** The Freckled Duck is found primarily in south-eastern and south-western Australia, occurring as a vagrant elsewhere. It breeds in 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. The duck is forced to disperse during extensive inland droughts when wetlands in the Murray River basin provide important habitat. The species may also occur as far as coastal NSW and Victoria during such times. Prefer permanent freshwater swamps and creeks with heavy growth of Cumbungi, Lignum or Tea-tree. The largest numbers of Freckled Ducks occur in brackish to hyposaline wetlands that are densely vegetated with Lignum. During drier times they move from ephemeral breeding swamps to more permanent waters such as lakes, reservoirs, farm dams and sewage ponds. Generally rest in dense cover during the day, usually in deep water. Feed at dawn and dusk and at night on algae, seeds and vegetative parts of aquatic grasses and sedges and small invertebrates. Nesting usually occurs between October and December but can take place at other times when conditions are favourable. Nests are usually located in dense vegetation at or near water level.	Aabsent	Unlikely	No

Species Name and Ecology	Presence of habitat	Likelihood of occurrence	Potential for impact
Tyto novaehollandiae **Masked Owl** **TSC-V** Extends from the coast where it is most abundant to the western plains. Lives in dry eucalypt forests and woodlands from sea level to 1100 m. Habitat for this species is also widespread throughout the dry eucalypt forests of the tablelands, western slopes and the undulating wet-dry forests of the coast. Optimal habitat includes an open understorey and a mosaic of sparse (grassy) and dense (shrubby) ground cover on gentle terrain. Roosts in hollows in live or occasionally dead eucalypts; dense foliage in gullies; and caves. Nest in old hollow eucalypts, live or dead, in a variety of topographic positions, with hollows greater than 40 cm wide and greater than 100 cm deep. Hollow entrances are at least 3 m above ground, in trees of at least 90 cm diameter at breast height. A specialist predator of terrestrial mammals, particularly native rodents. Home range has been estimated as 400-1000 ha according to habitat productivity.	Present – broad habitat preference	Possible – although not detected during call playback surveys.	Low - the constraints analysis identified areas with abundant hollow-bearing trees to be avoided by the proposed works therefore the impact to breeding habitat would be minimal.
Mammals			

Species Name and Ecology	Presence of habitat	Likelihood of occurrence	Potential for impact
Antechinomys laniger **Kultarr** **TSC-E** Widespread across arid and semi-arid NSW but present in very low numbers. Records typically derive from captures by domestic cats or are collected after falling into steep-sided holes. Recent records have come primarily from the Cobar and Brewarrina region. Habitat of the Kultarr is generally described as sparsely vegetated arid and semiarid plains on stony, sandy and clayey soils. Specific habitat types include gibber plains, open shrubland, mallee woodland, hummock grassland, flood plains, stony areas with sparse ground cover, and acacia shrubland and woodland (particularly Mulga) with sparse groundcover. The eastern Australian subspecies appears to prefer sparsely vegetated claypans among *Acacia* Woodland. Nocturnal, sheltering by day in hollow logs or tree-stumps, beneath saltbush and spinifex tussocks, in deep cracks in the soil and in the burrows of other animals. A terrestrial insectivore. Populations appear to fluctuate seasonally in response to environmental stresses, including declines following periods of drought and intensive flooding.	Present –roadside verges provide better quality habitat	Possible – although unlikely to occur considering high number of predators in the area.	Low – very small amount of potential habitat would be impacted.
Chalinolobus picatus **Little Pied Bat** **TSC-V** The Little-Pied Bat is found in inland Queensland and NSW (including Western Plains and slopes) extending slightly into South Australia and Victoria. Occurs in dry open forest, open woodland, mulga woodlands, chenopod shrublands, cypress-pine forest, mallee, Bimbil box. Roosts in caves, rock outcrops, mine shafts, tunnels, tree hollows and buildings. Can tolerate high temperatures and dryness but need access to nearby open water. Feeds on moths and possibly other flying invertebrates.	Present	Present	Moderate – small amount of potential roosting habitat would be impacted. Abundant habitat available adjacent to the site.

Species Name and Ecology	Presence of habitat	Likelihood of occurrence	Potential for impact
Conilurus albipes **White-footed Rabbit-rat** **TSC-CE** **EPBC-Ex** The White-footed Rabbit-rat was endemic to Australia, where it appears to have been distributed in south-eastern South Australia, Victoria, southern and eastern New South Wales and possibly in extreme south-eastern Queensland. Gould (1863) listed the known range of the species as being the south-eastern portions of Australia generally, including all parts of New South Wales, Port Phillip and South Australia. Pleistocene and recent fossils from cave deposits have been collected from several localities in south-eastern South Australia, southern Victoria, eastern New South Wales and southern Queensland. These fossils support Gould's statements about the species' distribution. This species is presumed to be extinct. The White-footed Rabbit-rat was reported as being common in Victoria by John Cotton in 1846. However, its population appeared to decline rapidly and has not been recorded since 1860-1862 in Victoria. Although it was widely distributed, it was apparently not abundant. Surveys conducted over the years have not found this species. The White-footed Rabbit-rat was known to inhabit open forest woodlands and grassy ecosystems in Victoria. Habitat information is not known for other states in which the species occurred. Gould observed the species sleeping in the hollow limbs of prostrate trees, or in hollow branches of large Eucalypts near the ground.	Present – specific habitat preferences not known	Unlikely – has not been sighted in the region since 1846	No

Species Name and Ecology	Presence of habitat	Likelihood of occurrence	Potential for impact
Dasyurus maculatus maculatus **Spot-tailed Quoll /Tiger Quoll (SE mainland population)** **TSC-V, EPBC-E** Found on the east coast of NSW, Tasmania, eastern Victoria and north-eastern Queensland. Recorded across a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. Individual animals use hollow-bearing trees, fallen logs, small caves, rock crevices, boulder fields and rocky-cliff faces as den sites. Mostly nocturnal, although will hunt during the day; spends most of the time on the ground. The home-range of this species is unknown, but estimates are between 800ha and 20km^2. Usually traverse their ranges along densely vegetated creeklines. They need suitable den sites and abundant food, requiring large areas of intact vegetation for foraging. Use 'latrine sites', often on flat rocks among boulder fields and rocky cliff-faces; latrine sites can be recognised by the accumulation of the sometimes characteristic 'twisty-shaped' faeces deposited by animals. Consumes a variety of prey, including gliders, possums, small wallabies, rats, birds, bandicoots, rabbits and insects; also eats carrion and takes domestic fowl.	Absent – no creeklines or rocky habitats present at the site	Unlikely	No

Species Name and Ecology	Presence of habitat	Likelihood of occurrence	Potential for impact
Nyctophilus corbeni **South-eastern Long-eared Bat** **TSC-V, EPBC-V** 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. It is distributed throughout inland NSW except in the north-west area which is dominated by treeless plains. It can be found in the Hunter Valley, extending from central NSW to the eastern Hunter Valley coast. Records also indicate populations in River Red Gum, *Eucayptus camaldulensis,* forests along the Murray River. In the Hunter Valley, NSW, the species is found in areas such as the Monobalai Nature Reserve and Goulburn River and Wollemi National Parks. It has primarily been recorded in moister woodland of various eucalypt species with a distinct shrub layer frequently adjacent to watercourses. There are a small number of records from closed forest adjacent to dry sclerophyll woodlands; in Araucarian notophyll vine forest in the Bunya Mountains and in semi evergreen vine thickets on the banks of the Dawson River and in the Brigalow Belt Bioregion. Inhabits a variety of vegetation types, including mallee, bulloke *Allocasuarina leuhmanni* 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. Roosts in tree hollows, crevices, and under loose bark. Found that roost sites were on average 1.89 ± 1.61 km (range 0.34–7.06 km) from the capture point. Slow flying agile bat, utilising the understorey to hunt non-flying prey – especially caterpillars and beetles – and will even hunt on the ground. Mating takes place in autumn with one or two young born in late spring to early summer.	Present	Possible	Low – very small amount of potential habitat would be impacted. Abundant potential habitat is available adjacent to the site.

Species Name and Ecology	Presence of habitat	Likelihood of occurrence	Potential for impact
Petrogale penicillata **Brush-tailed Rock-wallaby** **TSC-E, EPBC-V** The range of the Brush-tailed Rock-wallaby extends from south-east Queensland to the Grampians in western Victoria, roughly following the line of the Great Dividing Range. The species' range is now fragmented, particularly in the south where they are now mostly found as small isolated populations dotted across their former range. In NSW they occur from the Queensland border in the north to the Shoalhaven in the south, with the population in the Warrumbungle Ranges being the western limit. Occupy rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges facing north. Throughout their range, Brush-tailed Rock-wallabies feed on a wide variety of grasses and shrubs, and have flexible dietary requirements. Shelter or bask during the day in rock crevices, caves and overhangs and are most active at night. Highly territorial and have strong site fidelity with an average home range size of about 15 ha. Live in family groups of 2 – 5 adults and usually one or two juvenile and sub-adult individuals. Dominant males associate and breed with up to four females. Breeding is likely to be continuous, at least in the southern populations, with no apparent seasonal trends in births.	Absent	Unlikely	No

Species Name and Ecology	Presence of habitat	Likelihood of occurrence	Potential for impact
Phascolarctos cinereus **Koala (combined populations of QLD, NSW and the ACT)** **TSC-V, EPBC-V** Occurs in eastern Australia, from north-eastern Queensland to south-eastern South Australia and to the west of the Great Dividing Range. In NSW it mainly occurs on the central and north coasts with some populations in the western region. It was historically abundant on the south coast of NSW, but now occurs in sparse and possibly disjunct populations. The koala inhabits a range of eucalypt forest and woodland communities, including coastal forests, the woodlands of the tablelands and western slopes, and the riparian communities of the western plains. Examples of important shelter trees are cypress pine and brush box. The quality of forest and woodland communities as habitat for koalas is influenced by a range of factors, such as; species and size of trees present; structural diversity of the vegetation; soil nutrients; climate and rainfall; size and disturbance history of the habitat patch. Feed on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species. Home range size varies with quality of habitat, ranging from less than two ha to several hundred hectares in size. Breeding season for the koala peaks between September and February.	Present	Possible – although closest record is over 70 km away	Low – not recorded during surveys, and a very small amount of potential habitat would be impacted. Abundant habitat available adjacent to the site.
Pteropus poliocephalus **Grey-headed Flying-fox** **TSC-V, EPBC-V** Grey-headed Flying-foxes are found within 200 km of the eastern coast of Australia, from Bundaberg in Queensland to Melbourne in Victoria. Occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are generally located within 20 km of a regular food source, often in stands of riparian rainforest, Paperbark or Casuarina forest, and are commonly found in gullies, close to water, or in vegetation with a dense canopy. Forage on the nectar and pollen of native trees, in particular *Eucalyptus*, *Melaleuca* and *Banksia,* and fruits of rainforest trees and vines. Travel up to 50 km to forage. Annual mating commences in January and a single young is born each October or November. Site fidelity to camps is high with some camps being used for over a century.	Absent	Unlikely	No

Species Name and Ecology	Presence of habitat	Likelihood of occurrence	Potential for impact
Saccolaimus flaviventris **Yellow-bellied Sheathtail-bat** **TSC-V** The Yellow-bellied Sheathtail-bat is a wide-ranging species found across northern and eastern Australia. In the most southerly part of its range – most of Victoria, south-western NSW and adjacent South Australia – it is a rare visitor in late summer and autumn. There are scattered records of this species across the New England Tablelands and North West Slopes. Roosts singly or in groups of up to six, in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows. When foraging for insects, flies high and fast over the forest canopy, but lower in more open country. Forages in most habitats across its very wide range, with and without trees; appears to defend an aerial territory. Breeding has been recorded from December to mid-March, when a single young is born. Seasonal movements are unknown; there is speculation about a migration to southern Australia in late summer and autumn.	Present – broad habitat preferences	Present	Moderate – small amount of potential roosting habitat would be impacted. Abundant habitat available adjacent to the site.
Sminthopsis macroura **Stripe-faced Dunnart** **TSC-V** Occurs 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. Inhabit native dry grasslands and low dry shrublands, often along drainage lines. During periods of hot weather they shelter in cracks in the soil, in grass tussocks or under rocks and logs.	Present	Possible, although majority of site is not native grassland	Low – small amount of potential habitat to be impacted. Abundant potential habitat available adjacent to the site.

Species Name and Ecology	Presence of habitat	Likelihood of occurrence	Potential for impact
Vespadelus baverstocki **Inland Forest Bat** **TSC-V** Because of the difficulty of identification, the distribution of this species, particularly in NSW, is very poorly known. Believed to occur widely in all the mainland states, generally in areas with annual rainfall less than 400 millimetres. In Victoria it is confined to the extreme north west. In NSW it has been most regularly captured in the far south west, north from the Murray River to Menindee, and at least as far east as the Balranald-Ivanhoe Road. There is some evidence to suggest that this species also occurs in the central NSW mallee, centred on Nombinnie Nature Reserve, although there has been very little recent survey in this part of the state. There are also records just south of the Queensland border around the Culgoa River, though whether this connects with the other NSW populations, or is the southern extent of a northern population is unknown. There are records further east in NSW but the identification of these records have not been confirmed. There are relatively few records of any *Vespadelus* species in the north west of NSW and so whether this species does occur here is unknown. Some of the gaps in knowledge on the distribution on this and other bat species in western NSW probably reflects the lack of survey effort in most of this region. Roosts in hollows, fissures or cracks in live or dead trees, and roosts in abandoned buildings. Known to roost in very small hollows in stunted trees only a few metres high. The habitat requirements of this species are poorly known but it has been recorded from a variety of woodland formations, including mallee, mulga and River Red Gum. Most records are from drier woodland habitats with riparian areas inhabited by the Little Forest Bat. However, other habitats may be used for foraging and/or drinking. Colony size ranges from a few individuals to more than sixty. Females congregate to raise young in November and December, with young carried for the first week following birth. Young are independent by January. These bats fly rapidly and cover an extensive foraging area and are presumed to feed on flying insects.	Present	Possible – very little is known of this species	Moderate – small amount of potential roosting habitat would be impacted. Abundant habitat available adjacent to the site.
Migratory Species			

Species Name and Ecology	Presence of habitat	Likelihood of occurrence	Potential for impact
Apus pacificus **Fork-tailed Swift** **EPBC-Marine, Migratory** This species breeds in the north-east and mid-east Asia and winters in Australia and southern New Guinea. It is a visitor to most parts of Western Australia, beginning to arrive in the Kimberley in late September, in the Pilbara and Eucla in November and in the south-west land division in mid-December, and leaving by late April. It is common in the Kimberley, uncommon to moderately common near north-west, west and southeast coasts and rare to scarce elsewhere. They never settle voluntarily on the ground and spend most of their lives in the air, living on the insects they catch in their beaks.	Present – broad habitat preference	Possible – winter only Migratory (species or habitat may occur)	No – does not breed in Australia therefore works are unlikely to impact this species.
Ardea alba **Great Egret, White Egret** **EPBC-Migratory, Marine** The Eastern 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 species usually frequents shallow waters. Eastern Great Egrets usually nest in colonies and rarely as solitary pairs. In Australia, breeding sites are located in wooded and shrubby swamps including mangrove forests (the main habitat of the species in the Top End), *Melaleuca* swamps (on the eastern coast of Australia and south-western Western Australia) and mixed eucalypt/acacia/lignum swamps (in the Channel Country and Murray-Darling Basin). The Eastern Great Egret has a diverse diet that includes fish, insects, crustaceans, molluscs, frogs, lizards, snakes and small birds and mammal.	Absent	Unlikely	No

Species Name and Ecology	Presence of habitat	Likelihood of occurrence	Potential for impact
Ardea ibis **Cattle Egret** **EPBC-Marine, Migratory** The Cattle Egret is found in grasslands, woodlands and wetlands, and is not common in arid areas. It also uses pastures and croplands, especially where drainage is poor. Will also forage at garbage dumps, and is often seen with cattle and other stock. The Cattle Egret is partially migratory, moving during winter. The Cattle Egret prefers grasshoppers, especially during breeding season, but eats many other invertebrates. It also eats frogs, cane toads, lizards and some small mammals. Its sharp bill is used in a lunging and stabbing manner. It often feeds by following large animals such as cattle, grabbing insects and worms that they disturb with their feet. They also will sit on cattle to look out for insects. Cattle Egret pairs are monogamous for the breeding season, and they breed in colonies, usually with other waterbirds. Their shallow platform nests are made in wetland areas in trees and bushes, usually as high up as possible. Both parents build the nest and incubate the eggs, with one brood per season being raised.	Marginal – not common in arid areas	Unlikely	No

Species Name and Ecology	Presence of habitat	Likelihood of occurrence	Potential for impact
Haliaetus leucogaster **White-bellied sea eagle** **Migratory** White-bellied Sea-Eagles are a common sight in coastal and near coastal areas of Australia. Birds form permanent pairs that inhabit territories throughout the year. Their loud "goose-like" honking call is a familiar sound, particularly during the breeding season. Birds are normally seen, perched high in a tree, or soaring over waterways and adjacent land. In addition to Australia, the species is found in New Guinea, Indonesia, China, south-east Asia and India. The White-bellied Sea-Eagle feeds mainly off aquatic animals, such as fish, turtles and sea snakes, but it takes birds and mammals as well. It is a skilled hunter, and will attack prey up to the size of a swan. Sea-Eagles also feed on carrion (dead prey) such as sheep and fish along the waterline. They harass smaller birds, forcing them to drop any food that they are carrying. Sea-Eagles feed alone, in pairs or in family groups. White-bellied Sea-Eagles build a large stick nest, which is used for many seasons in succession. The nest can be located in a tree up to 30m above the ground, but may be also be placed on the ground or on rocks, where there are no suitable trees. At the start of the breeding season (May to October), the nest is lined with fresh green leaves and twigs. The female carries out most of the incubation of the two white eggs, but the male performs this duty from time to time.	Present – broad habitat preferences.	Possible – very occasional visitor.	Low - very small amount of potential roosting habitat would be impacted.

Species Name and Ecology	Presence of habitat	Likelihood of occurrence	Potential for impact
Merops ornatus **Rainbow Bee-eater** **Migratory, Marine** The Rainbow Bee-eater is found throughout mainland Australia, as well as eastern Indonesia, New Guinea and, rarely, the Solomon Islands. In Australia it is widespread, except in desert areas, and breeds throughout most of its range, although southern birds move north to breed. The Rainbow Bee-eater is most often found in open forests, woodlands and shrublands, and cleared areas, usually near water. It will be found on farmland with remnant vegetation and in orchards and vineyards. It will use disturbed sites such as quarries, cuttings and mines to build its nesting tunnels. Southern populations move north, often in huge flocks, during winter; northern populations are present year round. Rainbow Bee-eaters eat insects, mainly catching bees and wasps, as well as dragonflies, beetles, butterflies and moths. They catch flying insects on the wing and carry them back to a perch to beat them against it before swallowing them. Bees and wasps are rubbed against the perch to remove the stings and venom glands.	Present	Possible	Low - very small amount of potential habitat would be impacted. Abundant potential habitat available adjacent to the site.
Gallinago hardwickii **Latham's Snipe** **EPBC-Marine, Migratory** In Australia, 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. Latham's Snipe does not breed within Australian jurisdiction. Latham's Snipe is an omnivorous species that feeds on seeds and other plant material (mainly from species in families such as Cyperaceae, Poaceae, Juncaceae, Polygonaceae, Ranunculaceae and Fabaceae), and on invertebrates including insects (mainly flies and beetles), earthworms and spiders and occasionally molluscs, isopods and centipedes.	Absent	Unlikely	No

APPENDIX C FIELD SURVEY RESULTS

C.1 FLORA SPECIES LIST

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**

Cover/abundance scores relate to general abundance over the entire site, not to representative quadrats.

***Introduced species are preceded by an asterisk.**

Scientific name	Common name	Family	Abundance
TREES			
Acacia excelsa	Ironwood	Fabaceae	0-3
Acacia melvillei	Yarran	Fabaceae	1
Apophyllum anomalum	Warrior Bush	Capparidaceae	1
Callitris glaucophylla	White Cypress Pine	Cupressaceae	0-3
Capparis mitchellii	Wild Orange	Capparidaceae	1
Codonocarpus cotinifolius	Native Poplar	Gyrostemonaceae	1
Eremophila mitchellii	Budda	Myoporaceae	0-3
Eucalyptus intertexta	Inland Red Box	Myrtaceae	0-2
Eucalyptus largiflorens	Black Box	Myrtaceae	1
Eucalyptus populnea ssp *bimbil*	Bimble Box	Myrtaceae	0-3
?Flindersea maculosa	Leopardwood	Rutaceae	1
Geijera parviflora	Wilga	Rutaceae	0-3
Hakea tephrosperma	Hooked Needlewood	Proteaceae	1
**Melia azedarach*	White Cedar	Meliaceae	1
SHRUBS, SUB-SHRUBS			
Dodonaea viscosa ssp *mucronata*	Broad-leaf Hopbush	Sapindaceae	1
Eremophila longifolia	Emubush	Myoporaceae	0-2
Maireana microphylla	Eastern Cottonbush	Chenopodiaceae	1
Muehlenbeckia cunninghamii	Lignum	Polygonaceae	1
Salsola kali var. *kali*	Buckbush	Chenopodiaceae	1
Sclerolaena birchii	Galvanised Burr	Chenopodiaceae	0-4

Scientific name	Common name	Family	Abundance
Sclerolaena convexula		Chenopodiaceae	1
Sclerolaena diacantha	Grey Copperburr	Chenopodiaceae	2
**Senna occidentalis*		Fabaceae	1
Senna form taxon *'zygophylla'*	Punty Bush	Fabaceae	1
Solanum ferocissimum		Solanaceae	1
FERNS			
Cheilanthes sieberi ssp *sieberi*	Rock or Mulga Fern	Sinopteridaceae	1
Marsilea drummondii	Common Nardoo	Marsileaceae	1
VINES AND TWINERS			
Convolvulus recurvatus ssp. *recurvatus*	Bindweed	Convolvulaceae	0-2
Glycine ?canescens		Fabaceae	0-2
Jasminum lineare	Desert Jasmine	Oleaceae	1
Parsonsia eucalyptophylla	Gargaloo	Apocyanaceae	0-2
Rhyncharrhena linearis		Asclepidiaceae	1
FORBS			
Abutilon halophyllum	Plains Lantern-bush	Malvaceae	0-2
Alternanthera sp. A		Amaranthaceae	1
**Alternanthera pungens*	Khaki Weed	Amaranthaceae	0-3
**Asphodelus fistulosus*	Wild Onion	Asphodelaceae	1
**Aster subulatus*	Wild Aster	Asteraceae	0-2
Atriplex suberecta	Lagoon Saltbush	Chenopodiaceae	1
Boerhavia dominii	Tar Vine	Nyctaginaceae	0-2
Brunoniella australis	Blue Trumpet	Acanthaceae	0-2
Calotis cuneifolia	Purple Burr-daisy	Asteraceae	0-2
Calotis lappulacea	Yellow Burr-daisy	Asteraceae	0-3
**Carthamus lanatus*	Saffron Thistle	Asteraceae	1
Chamaesyce drummondii	Caustic Weed	Euphorbiaceae	1
Chamaesyce sp. B		Euphorbiaceae	1
Chenopodium cristatum	Crested Crumbweed	Chenopodiaceae	1
Chenopodium desertorum ssp *desertorum*		Chenopodiaceae	0-2
**Chenopodium murale*	Nettle-leaf Goosefoot	Chenopodiaceae	1
**Chondrilla juncea*	Skeleton Weed	Asteraceae	1
Chrysocephalum apiculatum	Yellow Buttons	Asteraceae	0-2
**Citrullus lanatus*	Camel Melon	Cucurbitaceae	1
**Conyza bonariensis*	Flax-leaf Fleabane	Asteraceae	1
**Conyza sumatrensis*	Tall Fleabane	Asteraceae	1

Scientific name	Common name	Family	Abundance
**Echium plantagineum*	Paterson's Curse	Boraginaceae	0-3
Einadia nutans ssp. *linifolia*		Chenopodiaceae	0-2
Einadia nutans ssp. *nutans*		Chenopodiaceae	1
Einadia polygonoides		Chenopodiaceae	0-3
**Emex australis*	Spiny Emex	Polygonaceae	1
Erodium ?crinitum	Blue Storksbill	Geraniaceae	1
Goodenia cycloptera	Serrated Goodenia	Goodeniaceae	0-2
*?*Hypochaeris microcephalum* ssp. *albiflora*		Asteraceae	1
**Lepidium africanum*	Peppercress	Brassicaceae	1
Maireana enchylaenoides		Chenopodiaceae	1
**Malva parviflora*	Small-flowered Mallow	Malvaceae	1
**Marrubium vulgare*	Horehound	Lamiaceae	1
**Medicago laciniata*	Cut-leaf Medic	Fabaceae	1
**Medicago sativa*	Lucerne	Lamiaceae	0-5
**Medicago* sp.	Medic	Lamiaceae	1
Persicaria prostrata	Creeping Knotweed	Polygonaceae	1
**Polygonum aviculare*	Wireweed	Polygonaceae	1
Portulaca oleracea	Purslane, Pigweed	Portulacaceae	1
Ptilotus ?atriplicifolia	Crimson Foxtail	Amaranthaceae	1
Ptilotus ?obovatus		Amaranthaceae	1
Ptilotus polystachyos	Long-tails	Amaranthaceae	0-2
Rostellularia adscendens var. *pogonanthera*	Pink Tongues	Acanthaceae	1
**Salvia verbenaca*	Wild Sage	Lamiaceae	1
Sida corrugata	Corrugated Sida	Malvaceae	0-2
Sida cunninghamii	Ridge Sida	Malvaceae	0-2
**Sida rhombifolia*	Paddy's Lucerne	Malvaceae	1
Solanum esuriale	Quena	Solanaceae	1
**Solanum nigrum*	Black-berry Nightshade	Solanaceae	1
**Sonchus oleraceus*	Milk Thistle	Asteraceae	0-2
Swainsona ?affinis		Fabaceae	1
**Verbena bonariensis*	Purpletop	Verbenaceae	1
**Verbesina encelioides* ssp. *encelioides*	Crownbeard	Asteraceae	1
Vittadinia cuneata var. *hirsuta*	Fuzzweed	Asteraceae	1
Vittadinia gracilis		Asteraceae	1
Vittadinia pustulatum	Fuzzweed	Asteraceae	1

Scientific name	Common name	Family	Abundance
Wahlenbergia communis	Tufted Bluebell	Campanulaceae	1
Wahlenbergia graniticola		Campanulaceae	1
Wahlenbergia ?luteola		Campanulaceae	1
**Xanthium italicum*	Hunter Burr	Asteraceae	1
**Xanthium spinosum*	Bathurst Burr	Asteraceae	0-3
Xerochrysum bracteatum	Paper Daisy	Asteraceae	1
GRASSES			
Aristida behriana	Brush Wiregrass	Poaceae	1
Aristida jerichoensis var. *subspinulifera*	Number 9 Wiregrass	Poaceae	0-3
Austrodanthonia setacea	Small-flowered Wallaby Grass	Poaceae	1
Austrostipa scabra ssp *falcata*	Corkscrew Grass	Poaceae	0-3
Austrostipa tuckeri	Tucker's Wiregrass	Poaceae	1
Austrostipa verticillata	Slender Bamboo Grass	Poaceae	0-3
**Avena* sp.	Wild Oats	Poaceae	1
Bothriochloa macra	Red-stem Grass	Poaceae	0-3
**Cenchrus ciliaris*	Buffel Grass	Poaceae	1
Chloris truncata	Windmill Grass	Poaceae	1
Chloris ventricosa	Tall Windmill Grass	Poaceae	0-3
Cymbopogon obtectus	Silky-heads	Poaceae	1
Cymbopogon refractus	Barbed Wire Grass	Poaceae	1
Cynodon dactylon	Couch Grass	Poaceae	1
Dichanthium sericeum	Queensland Bluegrass	Poaceae	1
Digitaria brownii	Cotton Panic Grass	Poaceae	0-3
Digitaria coenicola	Finger Panic Grass	Poaceae	1
Digitaria divaricatissima	Spreading Umbrella Grass	Poaceae	1
Enneapogon polyphyllus	Leafy Nineawn Grass	Poaceae	0-4
Enteropogon acicularis	Curly Windmill Grass	Poaceae	0-5
**Eragrostis cilianensis*	Stinkgrass	Poaceae	0-4
Eragrostis elongata	Clustered Lovegrass	Poaceae	0-3
Eragrostis megalosperma		Poaceae	1
Eragrostis ?microcarpa	Dainty Lovegrass	Poaceae	1
Eragrostis ?setifolia	Neverfail	Poaceae	1
Leptochloa digitata	Umbrella Cane Grass	Poaceae	0-4
Monachather paradoxa	Bandicoot Grass	Poaceae	1
Panicum laevinode	Pepper Grass	Poaceae	0-3
Paspalidium constrictum	Knotty Butt Grass	Poaceae	0-4

Scientific name	Common name	Family	Abundance
**Paspalum dilatatum*	Paspalum	Poaceae	1
Themeda australis	Kangaroo Grass	Poaceae	1
Thyridolepis mitchelliana	Mulga Mitchell Grass	Poaceae	1
Tragus australianus	Small Burr Grass	Poaceae	1
Tripogon loliiformis	Five-minute Grass	Poaceae	1
GRAMINOIDS			
Carex inversa	Knob Sedge	Cyperaceae	1

C.2 FAUNA SPECIES LIST

Legend

X – denotes scat

O – denotes species observed

W – denotes species call heard

D – denotes species digging

T – denotes track

* - denotes exotic species

Anabat survey

C –certainty of identification is confident

Pr –certainty of identification is probable

Po – certainty of identification is possible

Common Name	Scientific Name	Opportunistic	Spotlight	Anabat
Birds				
Apostlebird	*Struthidea cinerea*	O		
Australasian Grebe	*Tachybaptus novaehollandiae*	O		
Australian Magpie	*Cracticus tibicen*	O		
Australian Raven	*Corvus coronoides*	O		
Australian Ringneck	*Barnardius zonarius*	O		
Black-faced Cuckoo-shrike	*Coracina (Coracina) novaehollandiae*	O		
Blue Bonnet	*Northiella haematogaster*	O		
Blue-faced Honeyeater	*Entomyzon cyanotis*	O		
Bronzewing	*Phaps spp*	O		

Brown Falcon	*Falco berigora*	O		
Cockatiel	*Nymphicus hollandicus*	O		
Crested Pigeon	*Ocyphaps lophotes*	O		
Fairy Wren	*Malurus spp.*	O		
Galah	*Eolophus roseicapillus*	O		
Grey Butcherbird	*Cracticus torquatus*	O		
Grey-crowned Babbler	*Pomatostomus temporalis temporalis*	O		
Magpie Lark	*Grallina cyanoleuca*	O		
Nankeen Kestrel	*Falco cenchroides*	O		
Noisy Miner	*Manorina melanocephala*	O		
Quail	*Coturnix spp*	O		
Superb Parrot	*Polytelis swainsonii*	O		
Welcome Swallow	*Hirundo neoxena*	O		
White-winged Chough	*Corcorax melanorhamphos*	O		
Willie Wagtail	*Rhipidura leucophrys*	O		
Mammals				
Cat*	*Felis catus*		O	
Eastern Grey Kangaroo	*Macropus giganteus*	O	O,T	
European Rabbit*	*Oryctolagus cuniculus*	X	O	
Red Fox*	*Vulpes vulpes*		O	
Unidentified Glider	*Petaurus spp*		O	

APPENDIX D HOLLOW-BEARING TREE REGISTER

Note: Trees to be impacted by the solar plant and transmission line are highlighted.

Species	No. hollows			DBH (cm)	Height (m)	Quality	Waypoint	Coordinates (WGS 1984)	
	S	M	L					Latitude	Longitude
Eucalyptus populnea		2		100	12	High	1	-31.5785	147.0911
Eucalyptus populnea	1P			60	12	Low	2	-31.5784	147.0908
Eucalyptus populnea	3	2	1	90	12	High	3	-31.5787	147.0905
Eucalyptus populnea			2	100	12	Medium	4	-31.579	147.0905
Eucalyptus populnea		2		110	12	Medium	5	-31.579	147.0907
Eucalyptus populnea		1	1	100	8	Medium	6	-31.5786	147.0903
Eucalyptus populnea	3			60	10	Medium	7	-31.5786	147.0901
Eucalyptus populnea	3	2	1	100	12	Medium	8	-31.5787	147.0898
Eucalyptus populnea			1	110	12	High	9	-31.5789	147.0898
Eucalyptus populnea	1	2	1	100	10	Medium	10	-31.5792	147.0899
Eucalyptus populnea	2	2	1	110	12	High	11	-31.579	147.0893
Stag	2	4	2	90	8	High	12	-31.5786	147.0894
Eucalyptus populnea	2	4		80	10	Medium	13	-31.5785	147.0896
Stag	1		1	60	6	Medium	14	-31.5782	147.0897
Eucalyptus populnea	4	2	1	110	10	High	15	-31.5781	147.0901
Eucalyptus populnea	2	2		50	8	Medium	16	-31.5778	147.0901
Stag	2	4	1			High	17	-31.5779	147.0904

Species	No. hollows			DBH (cm)	Height (m)	Quality	Waypoint	Coordinates (WGS 1984)	
Eucalyptus populnea	2	4		110	8	High	18	-31.5778	147.0906
Eucalyptus populnea	1	2	1	50	6	Low	19	-31.5779	147.0906
Eucalyptus populnea	1	1	2	100	10	Medium	20	-31.578	147.0908
Eucalyptus populnea			1	80	8	High	21	-31.578	147.0907
Eucalyptus populnea		3	1	90	10	Medium	22	-31.578	147.0911
Eucalyptus populnea	2	2	1	110	10	High	23	-31.5779	147.0911
Eucalyptus populnea	2	2		60	8	Medium	24	-31.5779	147.0912
Stag	2	1	1	70	8	Medium	25	-31.5781	147.0913
Eucalyptus populnea			1			Low	26	-31.5782	147.0912
Eucalyptus populnea		1		100	8	Medium	27	-31.5772	147.0919
Eucalyptus populnea	2	3		70	10	Medium	28	-31.5771	147.0918
Eucalyptus populnea	1			70	10	Medium	29	-31.5771	147.0922
Eucalyptus populnea			1	100	8	High	30	-31.5775	147.0926
Eucalyptus populnea	5	2		70	10	High	31	-31.5778	147.0933
Eucalyptus populnea		1	1	90	10	High	32	-31.5783	147.0928
Stag			3	120	6	Medium	33	-31.5784	147.0926
Eucalyptus populnea		2	1	100	10	Medium	34	-31.5791	147.0921
Eucalyptus populnea	7	2	2	120	12	High	35	-31.5513	147.1008
Eucalyptus populnea		1		70	12	Medium	37	-31.5457	147.0972
Eucalyptus populnea			1	70	12	Medium	38	-31.5462	147.0948
Eucalyptus populnea			1	110	10	High	39	-31.5463	147.0945

Species	No. hollows		DBH (cm)	Height (m)	Quality	Waypoint	Coordinates (WGS 1984)	
Eucalyptus populnea		1	60	8	Medium	40	-31.5463	147.0938
Eucalyptus populnea		2	100	8	Medium	41	-31.5463	147.0933
Eucalyptus populnea		1 1	70	6	Medium	42	-31.5464	147.0932
Eucalyptus populnea		1	110	12	Medium	43	-31.5477	147.0874
Eucalyptus populnea		1	90	15	Medium	46	-31.5496	147.0771
Eucalyptus populnea		2 1	100	15	Medium	47	-31.5496	147.077
Eucalyptus populnea	1		60	15	Medium	49	-31.5575	147.0835
Eucalyptus populnea		1	80	12	Medium	52	-31.5574	147.0843
Eucalyptus populnea	1		110	12	Medium	54	-31.5573	147.0858
Eucalyptus populnea	1		60	12	Medium	59	-31.5605	147.0871
Stag		1	50	8	Low	60	-31.5613	147.0876
Stag	1	1	40	6	Medium	61	-31.5614	147.0876
Eucalyptus populnea		1	60	10	Medium	62	-31.5619	147.0876
Eucalyptus populnea	1		70	8	Medium	63	-31.5621	147.0881
Eucalyptus populnea		1	60	10	High	64	-31.5624	147.0875
Eucalyptus populnea	1		110	12	Medium	65	-31.5627	147.0879
Eucalyptus populnea	1		50	10	Low	66	-31.5626	147.0883
Eucalyptus populnea		3	70	10	Medium	67	-31.5629	147.0882
Eucalyptus populnea	1		60	12	High	68	-31.5628	147.0878
Eucalyptus populnea		1	70	12	Medium	69	-31.5629	147.0873
Eucalyptus populnea		3 1	80	15	High	70	-31.5606	147.0993

Species	No. hollows		DBH (cm)	Height (m)	Quality	Waypoint	Coordinates (WGS 1984)	
Eucalyptus populnea		1 2	100	15	High	72	-31.5778	147.0954
Eucalyptus populnea	2		50	12	Low	73	-31.5777	147.0957
Eucalyptus populnea		4	120	12	High	74	-31.5778	147.0965
Eucalyptus populnea		1 1	70	12	High	75	-31.578	147.0963
Eucalyptus populnea		2	110	12	Medium	76	-31.5774	147.0969
Stag		3	100	10	Medium	77	-31.5776	147.097
Eucalyptus populnea	1	2	100	15	High	78	-31.5775	147.0971
Eucalyptus populnea	1	2	80	12	Medium	79	-31.5776	147.0975
Eucalyptus populnea		1	40	12	High	80	-31.5772	147.0973
Eucalyptus populnea		1	110	15	Medium	81	-31.5763	147.0968
Eucalyptus populnea		1	110	12	Medium	82	-31.5766	147.0964
Eucalyptus populnea	1P	1	100	12	Medium	83	-31.5768	147.0957
Eucalyptus populnea	1	2 1	110	12	High	84	-31.5765	147.0953
Eucalyptus populnea	3		100	12	Medium	85	-31.5766	147.0945
Eucalyptus populnea		2P	80	15	Low	88	-31.5768	147.0946
Eucalyptus populnea		1	70	12	High	89	-31.5773	147.0943
Eucalyptus populnea	3	2	70	12	Medium	90	-31.5776	147.0944
Eucalyptus populnea		3			Medium	91	-31.5776	147.0942
Eucalyptus populnea	2		60	15	Medium	92	-31.5777	147.0938
Eucalyptus populnea		4 1	90	12	High	94	-31.549	147.0803
Eucalyptus populnea		5 2	90	12	High	95	-31.549	147.0802

Species	No. hollows			DBH (cm)	Height (m)	Quality	Waypoint	Coordinates (WGS 1984)	
Eucalyptus populnea	5	4		70	15	High	96	-31.55	147.0746
Eucalyptus populnea	2			30	10	Low	97	-31.5591	147.0716
Eucalyptus populnea	1			40	12	Medium	99	-31.5593	147.0749
Eucalyptus populnea	1			60	12	High	100	-31.559	147.0753
Eucalyptus populnea	1			100	12	Medium	101	-31.5583	147.0788
Eucalyptus populnea		1		30	12	High	105	-31.5579	147.0816
Eucalyptus populnea	1	1		30	12	Low	106	-31.5626	147.0865
Eucalyptus populnea	1	1		30	12	Medium	107	-31.5627	147.0867
Eucalyptus populnea		1		50	10	Medium	108	-31.5658	147.0825
Eucalyptus populnea		1		90	12	Medium	109	-31.5658	147.0812
Eucalyptus populnea	1	2	1	80	12	Medium	200	-31.5660	147.0704
Eucalyptus populnea		1	1	60	12	Medium	201	-31.5710	147.0696
Eucalyptus populnea	1	3	1	60	12	Medium	202	-31.5795	147.0683
Eucalyptus populnea	1	5	1	150	12	High	204	-31.5843	147.0687
Eucalyptus populnea	2	1		60	12	Medium	205	-31.5844	147.0691
Eucalyptus populnea	1	5		50	12	Medium	206	-31.5842	147.0694
Eucalyptus populnea	1		2	70	8	Medium	207	-31.5847	147.0687
Eucalyptus populnea		1		60	10	Medium	208	-31.5847	147.0686
Eucalyptus populnea	2	3		50	8	Low	211	-31.5854	147.0666
Eucalyptus populnea	1	4	2	70	10	High	212	-31.5853	147.0664
Eucalyptus populnea			1P	60	12	Low	213	-31.5850	147.0670

Species	No. hollows			DBH (cm)	Height (m)	Quality	Waypoint	Coordinates (WGS 1984)	
Eucalyptus populnea	1	2	2	130	15	High	216	-31.5808	147.0686
Eucalyptus populnea	2			70	15	Medium	218	-31.5885	147.0633

APPENDIX E ASSESSMENTS OF SIGNIFICANCE

The *Threatened Species Conservation Act 1995* (TSC Act) specifies a set of seven factors which must be considered by decision makers in assessing the effect of a proposed development or activity on threatened species, populations or ecological communities or their habitats. These factors are collectively referred to as the 'seven part test'.

An assessment of habitat suitability based on known ecological requirements and distribution records was undertaken for the Proposal and concluded that the Grey-crowned Babbler (*Pomatostomus temporalis*), listed as Vulnerable on the TSC Act, would be impacted by the Proposal.

Initial surveys in May/June 2012 found Grey-crowned Babblers to be common at the study site. A family group and three nests were observed within Area 3 (Figure 4-7), which comprises approximately 5.7 ha. This area would be removed by the Proposal. Further targeted surveys of Grey-crowned Babblers at the study site and in the study area were undertaken in August 2012 to assess their abundance and distribution, in order to establish the importance of Area 3 to the local population. The following test assesses the potential impact to this species.

The Grey-crowned Babbler occupies open woodlands dominated by mature eucalypts, with regenerating trees, tall shrubs, and an intact ground cover of grass and forbs. They are insectivorous and forage in leaf litter, fallen timber and on bark of trees. In NSW, the Grey-crowned Babbler occurs on the western slopes and plains but is less common at the higher altitudes of the tablelands. Isolated populations are known from coastal woodlands on the North Coast, in the Hunter Valley and from the South Coast near Nowra (Blakers *et al*.. 1984; Schodde & Mason 1999; NSW Scientific Committee 2011). The activity ranges of Grey-crowned Babbler groups vary from 2 to 53 hectares (Blakers *et al*. 1984) and increases with increasing group size and habitat connectivity (Counsilman 1977; King 1980; Parsons Brinckerhoff 2005). The Grey-crowned Babbler has declined in numbers and disappeared from large parts of its range. It is threatened by clearance and the fragmentation of habitat including removal of dead timber. The species occupies woodlands on fertile soils of plains and undulating terrain. Grey-crowned Babbler habitat has been disproportionately cleared for agriculture. Isolation of populations in scattered remnants is exacerbated by the apparent reluctance of birds to traverse tracts of cleared land (NSW Scientific Committee 2011).

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.

Grey-crowned Babblers live and breed in co-operative territorial groups of two to fifteen individuals. They are sedentary and territorial. The breeding season extends from June to February. Nests are located in shrubs or the lower canopy of trees, usually less than six metres above the ground (Brown *et al.* 1983; Parsons Brinckerhoff, 2005). Often old nest sites are renovated and re-used from year to year (Parsons Brinckerhoff, 2005). A viable population is likely to contain more than 10 family groups, while populations with less than 10 groups are likely to have a high rate of extinction (Parsons Brinckerhoff, 2005).

Approximately 16 Grey-crowned Babbler family groups and 61 nests were observed in the area immediately adjacent to the footprint of the proposed solar farm during the August surveys. Area 3 was also traversed to confirm the use of this vegetation corridor by Grey-crowned Babblers; one family group was observed, and 3 nests. Approximately 5.7 ha of known foraging habitat, currently occupied by a group of six Babblers, and 3 nests would be removed under the Proposal. Approximately 70 ha of known habitat for the Grey-crowned Babbler that won't be impacted occurs in the immediate vicinity of the site.

The alignment of the solar plant has been designed to avoid Area 2, which also contains 2 known family groups and 2 nest sites. The transmission line location has been chosen to avoid areas with nests and optimal foraging habitat. It is estimated from the surveys in August that approximately 16-17 family groups occur in the vegetation remnants surrounding the site. The removal of habitat within Area 3 would comprise approximately 8% of the available habitat surveyed, therefore it is unlikely that the Proposal would have an adverse effect on the life cycle of this species. In addition, active nests with chicks were recorded in surrounding areas in August, and are a further indication that the population in the study area is viable.

The movement of vehicles and equipment into the site would be increased during the construction phase and hence noise levels would increase. The Grey-crowned Babble appears to be relatively disturbance tolerant as this species has been observed foraging in gardens, parks and small remnants, along fence boundaries and man-made structures near major roads, providing there is nearby connectivity to suitable habitat (Parsons Brinckerhoff 2005). However, this species is a laborious flyer and is known to feed on the ground placing it at risk of being killed by construction traffic. 'Traffic management' would be incorporated and would address traffic flow, vehicle speed and vehicle numbers entering and leaving the site. As such, the proposed works would have an impact on the life cycle of the group of 6 birds that currently occupy the east-west strip of vegetation to be removed. However, since 16-17 groups are resident in the area survey immediately surrounding the site, this loss would not impact on breeding at population level.

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**

Grey-crowned Babbler groups were recorded at six different locations in the vicinity of the Solar Plant and transmission line during surveys in May/June (Figure 4-9). Eight nest sites were also recorded during those surveys (Figure 4-7). During the August surveys approximately 16-17 family groups and 61 nests were recorded on the site and immediate surrounds (Figure 4-9).

Three nests and 5.7 ha of known foraging habitat would be removed as a result of the Proposal. This represents foraging and breeding habitat for one group of Grey-crowned Babbler comprising six individuals. Approximately 70 ha of known breeding and foraging habitat exists adjacent to the study site, and additional areas also exist adjacent to the sites that are likely to provide suitable habitat for the Grey-crowned Babbler. These areas would not be impacted by the Proposal.

A family group of Grey-crowned Babblers was recorded within the transmission line easement to the south of the Barrier Highway (Area 4, Figure 4-9). This area would be cleared for installation of the powerline. The amount of vegetation to be cleared is approximately 4.5 ha. No nest sites were recorded within the development envelope of Area 4. Additional habitat to the south of the Barrier Highway would also be cleared for the transmission line easement, however the amount of habitat to be removed (4.5 ha) is relatively small considering the available habitat adjacent to the site. The impacts to the vegetation along the transmission line are considered to be minimised through future maintenance of the transmission easement by allowing groundcover and small shrubs to subsist.

Other areas identified as foraging and breeding habitat for the Grey-crowned Babbler (Areas 1 and 2) would not be impacted by the proposed works.

(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

The Proposal would not fragment or isolate any areas of habitat. Connectivity would be altered with the removal of vegetation for the transmission line and Area 3, however this would not fragment or isolate any areas of habitat. Connectivity would be maintained between Area 1 and Area 2, despite the removal of Area 3. Suitable habitat for the Grey-crowned Babbler would not be fragmented by vegetation removal for the transmission line as it is located along the edge of existing woodland. Additionally, following construction, low-growing vegetation would be able to regenerate within the transmission easement to minimise the impacts of vegetation removal during the construction phase.

(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.

The Grey-crowned Babbler prefers structurally diverse habitat available in the woodland areas of the site, particularly the roadside verges. The removal of a small amount of edge habitat for the transmission line and 5.7 ha of foraging and breeding habitat within Area 3 is not considered by this assessment to be important habitat for the long-term survival of this species. This species is common across the study area and the vegetation to be removed within Area 3 and Area 4 is considered to be less optimal to the long-term survival of this species compared to the more complex vegetation communities in the surrounding areas that would be retained.

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

No areas of critical habitat have been declared for the species.

f) Whether the action proposed is consistent with the objectives or actions of a Recovery Plan or Threat Abatement Plan.

The Action Plan for Australian Birds 2000 lists the Grey-crowned Babbler as near threatened. The recommendations that are relevant to the proposed works include:

- Protect all woodland in which Grey-crowned Babblers are known to be resident from clearing, monitoring compliance biennially.
- Secure all Grey-crowned Babbler subpopulations found on public land through conservation management, particularly those in timber reserves or transport corridors or on local government land

- Within the Babbler's range, manage at least 15% of the pre-European area of all woodland communities on public or private land for nature conservation, using incentives where necessary
- Using appropriate incentives, undertake extension with land-holders that have suitable woodland habitat to promote sound management of remnants and encourage greater connectivity between sub-populations.
- Undertake long-term monitoring of remnant sub-populations

Offsets of suitable habitat for the Grey-crowned Babbler have been recommended as part of this Biodiversity 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 would result in the operation of the following key threatening processes relevant to the Grey-crowned Babbler:

- Clearing of native vegetation
- Removal of dead wood and dead trees

The clearing of native vegetation is considered a major contributor to the loss of biodiversity. 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, and habitat degradation. The removal of a degraded strip of vegetation (Area 3) for the construction of the solar plant is not likely to impact the Grey-crowned Babbler considering the abundance of good quality habitat adjacent to the site. The removal of habitat for the transmission line would only temporarily impact habitat for the Grey-crowned Babbler, and post-construction this area would be allowed to regenerate.

There is an abundance of dead wood and dead trees in the study area. In comparison to the wider area, there is minimal dead wood in the areas to be impacted by both the solar plant and transmission line. Any dead wood and dead trees encountered during construction works would be relocated to nearby areas to enhance and increase habitat structure so as to be suitable for the Grey-crowned Babbler. Dead material removed for construction of the transmission line would be re-instated to that area post-construction.

It is unlikely that any key threatening processes listed under the TSC Act would be exacerbated by this Proposal as the Solar Plant and transmission line have been located to avoid areas of good quality habitat. The Proposal would not result in the operation of any key threatening process relevant to the Grey-crowned Babbler.

Conclusion

Foraging and breeding habitat for one group of Grey-crowned Babblers would be removed as a result of this proposal. Surveys conducted for this project revealed 16-17 groups occupying the vegetation remnants in close proximity to the site. The 5.7ha of vegetation to be removed supported three Babbler nests. A total of 61 nests were encountered in the surrounding woodlands and more would occur in similar unsurveyed habitat in the locality. Thus this assessment concludes that the removal of one group and three nests would not have an adverse impact on this species at the population level.

Based on this seven-part test the proposed works are unlikely to have a significant impact on the species and a Species Impact Statement is not required.

Required mitigation measures:

- Protection of Grey-crowned Babbler nest sites in Areas 1, 2 and 4 during the infrastructure siting and design process (Figure 4-7).
- Traffic management measures on site to minimise collision risks.
- Reinstate fallen/dead timber ground layer in the transmission line easement in a natural distribution to provide insect habitat and foraging habitat for the Babblers.
- Removal of vegetation in Area 3 outside of the breeding season which runs from June to February or at the end of the breeding season.
- Offsetting to ensure an overall 'maintain or improve' biodiversity outcome is achieved.

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APPENDIX F VEGETATION CLEARING GUIDELINES

General clearing and trimming guidelines

- Tree and shrub removal should aim to minimise disturbance to soils, waterways and neighbouring vegetation. This may be achieved using a chainsaw for felling and a small excavator to remove the stump, working from disturbed ground where practicable.
- Check for animals in the zone of disturbance before clearing and scare or remove them before beginning operations where possible. Re-check after clearing to ensure no animals have become trapped or injured during clearing operations.
- Clearly mark the limits of the vegetation to be removed and retained by differentiating with coloured flagging tape.
- Fell trees into the zone of disturbance to avoid damaging adjacent vegetation and do not push felled vegetation into areas to be retained.
- Retain tree hollows where practical when pruning branches.
- Take care when moving equipment near native vegetation to be retained.
- Mulch rather than burn cleared native vegetation. Where possible, consider distributing some logs from the felled trees into areas of vegetation to be retained where it would not be considered a fire hazard. This would provide additional habitat for ground dwelling fauna such as reptiles and small mammals.

Clearing Hollow-bearing Trees

- Medium and large trees with hollows or cracks which may be used by fauna such as mammals, birds and bats which are required to be removed should be inspected prior to removal.
- Hollow-bearing tree (HBT) removal should be conducted between January to March to avoid the breeding seasons of bats, birds and hollow-bearing dependant fauna.
- Clearly mark the HBT to be removed and/or retained by differentiating with coloured flagging tape.
- Remove all non-hollow bearing vegetation prior to the removal of HBT.
- Where possible, leave HBT standing for at least one night after other clearing to allow any fauna the opportunity to remove themselves after site disturbance.
- Before felling HBT, tap along trunk using an excavator or loader to scare animals from the hollows. Repeat several times. The aim of this is to 'substantially' shake the tree. Most fauna would exit the tree during this process.
- For medium-large hollow-bearing trees which may contain arboreal mammals, sectional removal should be used with a suitably qualified and licensed zoologist or trained wildlife carer present. This person should ensure that any fauna found is safely located to nearby habitat.
- When using sectional removal, the non-hollow-bearing branches should be removed before the hollow-bearing branches.

Use and disposal of cleared vegetation

- Non-weedy vegetation can be mulched and re-used for site stabilisation and rehabilitation. Vegetation that contains weeds should not be re-used as mulch on any part of the site.

- Mulched plant material should be shredded when it is first cut, and allowed to decompose while the works are carried out. The decomposing pile should be stockpiled in a weed free area and turned weekly to prevent overheating and possible spontaneous combustion.
- Loose mulch should not be used in areas subject to significant surface water flows during rain.
- Large tree trunks and limbs, particularly hollows, fallen timber from the areas to be cleared, as well as felled timber should be redistributed in to areas with poor groundlayer complexity to supplement foraging habitat for Grey-crowned Babblers.
- Cleared vegetation that is not needed for mulch should be removed from the site or burnt in an open area, well away from retained trees, intact native vegetation and runoff flow paths.

APPENDIX G OFFSET STRATEGY OUTLINE

G.1 REQUIREMENT TO OFFSET

The DGRs issued for the Proposal state that the EIS must:

"include measures to avoid, mitigate or offset impacts consistent with "improve or maintain" principles. Sufficient details must be provided to demonstrate the availability of viable and achievable options to offset the impacts of the development, if required…"

The purpose of this appendix is to outline the offset strategy, providing more certainty around:

- How offsets will be identified
- How offsets will be managed
- How offsets will be secured
- How OEH's *Principles for the use of Biodiversity Offsets in NSW* are addressed

G.2 IDENTIFYING OFFSETS

The key components in identifying offsets are:

a) Calculating the areas to be impacted
b) Determining a suitable offset ratio
c) Selecting the offset site

G.2.1 Calculating the areas to be impacted (area required to be offset)

Only one native vegetation type (Poplar Box – Gum-barked Coolabah – White Cypress Pine shrubby woodland) occurs within the study area. The majority of the vegetation to be impacted comprises exotic dominated pasture which would not be offset. Section 5 of the Biodiversity Assessment estimates that a total of approximately 9.9 ha (5.7 ha at the solar plant site and 4.2 ha within the transmission line easement) of native vegetation will be permanently impacted by the proposal including 10 hollow-bearing trees. The proponent would prepare of an offset plan *before construction* but would ensure that the actual areas impacted are 'validated' *after construction* to ensure that the actual not estimated impacts have been offset. 'Validation' of the impact area post construction is not intended to delay specifying the offset site pre-construction but is intended to provide certainty that the actual area of impact has been offset; it is essentially an audit to ensure the offset is adequate. Further it provides an incentive during construction to minimise the footprint and thereby impact less habitat and reduce the projects offset requirement.

Impacts to threatened flora species

Two threatened flora species, *Diuris tricolor* and *Swainsona plagiotropis*, have the potential to occur on the development site. Surveys have been conducted outside the period where these species may be detected. Further survey for these species is planned as part of this proposal. If these surveys identify these species as occurring in areas proposed for impact, micrositing of infrastructure would be undertaken to ensure a significant impact is avoided. If unavoidable, all areas of suitable habitat within the easement would be included as additional permanent impact areas and would be added to the total area required to be offset.

G.2.2 Determining a suitable offset ratio

The native vegetation within the study area is known to provide habitat for the threatened Grey-crowned Babbler (listed as vulnerable under the TSC Act) which was recorded at the site. As only one vegetation type occurs across the study area and Babbler groups appear to be widespread across the area, it is assumed that all of the native vegetation on site provides habitat for this threatened species. An offset ratio of 1:5 is proposed for the Poplar Box – Gum-barked Coolabah – White Cypress Pine shrubby woodland vegetation to be impacted. This ratio assumes all habitat to be affected could be considered Grey-Crowned Babbler habitat.

If impacts to the two threatened flora species are unavoidable then a ratio of 1:10 is proposed for habitat for these species.

The loss of hollow-bearing trees is proposed to be offset by installing nest boxes at a ratio of 1:1 (one nest box for each hollow). This is additional to the salvage of hollows from felled trees which are to be remounted in adjacent retained trees.

G.2.3 Selecting the offset site

When selecting the offset site (or sites) able to meet the ratio set out above, the proponent will ensure the selected offset site is:

- Not already a type of biodiversity conservation reserve or an existing offset.
- Of sufficient size to achieve the set ratio (i.e., approximately 50 ha).
- Of appropriate type to achieve a 'like for like' or 'like for better' offset.
- Complying with *Principles for the use of biodiversity offsets in NSW* guidance document.

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.

In selecting the offset site, a principle aim will be to offset vegetation containing trees of similar or greater maturity to ensure that habitat for hollow dependant fauna is also adequately offset. Connectivity to surrounding areas of similar vegetation will also be a priority.

If threatened flora species are to be impacted by the Proposal, it will be ensured that the offset site contains habitat that is suitable for these species.

A specific site has yet to be identified. However, there are opportunities for offsetting within the north-south strip of vegetation within the project site and preliminary advice from the proponent indicates that there are other areas that could potentially satisfy the offset requirements in close proximity to the project site. These areas are likely to contain vegetation of a similar type and condition to that which will be impacted by the Proposal.

G.3 MANAGEMENT OF THE OFFSET SITE

It is proposed that the proponent would be responsible for the management of the offset site during the operational life of the solar plant. The proponent would:

1. Delineate suitable offset areas within the project site,
2. Obtain ownership of a separate suitable site, or

3. Enter into an arrangement with the owner of a suitable site to undertake offset management activities.

The requirement to offset would be a condition of the proponent's consent and would therefore remain with the proponent.

A management strategy detailing specific management requirements for the offset site will be developed as part of the offset plan once a site is determined. The following actions may be required:

- Fencing and signage to ensure the site is adequately protected.
- Weed control and monitoring.
- Feral animal control and monitoring.
- Replanting native trees to enhance landscape connectivity in specific areas.

At the decommissioning stage, the ongoing management of the site would be the responsibility of the landowner. It is expected that by this time the majority of the required management actions would have been undertaken and ongoing management tasks will largely coincide with routine agricultural activities such as fencing, light grazing and weed control. Land use restrictions will remain in place on the offset site so that any activities undertaken on the offset site must be compatible with the offset site's overall function to improve biodiversity values.

The outcomes of the management actions would be monitored. Monitoring results would be reported every 2 years for the duration of the project (up to 30 years) to demonstrate that a 'maintain or improve' outcome has been met.

G.4 IN-PERPETUITY SECURITY OF THE OFFSET SITE

An appropriate management vehicle is required that:

- Secures the site in perpetuity
- Allows for the ongoing management of the site (including how the designated management actions will be funded)

Four options may be considered for securing a long-term management arrangement at the offset site:

- Biobanking agreement (TSC Act , part 7 A)
- Conservation Property Vegetation Plan (CPVP) (Native Vegetation Act)
- Local Environmental Plan: Environmental Zone E2 or E3 (Environmental Planning and Assessment Act)
- Plan of management with S.88b covenant (Environmental Planning and Assessment Act)

It is proposed that a Conservation Property Vegetation Plan (CPVP) would be established over the offset area that will be attached to the land title. To ensure that the CPVP is binding on successors in title, an abstract of the CPVP will 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 CPVP would include the management strategy associated with the offset area that will apply in perpetuity.

G.5 PRINCIPLES FOR THE USE OF BIODIVERSITY OFFSETS IN NSW

The NSW OEH has provided 13 principles that can be used as a frame work for considering environmental impacts and developing offset proposals. A description of how these principles have been or will be addressed is provided below.

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

Offsets are then used to address remaining impacts. This may include modifying the proposal to avoid an area of biodiversity value or putting in place measures to prevent offsite impacts.

By way of iterative infrastructure planning including considering refined constraints mapping, the proposal has avoided and mitigated, proposing to offset only residual impacts. This is documented within the Biodiversity Assessment.

2. All regulatory requirements must be met.

Offsets cannot be used to satisfy approvals or assessments under other legislation, e.g. assessment requirements for Aboriginal heritage sites, pollution or other environmental impacts (unless specifically provided for by legislation or additional approvals).

This Offset Strategy aims to satisfy the DGR's for the environmental assessment of the Proposal. Approvals or assessments under other legislation are not relevant to this proposal.

3. Offsets must never reward ongoing poor performance.

Offset schemes should not encourage landholders to deliberately degrade or mismanage offset areas in order to increase the value from the offset.

This can be addressed in two ways:

a) The offset site can be set up in perpetuity – this removes the incentive to degrade the offset site to facilitate development at a later date.

b) The management measures can have clear targets and be weighted towards the beginning of the agreement, where successful accomplishment of targets would be rewarded by less intensive management in ongoing years. This suits measures such as weed control which are more easily achieved with intensive efforts than with small ongoing efforts.

This strategy proposes to address both aspects, as discussed in Sections G.3 (management) and G.4 (in-perpetuity security) of this strategy.

4. Offsets will complement other government programs.

A range of tools is required to achieve the NSW Government's conservation objectives, including the establishment and management of new national parks, nature reserves, state conservation areas and regional parks and incentives for private landholders.

The offset site has not yet been selected. As discussed in Section G.2.3, it has been established that it cannot be a site already used as a type of biodiversity conservation reserve. The establishment of an offset site on private land contributes to NSW Government's conservation objectives and would complement existing conservation areas.

5. Offsets must be underpinned by sound ecological principles.

They must:

- *include the consideration of structure, function and compositional elements of biodiversity, including threatened species*
- *enhance biodiversity at a range of scales*
- *consider the conservation status of ecological communities*
- *ensure the long-term viability and functionality of biodiversity.*

Biodiversity management actions, such as enhancement of existing habitat and securing and managing land of conservation value for biodiversity, can be suitable offsets. Reconstruction of ecological communities involves high risks and uncertainties for biodiversity outcomes and is generally less preferable than other management strategies, such as enhancing existing habitat.

These are features that need to be considered in the selection of the offset site as well as the management actions for the site. As set out in Section G.2 of this strategy, the selection of the offset site will consider the ability to enhance landscape connectivity. As set out in Section G.3, it will be managed, subject to a management plan prepared for the offset site specifically. The success of management actions will be monitored and adapted as required to achieve their set objectives.

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

Enhancement of biodiversity in offset areas should be equal to or greater than the loss in biodiversity from the impact site.

Setting aside areas for biodiversity conservation without additional management or increased security is generally not sufficient to offset against the loss of biodiversity. Factors to consider include protection of existing biodiversity (removal of threats), time-lag effects, and the uncertainties and risks associated with actions such as revegetation.

Offsets may include enhancing habitat, reconstructing habitat in strategic areas to link areas of conservation value, or increasing buffer zones around areas of conservation value and removal of threats by conservation agreements or reservation.

As above, this is incorporated in Sections G.2 and G.3 of this strategy.

7. Offsets must be enduring - they must offset the impact of the development for the period that the impact occurs.

As impacts on biodiversity are likely to be permanent, the offset should also be permanent and secured by a conservation agreement or reservation and management for biodiversity. Where land is donated to a public authority or a private conservation organisation and managed as a biodiversity offset, it should be accompanied by resources for its management. Offsetting should only proceed if an appropriate legal mechanism or instrument is used to secure the required actions.

The offset security for this development is required in perpetuity. This is discussed in Section G.4 of this strategy.

8. Offsets should be agreed prior to the impact occurring.

Offsets should minimise ecological risks from time-lags. The feasibility and in-principle agreements to the necessary offset actions should be demonstrated prior to the approval of the impact. Legal commitments to the offset actions should be entered into prior to the commencement of works under approval.

The strategy sets out a pathway to establish the offset site and its management. This strategy requires input from OEH and landholders prior to any impacts occurring.

It is a requirement that all offset arrangements be established prior to plant operation. The offset plan will verify that the objectives set out in this strategy have been achieved.

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

Offsets should be based on quantitative assessment of the loss in biodiversity from the clearing or other development and the gain in biodiversity from the offset. The methodology must be based on the best available science, be reliable and used for calculating both the loss from the development and the gain from the offset. The methodology should include:

- *the area of impact*
- *the types of ecological communities and habitat/species affected*
- *connectivity with other areas of habitat/corridors*
- *the condition of habitat*
- *the conservation status and/or scarcity/rarity of ecological communities*
- *management actions*
- *level of security afforded to the offset site.*

The first five points have been addressed in the Biodiversity Assessment. The final two points are addressed in Sections G.3 and G.4 of this strategy.

The best available information/data should be used when assessing impacts of biodiversity loss and gains from offsets. Offsets will be of greater value where:

- *they protect land with high conservation significance*
- *management actions have greater benefits for biodiversity*
- *the offset areas are not isolated or fragmented*
- *the management for biodiversity is in perpetuity (e.g. secured through a conservation agreement).*

Extensive field assessment has ensured that the best information and data has been used in assessing the impacts of the Proposal. A similar level of detailed assessment would be afforded to the offset site once selected. The definition of the offset site will be done according to Section G.2.3, to ensure like for like (or better) and considering ways to enhance landscape connectivity. Section G.4 addresses perpetuity.

Management actions must be deliverable and enforceable.

The management plan for the offset site is discussed in Section G.3. This guidance information is intended to ensure that the actions achieve their objectives, to improve biodiversity values at the offset site.

10. Offsets must be targeted.

They must offset impacts on the basis of like-for-like or better conservation outcome. Offsets should be targeted according to biodiversity priorities in the area, based on the conservation status of the ecological community, the presence of threatened species or their habitat, connectivity and the potential to enhance condition by management actions and the removal of threats. Only ecological communities that are equal or greater in conservation status to the type of ecological community lost can be used for offsets. One type of environmental benefit cannot be traded for another: for example, biodiversity offsets may also result in improvements in water quality or salinity but these benefits do not reduce the biodiversity offset requirements.

Offsets will be selected based on biodiversity values and achieve a like for like or like for better outcome as outlined in Section G.2.3.

11. Offsets must be located appropriately.

Wherever possible, offsets should be located in areas that have the same or similar ecological characteristics as the area affected by the development.

Current options for offsetting include an area within the project site and another area to the south of the project site. Given the relative homogeneity of habitats in the landscape, it is considered likely that the offset site would contain the same or similar ecological characteristics as the area to be affected by the development.

12. Offsets must be supplementary.

They must be beyond existing requirements and not already funded under another scheme. Areas that have received incentive funds cannot be used for offsets. Existing protected areas on private land cannot be used for offsets unless additional security or management actions are implemented. Areas already managed by the government, such as national parks, flora reserves and public open space cannot be used as offsets.

This point has been considered in Section G.2.3.

13. Offsets and their actions must be enforceable through development consent conditions, licence conditions, conservation agreements or a contract.

Offsets must be audited to ensure that the actions have been carried out, and monitored to determine that the actions are leading to positive biodiversity outcomes.

The establishment of the measures outlined in Section G.4 would ensure security and management for the offset site. Management actions would be shared between the proponent (for the life of the impact) and the landowner (post decommissioning), as discussed in Section G.3.

G.6 CONCLUSION

This Offset Strategy sets out a methodology to identify, manage and secure an offset site in perpetuity to offset the impacts of the construction of the proposed Nyngan Solar Plant. A site has yet to be identified, but there is adequate land of suitable type at the site or adjacent to the site which would likely be available for offsetting. This strategy addresses the *Principle for the use of Biodiversity Offsets in NSW* and provides clear incentives, in the form of a pre-set ratio for the proponent to further minimise impacts and thereby reduce the offset requirement for the proposal.

APPENDIX H SITE PHOTOS

Photograph 1. Typical exotic pasture at the solar plant site.

Photograph 2. Woodland vegetation along the northern boundary of the solar plant site.

Photograph 3. Native Copperburrs (*Sclerolaena* spp.) occurring on the edges of exotic pasture.

Photograph 4. Better quality vegetation within the north-south strip in the centre of the solar plant site.

Photograph 5. Woodland vegetation with a highly degraded understorey in the east-west strip along the southern boundary of the solar plant site.

Photograph 6. Hollow-bearing tree within the east-west strip along the southern boundary of the solar plant site.

Photograph 7. Native grasses within the east-west strip along the southern boundary of the solar plant site.

Photograph 8. Bathurst Burr (*Xanthium spinosum*) in woodland vegetation around the dam area along the southern boundary of the solar plant site.

Photograph 9. Close up of Bathurst Burr (*Xanthium spinosum*) around the dam area along the southern boundary of the solar plant site.

Photograph 10. Scattered White Cypress Pines (*Calitris glaucophylla*) within exotic pasture in the north-east portion of the solar plant site.

Photograph 11. Bare ground within exotic pasture in the west of the solar plant site.

Photograph 12. Grey-crowned Babblers and a Noisy Miner within the TSR to the south of the Barrier Highway

Photograph 13. Better quality woodland vegetation within the north-south strip in the centre of the solar plant site.

Photograph 14. Northern section of the transmission easement looking south from the solar plant site.

Photograph 15. Vegetation along the northern verge of the Barrier Highway within the proposed transmission easement.

Photograph 16. Vegetation along the northern verge of the Barrier Highway within the proposed transmission easement looking from the south.

Photograph 17. Vegetation south of the Barrier Highway within the proposed transmission easement.

Photograph 18. Cultivated area in the southern portion of the transmission easement looking south towards the existing 132kV line.

APPENDIX I AUTHOR QUALIFICATIONS AND EXPERIENCE

Dave Maynard (Lead author/lead ecologist - botany)
B. Sc. (Hons 1)

Dave holds qualifications in science and engineering. He completed his honours in plant systematics in conjunction with the Botanic Gardens Trust, Sydney in 2004. Dave has extensive experience working on the north-western plains, south-western and north-western slopes and the southern tablelands of NSW in a broad range of vegetation types. This includes project management, field surveys and biodiversity impact assessment for four large scale solar farms at Nyngan, Moree, Manildra and Bungendore, and large scale wind farms at Rye Park, Collector, Birrema and Gullen Range. These assessments included reviewing existing information on State and Commonwealth listed threatened entities with potential to occur at the sites, undertaking detailed flora and vegetation community surveys (including targeted threatened species surveys), identification of biodiversity impacts, mapping of biodiversity constraints and recommendations of management strategies to mitigate biodiversity impacts at the sites. During the initial stages of these projects Dave also conducted preliminary constraints analyses involving rapid site assessment and prioritisation of biodiversity issues. Dave has also undertaken broad scale rapid vegetation assessment in the Mudgee region as part of the OEH Land Alive Project.

Freya Gordon (Co-author/lead ecologist - fauna)
Qualifications

Freya Gordon is a senior ecologist with nghenvironmental. Projects she has managed and implemented include a microbat monitoring program for the Holbrook Bypass (RTA); a Squirrel Glider monitoring program for the Albury Bypass (Conneq); and multiple ecological assessments and constraints analyses for Stockland, the RTA, Lake Coal, Epuron, and local councils. Freya has designed and coordinated a Striped Legless Lizard (*Delma impar)* monitoring program and is currently working on a Pest Bird Management Plan for the Bathurst Council. 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 conducted shorebird monitoring for Birds Australia, wildlife monitoring for Sydney Airport Corporation Limited, and managed large scale field programs in the Simpson Desert for the University of Sydney Desert Ecology Research Group.

Jackie Miles (Ecologist)
B Sc.

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.

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.

Brooke Marshall (Project manager/senior review and technical input)
B. Nat. Res. (Hons 1), CEnvP

Brooke graduated as a first class honours Natural Resources graduate of the University of New England (UNE).

Since joining nghenvironmental, Brooke has provided a range of services including 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. Key projects have included impact assessments for several wind and solar farm developments.

Brooke is an accredited Biobanking Assessor and Certified Environmental Practitioner.