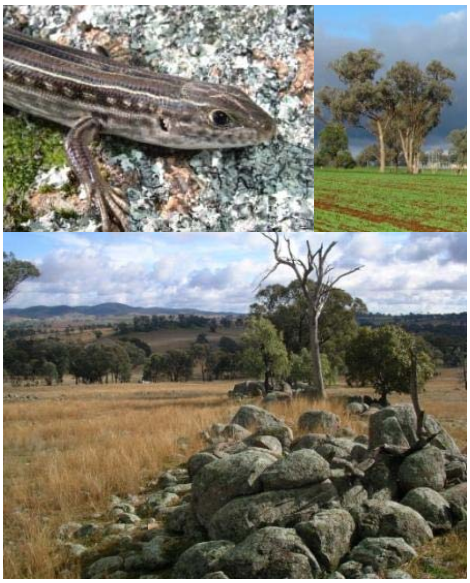
Appendix E Biodiversity Assessment

Biodiversity Assessment

MANILDRA SOLAR FARM



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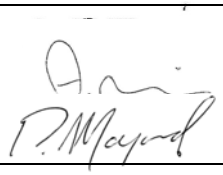
Final V1.0	01/11/10	Andrew Morrison Dave Maynard		Brooke Marshall		Brooke Marshall	

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Acronyms and terminology used in this report

Acronyms

DECCW	Department of Climate Change and Water (NSW)
DEWHA	Department of Environment, Water, Heritage and the Arts (C'th)
TSC Act	*Threatened Species Conservation Act 1995* (NSW)
EPBC Act	*Environmental Protection and Biodiversity Conservation Act 1999* (C'th)
NPWS	National Parks and Wildlife Service (NSW)
EEC	Endangered Ecological Community
CEEC	Critically Endangered Ecological Community
ROTAP	Rare or Threatened Australian Plants register (CSIRO)
JANIS	Joint ANZECC/MCFFA National Forest Policy Statement Implementation Sub-committee

Terminology

PV array	Refers to a photovoltaic array, a linked collection of photovoltaic modules which are made up of interconnected solar cells.
Threatened entity	Refers to all units listed as threatened under the EPBC Act and/ or TSC Act including species, populations and ecological communities
Key species or key taxa	'Key species' or 'key taxa' refers to taxa listed under any category of conservation status by relevant legislation (i.e. migratory through to endangered under EPBC Act or TSC Act) and taxa naturally occurring at low densities (such as raptors).
Subject site	The area directly affected by the proposal.
Development Envelope	The development envelope refers to an assessment approach. All parts of the site which have the potential to carry infrastructure are referred to as the development envelope. In practice infrastructure would rarely occupy the entire development envelope and hence the final layout of the development, or subject site, is a subset of the development envelope. The development envelope differs from the subject site in that it provides a site-specific study area within which the most appropriate areas for direct impact on biodiversity values are identified.

1 INTRODUCTION

1.1 PURPOSE OF THE REPORT

Infigen Suntech Australia Pty Ltd ('Infigen') proposes to construct a 50 megawatt capacity photovoltaic solar farm (solar farm) at Manildra in central western New South Wales. This Biodiversity Assessment examines biodiversity values and likely impacts associated with the proposed solar farm. The Biodiversity Assessment:

- Provides a summary description of the proposed works
- Outlines the environmental and legislative context of the Proposal
- Identifies, describes and maps the biodiversity values of the Proposal site (the 'subject site'), including threatened species and communities
- Classifies and maps the biodiversity constraints in relation to the proposed development
- Identifies and assesses the significance of the potential impacts associated with the Proposal to biodiversity values
- Provides a series of recommended measures designed to avoid and mitigate impacts to biodiversity values.

The Biodiversity Assessment is intended to meet the assessment requirements under Part 3A of the *Environmental Planning and Assessment Act 1979*, the *Threatened Species Conservation Act 1995* and the Commonwealth *Environmental Protection Biodiversity Conservation Act 1999*, the Director-General's Requirements for the project issued by the Department of Planning and the Draft Guidelines for Threatened Species Assessment (DEC, 2005).

1.2 THE PROPOSAL

1.2.1 Location

The proposed solar farm would be located on a 180 hectare site beside the Molong Manildra Road, Manildra. The location of the Proposal Site is shown in Figure 1-1 .

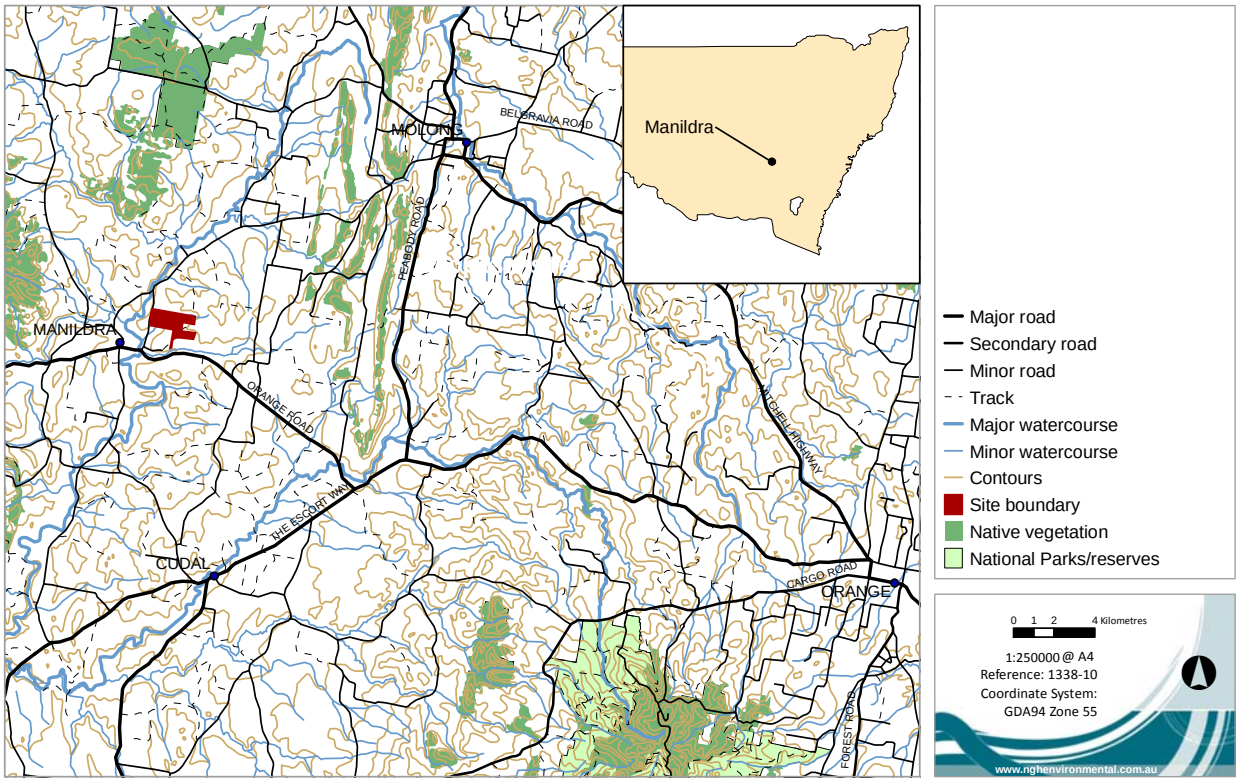

Figure 1-1 Location of the proposed Manildra Solar Farm

1.2.2 Proposal description

The solar farm would comprise a series of photovoltaic modules (PV arrays) mounted on fixed frames, and would occupy approximately 100 hectares. Preliminary layout and structural plans for the Proposal are provided in Appendix F and the Proposal Site boundary is shown in Figure 1-2.

The Manildra Solar Farm would connect to the existing Manildra 132kV substation which is immediately adjacent to the solar farm. The solar farm would have an expected operating life of up to 50 years. The decommissioning phase would remove all above ground infrastructure from the site.

The Proposal would involve the construction, operation and eventual decommissioning of:

- A fixed photovoltaic solar module array, arranged in a series of rows between one and three metres above the ground, angled for maximum efficiency and supported by steel framing on steel posts driven into the ground to a depth of 2 metres or concrete footings resting on the ground surface.
- A series of central inverters and kiosk transformers distributed throughout the PV array
- Electrical connections between the PV array , central inverters and transformers via underground or frame secured cabling
- Electrical connection into the existing 132kV Manildra substation via an underground transmission line
- Internal access tracks and upgrades to existing roads, where required
- Fencing and landscaping around the Solar Farm
- Fencing around offset areas
- Site office and Operations and Maintenance building

- A Research Office and monitoring infrastructure
- Additional temporary construction infrastructure such as a site compound and equipment laydown area.

The construction company Tenix would be engaged to construct the solar farm. During the construction phase up to 50 staff would be working on site at any time. A suitable location for the site office would be selected, avoiding areas that are regarded as having environmental constraints. The site office would include several demountable buildings, and an amenities block located on site for the duration of construction. The site facilities would cover an area of 400 m^2 and would be fenced independent of the PV array site.

The solar farm would be surrounded by a security fence as a safety precaution to prevent trespassers and stock ingress. Standard 2 to 2.6 metre cyclone fencing would be installed for perimeter fencing.

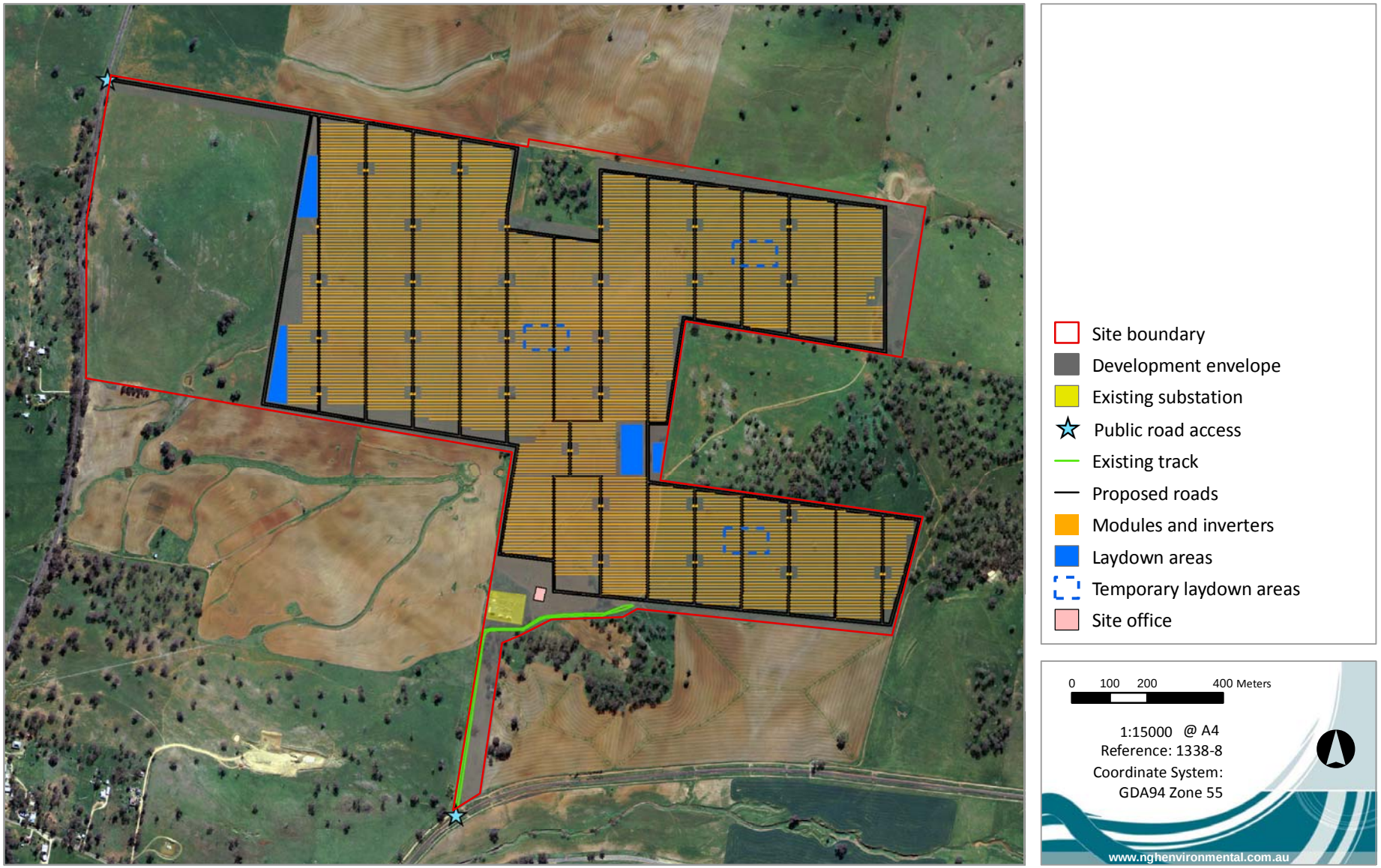

Figure 1-2: Indicative Manildra Solar Farm layout showing roads, modules and inverters, lay-down areas and site office with the development envelope

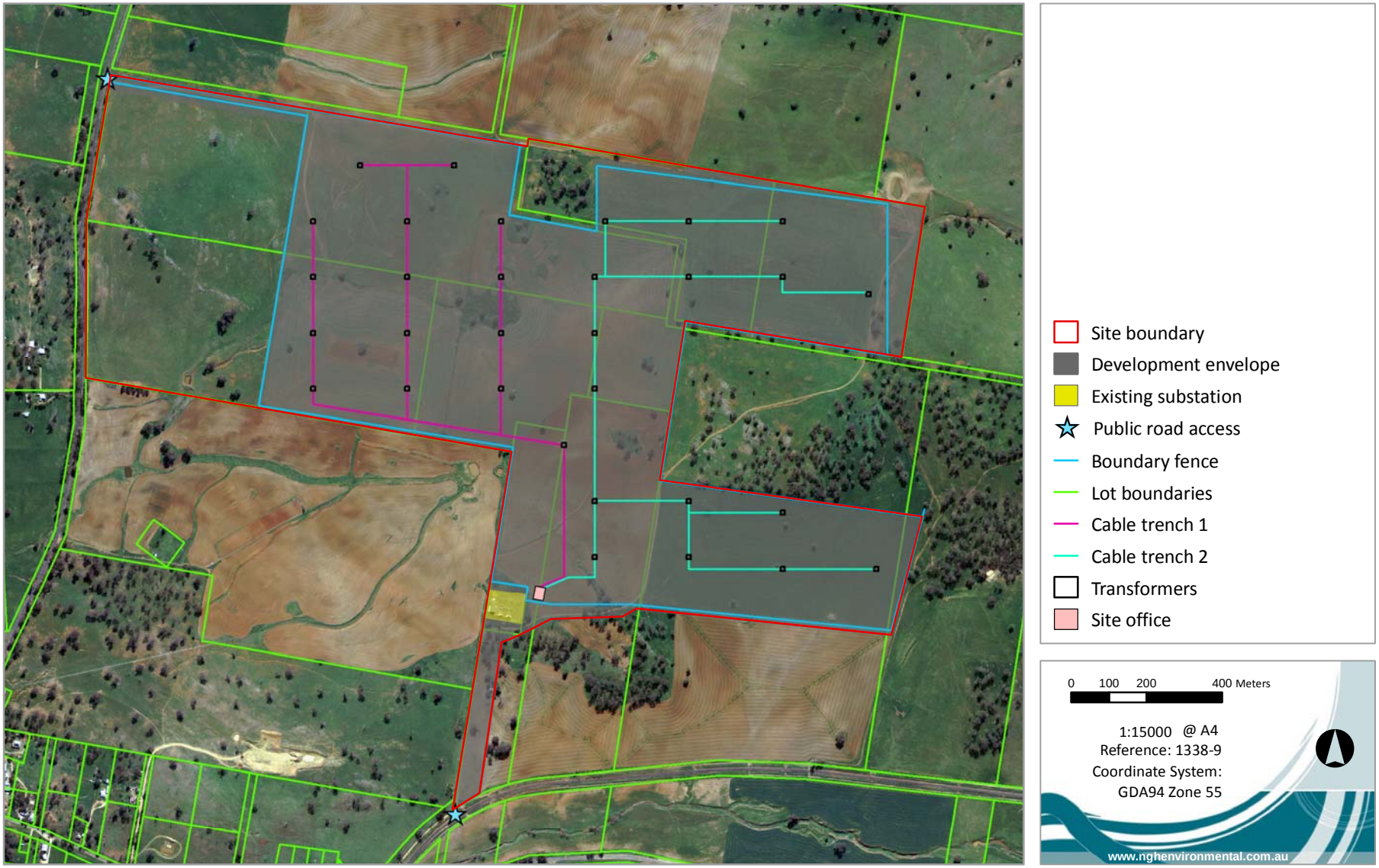

Figure 1-3 Indicative Manildra Solar Farm layout showing cadastral boundaries, boundary fence, transformers, site office and underground transmission lines

1.2.3 Potential impacts of the Proposal

Potential impacts to biodiversity during the construction phase of the solar farm Proposal relate to site preparation, operation of vehicles and machinery and the installation of infrastructure. This may involve earthworks and excavations, vegetation clearing and pollution risks from chemicals used onsite and concreting works.

The operation of PV arrays is generally considered to generate low environmental impact, especially with regard to biodiversity values (Kaygusuz 2009). The components are non-moving, the surface non-reflective and the PV arrays release no emissions. The potential environmental impacts of PV solar farms depend on the size and nature of the project and are frequently site specific (Gekas *et al.* 2002). Biodiversity impacts in particular are likely to be closely tied to the specific biodiversity values of the site and their sensitivity to the installation of infrastructure such as solar module arrays, perimeter fencing and overhead transmission lines.

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

- **Environmental benefits** - significant noise or chemical pollutants emission reductions and an increase in soil humidity and plant growing conditions in dry areas
- **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. Impacts are 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. In the case of copper indium diselenide (CIS) and Cadmium Tellure (CdTe) panels, which include small quantities of toxic substances, there is a potential slight risk that a fire in an array might cause small amounts of these chemicals to be released into the environment (Tsoutsos *et al.* 2005). The photovoltaic PV array array (PV array) being considered for this Proposal consists of Suntech 270 Watt Poly-crystalline solar panels. These silicon based panels do not pose a pollution risk in the event of fire[1].
- **Air pollution** - minor emissions associated with transport of the modules.

Mitigation of biodiversity impacts can be achieved by avoiding ecologically sensitive (Gekas *et al.* 2002).

Specific potential biodiversity impacts relevant for the Manildra solar farm project are summarised in Table 1-1.

[1] The Suntech modules to be used do not contain these heavy metals, have passed the Underwriters Laboratories standard UL1703 (which includes flammability tests) and do not pose a pollution risk in the event of fire.

Table 1-1 Potential biodiversity impacts of the Proposal

	Construction and decommissioning	Operation phase
Vegetation	• Clearing and disturbance during construction and installation of the array • Tree clearing required for the transmission line corridor • Risk of noxious and environmental weed introduction and spread	• Microclimate impacts under the PV array (shading, temperature, humidity) • Potential soil erosion under the array from concentrated rainsplash and possible vegetation loss • Shading under the PV array • Weed growth and spread
Fauna	• Clearing of habitat for the transmission line and access roads (such as tree food sources, tree hollows, rock habitats) • 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 • Movement barrier and collision hazard created by perimeter fencing (also potential predator exclusion) • Habitat avoidance due to presence of infrastructure • Vehicle collision risks to fauna
Riparian and aquatic habitats	• Potential soil erosion and sedimentation • Alteration to local hydrology due to earthworks, site drainage or concentrated runoff • Pollution risks	• Potential soil erosion and sedimentation during the construction phase, and possible loss of soil cover resulting from shading or poor establishment of groundcover under the PV arrays • Alteration to local hydrology (eg due to module washing, site drainage or concentrated runoff) • Pollution risks

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 2008).

The subject site is located in the NSW South Western Slopes Bioregion, an extensive area of foothills and isolated ranges comprising the lower inland slopes of the Great Dividing Range extending from north of Cowra through southern NSW into western Victoria. The South Western Slopes Bioregion has been intensively cleared and cultivated; what native vegetation remains is mostly fragmented. These woodland fragments are important for species such as the vulnerable Superb Parrot (*Polytelis swainsonii*) and the endangered Regent Honeyeater (*Xanthomyza phrygia*) as well as non-breeding Swift Parrots (*Lathamus discolor*). Many of the remnant native vegetation communities in the bioregion are poorly conserved, with conservation tenures together occupying only about 2.3 per cent of the bioregion (DECCW 2008).

2.1.2 Catchment Management Authorities and subregions

The study area lies within the Lachlan Catchment Management Authority (CMA), close to the northern border with the Central West CMA. The study area is located close to the boundary between four catchment subregions:

- Central West CMA
    - Upper Slopes subregion
    - Orange subregion
- Lachlan CMA
    - Upper Slopes subregion
    - Orange subregion

These catchment subregions contain a large variety of landforms and vegetation types. Around 76% of the Lachlan CMA supports native vegetation cover although much of this is modified, while the majority of the Central West CMA has been cleared for agriculture. Some vegetation communities in the CMAs are poorly reserved, including Box-Gum Woodland, Native Grasslands, Chenopod Shrubland and wetlands and floodplain communities. Across the four subregions, there are six ecological communities, 24 flora and 60 fauna species listed as threatened under the NSW *Threatened Species Conservation Act 1995* (TSC Act).

2.1.3 Cabonne Local Government Area

The subject site is just outside the town of Manildra (population 503 at the 2006 census), in central western NSW. Manildra is within the Cabonne Local Government Area (LGA). The main land use in the

Manildra area is agriculture, including livestock farming (sheep for wool and meat; beef cattle) and cropping. Important crops in the area include wheat and canola (Cabonne Council 2009). The subject site is zoned No. 1 (a) General Rural Zone under the provisions of the Cabonne Local Environmental Plan 1991.

2.1.4 District scale

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 (see Locality assessment below).

Key conservation values include:

- The district forms part of the South-West Slopes Important Bird Area (IBA), which protects the core breeding area for the Superb Parrot (Birds Australia 2010)
- The district contains remnant Box-Gum Woodland (EEC)
- There are no protected areas within the district, although Goobang National Park lies 20-40 kilometres to the west and north-west.
- There are no significant wetlands in the district

2.1.5 Locality assessment

A locality-scale review of habitats was conducted with reference to aerial photography, topographic maps and vehicle-based survey results. The locations of important wetland, woodland and forest habitat areas, and potential connectivity with the subject site, were examined. For the purposes of this report, the district occupies an area surrounding the subject site over a radius of 15 kilometres.

The subject site is located in an area of largely cleared agricultural land which forms a matrix between several significant areas of remnant native vegetation. Nearby forest areas include:

- Five kilometers to the west lies forest/woodland that is connected with Goobang National Park to the north and Mandagery and Black Yamma State Forests to the south and south west.
- Five kilometers to the north lie low rocky ranges supporting uncleared native vegetation connected to Killonbutta State Forest further to the north.
- Located seven kilometers to the east, three thin, parallel, wooded ridges extend over twenty kilometers from north to south.

Connectivity between the remnant forests is generally limited to farmland carrying low density cleared woodland and lone paddock trees, with no clearly delineated corridors for fauna. Several waterways in the district provide more definitive fauna movement corridors through this matrix. Manildra Creek provides a movement corridor to the west and Mandagery Creek provides somewhat less continuous riparian tree coverage to the north and south of the subject site.

2.2 SITE DESCRIPTION

Land at the Proposal site is gently undulating with rocky patches throughout. Elevation ranges from 450 m to 490 m. The site is at a higher elevation than the majority of the Manildra township and has no issues with flooding; the majority of runoff directed towards the south and west. A small drainage

line runs through a short section of the most western paddock. Mandagery Creek lies 1.5 km west of the site.

The subject site is largely cleared of tree and shrub cover. The understorey is entirely exotic in cropped areas, and in grazed areas, is dominated by exotic grasses or native grasses with exotic forbs. Native species diversity is generally low. Native vegetation at the site is likely to be derived from Box-Gum Woodland. Overstorey species are predominantly White Box and Yellow Box eucalypts. Most trees are mature although very few have formed hollows.

2.3 POLICY AND LEGISLATION

The Proposal is deemed Critical Infrastructure and would be assessed as a Major Project under Part 3A of the *Environmental Planning and Assessment Act 1979* (EP&A Act). Projects approved under Part 3A of the EP&A Act require the approval of the Minister for Planning (via the NSW Department of Planning, or DoP). A requirement of Part 3A projects is to 'improve or maintain' biodiversity values.

Section 5A of the *Environmental Planning and Assessment Act 1979* (EP&A Act) specifies seven 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. Although not a legal requirement of a Part 3A development, Assessments of Significance provide a transparent and systematic characterisation of impact for listed entities. Assessments of significance have been completed for 12 threatened species identified as having the potential to be impacted by the Proposal.

The Department of Climate Change & Water (DECCW), who administers the *Threatened Species Conservation Act 1995,* will be consulted by the Department of Planning regarding potential impacts to NSW threatened species. The provisions of *State Environmental Planning Policy 44 Koala Habitat Protection* apply to the Proposal and are discussed further in section 5.4.3.

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'. 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.

3 ASSESSMENT APPROACH AND METHODOLGY

3.1 APPROACH

The Biodiversity Assessment involves:

- A review of research literature, online databases and other sources to determine regional and local biodiversity values.
- The methods and results of field investigations.
- Consideration of likely constraints and risks related to biodiversity.
- An evaluation of the likelihood of threatened species, populations and communities to occur within the study area and their potential to be impacted by the Proposal.
- Identification and mapping of regionally rare or declining species.
- Measures to reduce the risks and identified impacts, including avoidance and mitigation.

3.2 PRELIMINARY ASSESSMENTS

Online database searches of threatened and migratory species were undertaken for the Lachlan and Central West CMA catchments, Upper Slopes and Orange sub-catchments using the DECCW threatened species database and over a 25 kilometre radius using the Commonwealth EPBC Act Protected Matters search tool. The four sub-regions were included in the DECCW threatened species database search as the site is located close to the boundary of these regions. Other online resources included the NSW DECCW Wildlife Atlas, the PlantNET database of the Botanical Gardens Trust and threatened species databases (DECCW and DEWHA). Topographic maps and air photographs were used to prepare a draft stratification for the survey based on topography and interpreted vegetation cover.

Previous survey records (including those in the DECCW Wildlife Atlas) and predictive vegetation mapping (DECCW 2010) were also consulted to identify threatened species and associated habitats for targeting during the surveys. The likelihood of identified threatened species occurring within the study area and their potential to be impacted by the Proposal was assessed using the evaluation in Appendix B.

3.3 FIELD SURVEY AND MAPPING

3.3.1 Flora

The flora survey was undertaken on 5 & 6 July 2010 using informal transects (random meander after Cropper 1993) and inspection points. In total 10 random meanders and 13 inspection points were surveyed. The random meanders were up to 30 minutes in duration and each covered up to 1 hectare. A total of 8.5 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. Inspection points were established along a series of random meanders located within relatively homogeneous stratification zones. Inspection points were used to confirm vegetation structure and

type and note any alterations in relative species abundance. Survey was targeted towards areas of potential habitat for significant or sparsely distributed plant species.

The random meander survey sites and general inspection points are indicated on Figure 3-1.

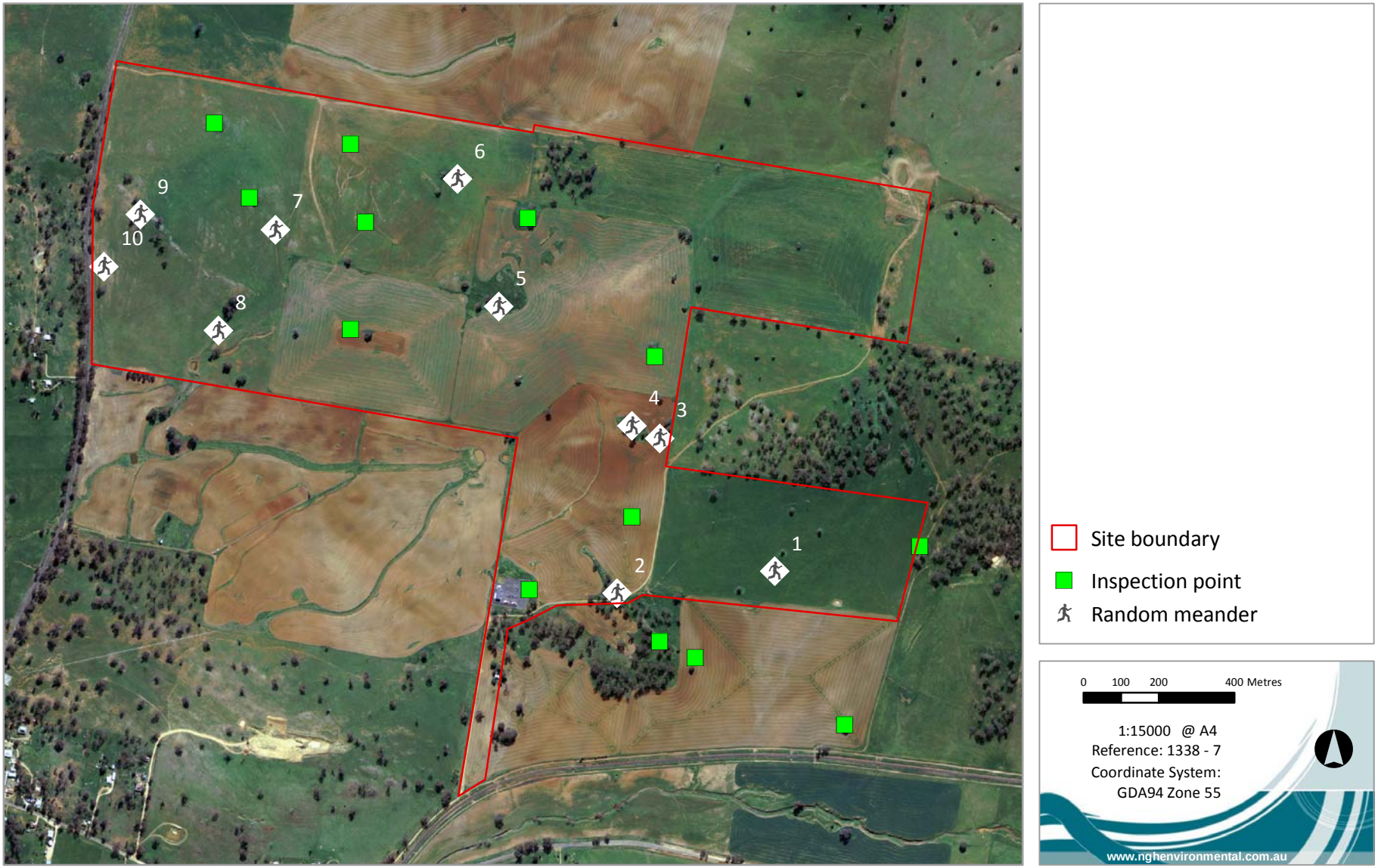

Figure 3-1 Location of flora survey sites

Vegetation condition was rated according to the following four-point scale, focusing on floristic integrity in the groundcover layer:

Exotic	Groundlayer dominated by exotics
Poor	Groundlayer dominated by one or two native grass species, <5 native non-grass species
Moderate	Groundlayer dominated by native grasses, 5-11 native non-grass species present
Good	Groundlayer dominated by native grasses with a diversity of native non grass (at least 12 native non-grass species).

These classes are considered most relevant for vegetation types with a naturally diverse grassy groundcover, such as woodland and natural grassland. The vegetation of the subject site has been classified using the NSW Vegetation Classification and Assessment (NSWVCA) system (Benson 2008) which provides the most recent and comprehensive classification for the South-western Slopes Bioregion.

3.3.2 Fauna

A fauna survey of the subject site and adjacent areas of remnant vegetation, was undertaken from the 5th to the 6th of July 2010 (winter). Weather during the survey was cool with some rainy periods on the night of the 7th. Details of the climatic conditions experienced during the survey are contained in Table 3-1.

Table 3-1: Survey conditions[2]

Date	Max(°C)	Min (°C)	Rain (mm)	Wind (3pm)	MSLP (hPa) (3pm)	Moon	Cloud
5/7/10	14	0.5	0.0	E @15km/h	1026	half	8/8
6/7/10	9.8	5.4	9.8	SW @17km/h	1020	half	5/8

Approach

The focus of the fauna survey was to identify and assess habitat, including suitability for threatened species, rather than to detect individual species. This approach is aimed at addressing the problems inherent in surveying for rare and cryptic species, particularly when utilising short duration surveys. Following the precautionary approach, if suitable habitat was found it has been inferred that the threatened species may also occur unless reliable data provides evidence otherwise.

[2] Weather observation data sourced from the BOM Parks weather station located 50km east of the subject site. Subject site climatic conditions are likely to have varied slightly from these figures due to spatial differences. The subject site received overnight rain, estimated at 5mm on the night of the 5/7/10.

This survey primarily focused on habitat assessment but also included 20 minute bird surveys, call playback, spotlighting, targeted habitat searches for reptiles and opportunistic records of sign and observations to identify habitat and detect resident species. The fauna survey effort is mapped on Figure 3-2. Survey information including survey methods, target species, and survey effort is shown in Table 3-2.

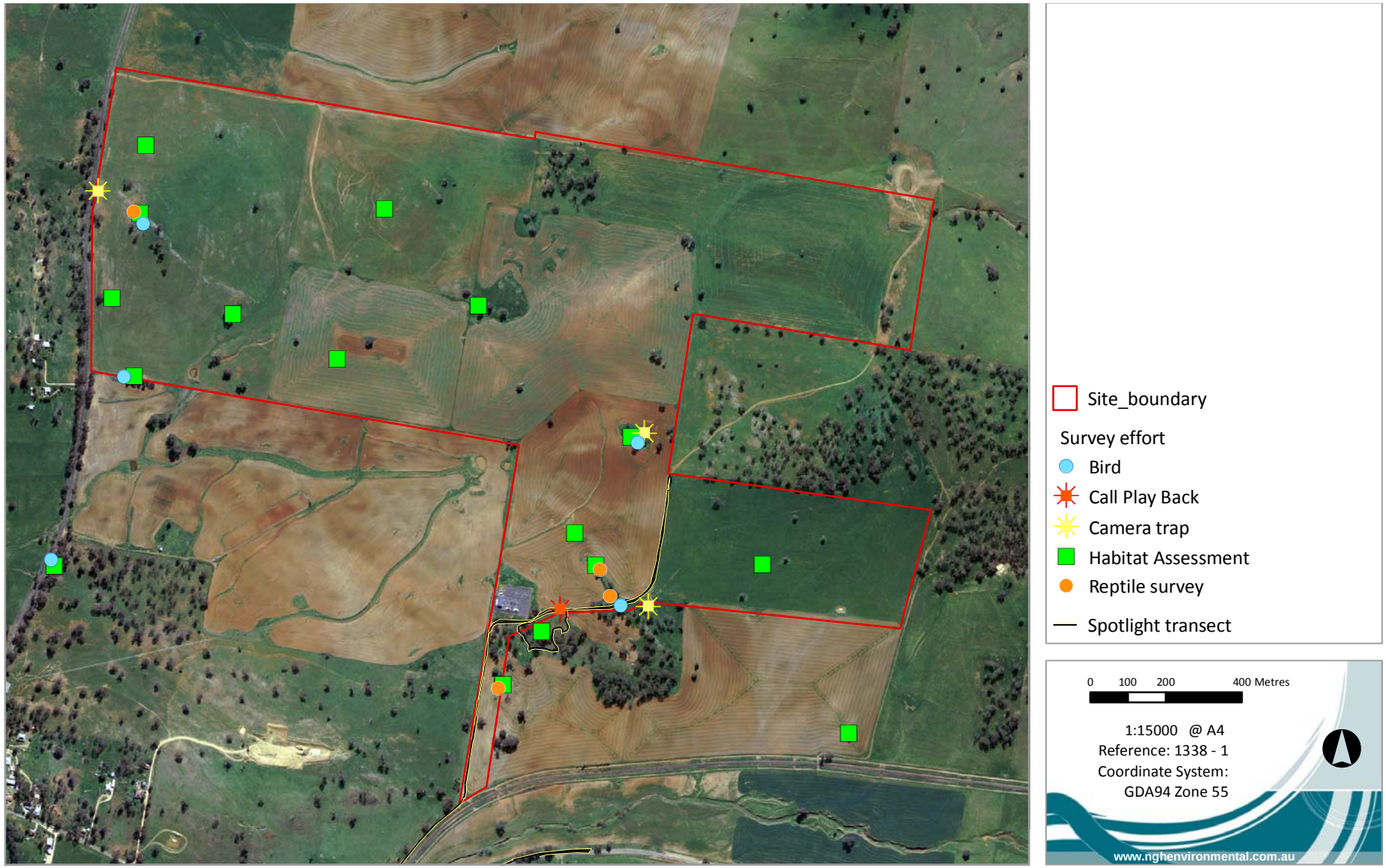

Figure 3-2 Fauna survey effort

Table 3-2 Fauna survey design and survey effort.

Survey type	Target species	Design	Survey effort
Habitat assessment	Threatened species sign and habitat	Habitat assessments recording presence and quality of threatened fauna habitat (for example hollow bearing trees, rock outcrops, proximity to water, stands of native grass, fallen timber, watercourses , mistletoe, past and present disturbance) were undertaken across the site. The survey points were originally stratified using aerial photography then adjusted if required following ground truthing to ensure thorough coverage of all habitat types.	16 assessments undertaken
Diurnal bird survey	Threatened bird species for example:: Superb Parrot Turquoise Parrot Brown Treecreeper	Twenty minute bird surveys were undertaken by one person covering an area of approximately 1 ha on foot. Birds were identified by call or observation (aided by binoculars). Additional opportunistic records were noted while completing other assessments on the site.	5 surveys; total of 120 minutes
Camera traps	Spot-tailed Quolls Feral predators	3 infra-red motion detection cameras (scoutguard SG550v) were installed for 1 night. Cameras were set ground bait stations located on existing animal pads. All were baited with honey and sardines.	3 camera nights
Spotlight	Arboreal mammals, nocturnal birds, amphibians for example: Squirrel Glider Large Forest Owls Spot-tailed Quoll	A foot spotlight session using a hand-held 12v 50w spotlight was conducted through the White Box woodland to the south of the substation. Spotlighting from a vehicle travelling <5km/hr was carried out through the subject site while travelling to and from the foot spotlight location.	1 foot transect, 1 vehicle transect

Survey type	Target species	Design	Survey effort
Call playback (CPB)	Barking Owl Powerful Owl	One survey broadcasting vocalisations of the Powerful Owl and Barking Owl was undertaken. Call playback was carried out after a 5 minute acclimation period. Calls for each species were played for 5 minutes. Listening for responses was carried out for an additional 5 minutes. Ten minutes of spotlighting around the call playback location followed the call play-back session.	1 surveys; 35mins
Reptile hand search	Pink-tailed Worm Lizard Little Whip Snake	Areas of rock outcrop or similar surface refuge sites were searched by hand. Reptiles found were caught and identified and the habitat values of the outcrop including presence of small black ants (food source for Pink-tailed Legless Lizards) and how embedded the rocks were was noted.	3 surveys; 50 minutes
Opportunistic	All	All opportunistic records of fauna or fauna sign were recorded.	at all times while on site

3.3.3 Mapping

Spatial data obtained during the survey using hand-held GPS Magellan and Garmin GPS units were plotted over aerial imagery (sourced from NSW Department of Lands) using ESRI's ArcGIS software for mapping, planning and presentation. Vegetation and condition boundaries were extrapolated from point and traverse data and notes taken during the general site inspection. All map references are based on the GDA 94 (new) datum. Due to discrepancies between the cadastral and aerial photography layers provided by the Department of Planning, the maps produced in this report show the Proposal infrastructure approximately 30m south-south west of the planned location in relation to the background aerial imagery.

3.3.4 Survey limitations

The short duration and winter timing of the survey was poor in terms of detection for many threatened flora and fauna species.

Some geophytic species, spring or summer flowering annuals and species which are inconspicuous or difficult to identify in their vegetative state will not have been recorded. The species diversity of the native pasture at the western extent of site in particular may have been underestimated. The possibility that significant species may have been omitted due to seasonal factors is addressed in section 4.3. Where some potential for unrecorded threatened species exists, this possibility is acknowledged and precautions incorporated into the impact assessment and mitigation measures.

At the time of survey the western areas of the subject site were being grazed by sheep, and this may have affected the recording and identification of some taller species and those being preferentially grazed. Ephemeral species which flower in response to irregular disturbance events such as fire will also have gone unrecorded. The development envelope occupies around 180 ha, requiring extrapolation and generalisation from the flora survey points, using air photo interpretation with some ground-truthing during the survey. Some fine-scale errors are possible, but are considered unlikely to alter the broad findings of the study. Areas under cropping within the subject site were considered to consist entirely of exotic agricultural species and were not investigated in any detail.

The winter timing of the survey was unsuitable for the detection of many threatened fauna species, particularly reptiles and microbats. Detailed habitat assessments were used as a surrogate for direct detection of threatened species and informed the assessment of probability of species occurring on the site.

The active and passive surveys undertaken in conjunction with the habitat assessments provide a snapshot of the biodiversity occurring on the site and should not be taken as a comprehensive inventory of species.

4 FLORA RESULTS

4.1 PRELIMINARY ASSESSMENTS

The Commonwealth EPBC Act Protected Matters search tool indicated two threatened ecological communities and four threatened species which are likely to occur in the search area (refer a.i.1.a.i.Appendix G). The DECCW threatened species database indicates the potential presence of an additional four threatened communities and nine threatened species listed under the TSC Act in the Upper Slopes and Orange sub-catchments of the Central West and Lachlan CMA catchments.

The evaluation presented in a.i.1.a.i.Appendix B concludes that one threatened community has at least moderate potential to be present in habitat at the subject site, and at least moderate potential to be impacted by the Proposal:

- White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland - Critically Endangered (EPBC) and Endangered (TSC).

The evaluation also concluded that two threatened species have low to moderate potential of occurring at the subject site and low to moderate potential to be impacted:

- Small Purple-pea (*Swainsona recta*) Endangered (TSC, EPBC)
- Silky Swainson-pea (*Swainsona sericea*) Vulnerable (TSC).

4.2 VEGETATION COMMUNITIES

For the purposes of the field survey and subsequent referral in the report the site was broken up into a number of areas largely based on paddock boundaries. The sections are referred to in the following descriptions and are as presented in Figure 4-1.

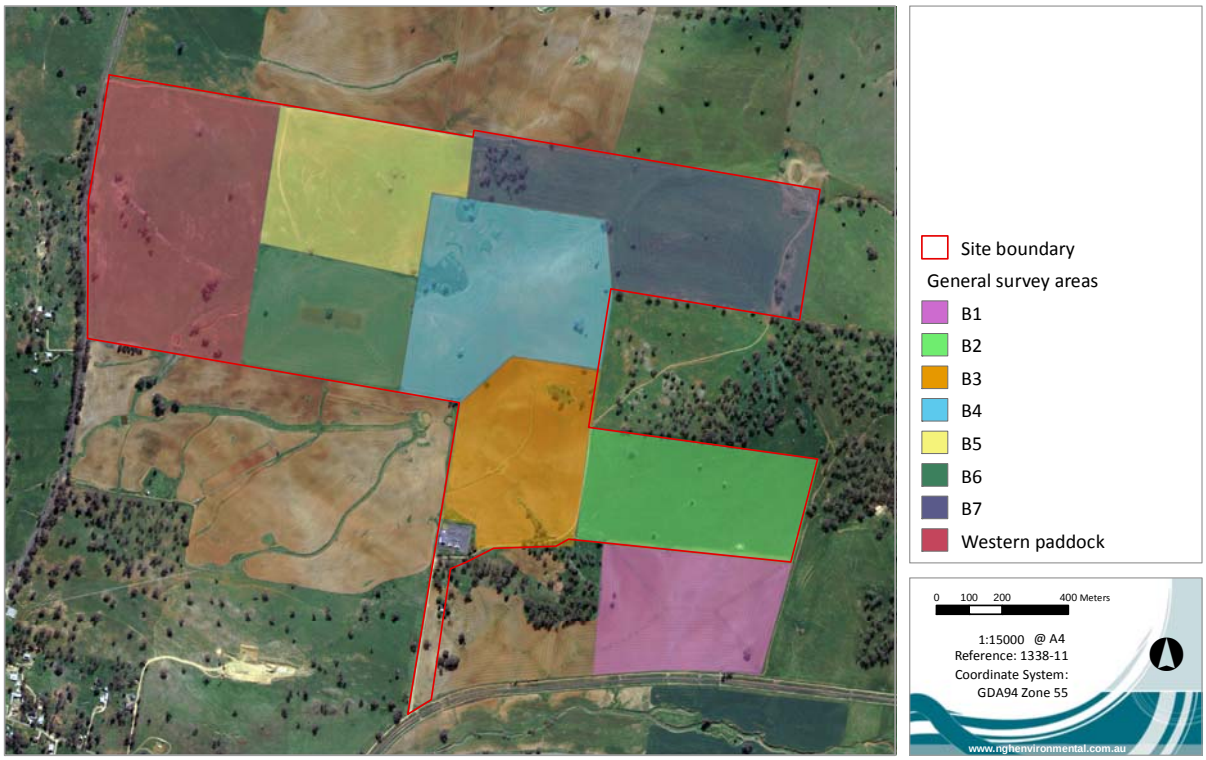

Figure 4-1 Designated survey areas at the Manildra solar farm site

The majority of the subject site (excluding the far west) was under cropping at the time of the survey, or was dominated by exotic grass species. These areas where no overstorey is present cannot be said to constitute any native vegetation community. However, scattered pasture trees were present in cropped and exotic pasture areas and, in comparison with more intact native vegetation within and adjoining the subject site, it was possible to ascertain the vegetation community that these trees were derived from. Where these trees are present it can be said that they represent these vegetation communities.

Remnant native vegetation within and adjoining the subject site is structurally representative of a grassy woodland formation and open grassland. The two most widespread, but now mainly cleared grassy woodlands in the sub-region are White Box (*Eucalyptus albens*) grassy woodland (ID266) and Blakely's Red Gum (*E. blakelyi*) and Yellow Box (*E. melliodora*) grassy woodland (ID277) (Benson, 2008). Both of these woodland communities belong to the Box-Gum Woodland community grouping. Remnant native vegetation within the subject site is representative of these communities. Native grassland occurs in the far west of the site (the western paddock) and is likely to be derived from these communities.

Other vegetation present within the subject site was restricted to isolated paddock trees comprising Kurrajong (*Brachychiton populneus*) and the introduced Pepper Tree (**Schinus areira*).

In summary, three vegetation communities were identified:

- Derived native grassland
- Box-Gum Woodland (native)
- Exotic (crop or pasture)

Flora survey results are summarised in Table 4-1. Random Meander survey points are mapped on Figure 3-1. The full list and general abundance of species recorded during the flora survey is presented in Appendix C. The configuration, distribution and condition of the vegetation communities at the time of the survey is discussed below and displayed in Figure 4-2

Table 4-1 Random meander survey results summary

Site	Community and location	Dominant species	Condition	Significance
1	Fallow paddock - red earths, dry area MGA 660767 6327515	**Eragrostis cilianensis, Bothriochloa macra, *Malva parviflora,*Hypochaeris glabra*	Poor	Low
2	Box-Gum Woodland - red earths, top of rise MGA 660351 6327457	*Eucalyptus albens, *Echium plantagineum, *Hordeum leporinum, *Urtica urens, *Malva parviflora*	Poor	Low-moderate
3	Cropped area, remnant trees - red earths, dry area MGA 660464 6327868	*Eucalyptus albens, * Sisymbrium orientale, *Echium plantagineum, *Urtica urens, *Malva parviflora. *Capsella bursa-pastoris*	Poor	Low-moderate
4	Cropped area, remnant trees - granite outcrops, dry area MGA 660390 6327900	*Eucalyptus albens, Bothriochloa macra *Sisymbrium orientale, *Echium plantagineum, *Capsella bursa-pastoris, *Avena sp.*	Poor	Low-moderate
5	Cropped area, remnant trees - red earths, drainage line MGA 66037 6328216	*Eucalyptus melliodora, *Malva parviflora, *Sisymbrium orientale*	Poor	Low-moderate
6	Exotic pasture - red earths, dry area MGA 659925 6328550	**Eragrostis cilianensis, *Trifolium sp, Chloris truncata, *Malva parviflora*	Poor	Low
7	Derived native pasture - granite outcrops, mid slope MGA 659437 6328417	*Austrostipa spp., Bothriochloa macra, Austrodanthonia spp., *Eragrostis cilianensis, * Trifolium sp.,Chamaesyce drummondii*	Moderate	Moderate[#]
8	Derived native/exotic pasture, remnant trees - red earths, drainage line MGA 659290 6328149	*Eucalyptus melliodora, *Malva parviflora, *Eragrostis cilianensis*	Poor	Low-moderate[#]
9	Exotic ground cover, remnant trees - granite outcrops, top of rise MGA 659083 6328457	*Eucalyptus albens,*Marrubium vulgare, *Chenopodium murale, *Malva parviflora*	Poor	Low-moderate
10	Derived native pature - granite outcrops, red earths MGA 658991 6328322	*Themeda australis, Austrostipa spp., Danthonia spp., Panicum effusum, Vittadinia muelleri*	Moderate	Moderate[#]

[#]Requires confirmation with a spring/summer survey

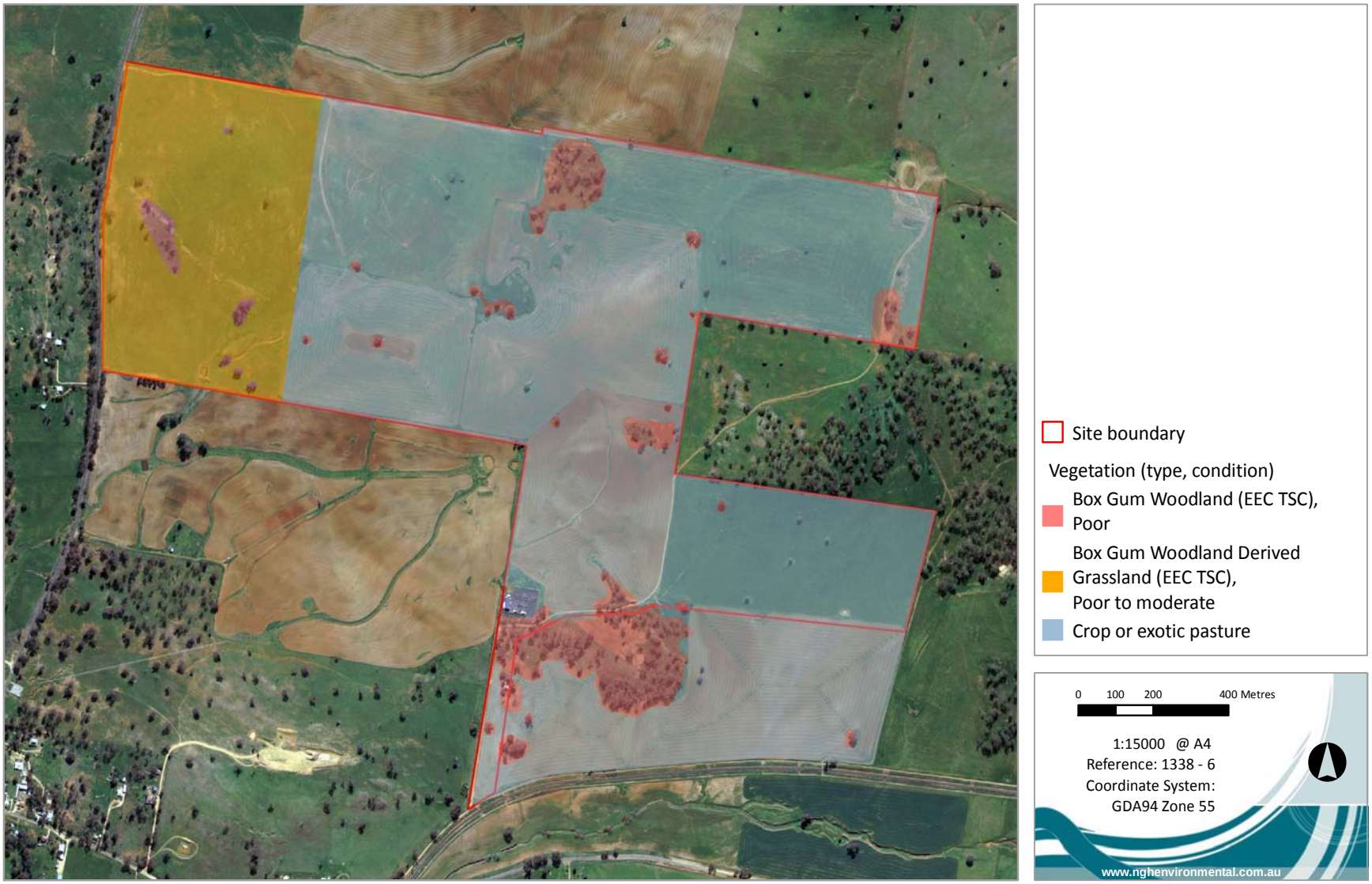

Figure 4-2: Vegetation communities present at the subject site

Areas under cropping and exotic pasture

Large areas in the central and eastern sections of the subject site are almost entirely utilised for Wheat (*Triticum aestivum*) and Canola (*Brassica sp.*) cropping with areas B1 & B3 utilised for Wheat and areas B4 & B6 for Canola (Figure 4-3). These areas have been repeatedly tilled for several years and, excluding isolated areas with scattered trees, are entirely comprised of the cropped species with other scattered, common exotics such as Small-flowered Mallow (**Malva parviflora*), Patterson's Curse (**Echium plantagineum*), Shepherd's Purse (**Capsella bursa-pastoris*) and Paddy Melon (**Cucumis myriocarpus*). Corners of these paddocks where tilling is not possible are also almost entirely exotic.

Figure 4-3 Example of areas under cropping at the Manildra Solar Farm site (Area B3 to the left and B4 to the right)

Area B5, north of the subject site, is dominated by the exotic grass, Stinking Love Grass (*Eragrostis cilianensis*) (Figure 4-4). This grass forms pure dense swathes across much of the said area and is generally regarded as an indicator of overgrazing or disturbance. Native grasses are scattered and patchy and predominately consist of Red Grass (*Bothriochloa macra*) and Spear Grasses (*Austrostipa spp.*). Exotic forbs are widespread and dominate in areas where grasses are sparse. A paddock in the south-east of the site (Area B2) (Figure 4-4) appears to have been chemically fallowed with the majority of vegetation having degenerated to a point where identification is not possible. Remains of Stinking Love Grass were evident and based on its dominance in Area B5, it is likely that this was dominant also in B2. Many forbs were in the early stages of regeneration and, although unable to be positively identified, are also likely to be exotic based on the species composition of surrounding areas.

Figure 4-4 Exotic dominated pasture in the north of the site (B5) and fallow paddock (B2)

Box-Gum Woodland

There are several closely related Box-Gum Woodland vegetation types described by Benson (2008) which include one or all of the canopy species White Box (*Eucalyptus albens*), Yellow Box (*E. melliodora*) and Blakely's Red Gum (*E. blakelyi*). These species were all present at the subject site.

The Box-Gum Woodland vegetation types are said to have few or no shrubs and a grassy understorey of very similar species composition. The two most common grassy woodlands in the sub-region are White Box grassy woodland (ID266) and Blakely's Red Gum and Yellow Box grassy woodland (ID277) (Benson, 2008). There was a clear pattern at the subject site where the rocky hill tops and rises were occupied predominately by White Box and the lower slopes, valleys and flats by Yellow Box and Blakely's Red Gum (Figure 4-5). This corresponds with the topographic descriptions of the communities provided by Benson and it is likely these are the communities represented on site.

Due to the high levels of disturbance at the site, almost all the overstorey species occurred with an almost entirely exotic understorey. Where native pasture occurs in the western section of the site, the species composition is common to the communities described by Benson and could be attributed to any one of these. Given these identification difficulties, and since all the types have similar EEC conservation status, they have not been differentiated in detail in this assessment. For the purposes of this assessment both communities will be referred to collectively as Box-Gum Woodland.

Figure 4-5 Remnant White Box on ridge tops and rises (left) and Yellow Box on lower slopes (right)

Derived Grassland

The paddock in the far west of the site supports a mosaic of native grass dominated areas and areas which are predominately exotic. Exotic areas tend to be limited to the high points and under trees (sheep camps); as such the bulk of the area was predominately native (Figure 4-6). Areas of native grasses were dominated by Spear Grasses (*Austrostipa spp*) and Red-grass (*Bothriochloa* macra) and to a lesser extent Wallaby Grass (*Austrodanthonia spp.*) and Kangaroos Grass (*Themeda australis*) particularly in better quality grassland to the west. Kangaroo Grass (*Themeda australis*) can indicate lower levels of past disturbance and higher potential for significant species in this community. Kangaroo Grass is uncommon at the site present only in the far west of THE WESTERN PADDOCK in small patches.

Native forb density was higher in this area however the likelihood of significant species being present is low. Native forbs were scattered and sparse over the majority of the area with exotic forbs common in open spaces between grasses. Native forbs became more dominant in the better quality grassland

to the west. The remnant trees within the area are comprised predominately of White Box, Yellow Box and Blakely's Red Gum and it is highly likely the native understorey in this area is derived from these communities. The derived grassland formation is common in the area due to the high levels of clearing for the purposes of grazing.

Figure 4-6 Native grassland and exotic patches under trees in the western paddock.

Table 4-2 shows the high level of depletion and poor conservation status of the woodland vegetation types present and from which the native pastures at the subject site are likely to be derived. Since woodlands frequently coincide with prime farmland, these communities have been heavily impacted by clearing, grazing, cultivation and the introduction of weed and pasture species. The impact of this depletion is compounded by the severe fragmentation and continuing degradation of remaining stands.

Applying the general JANIS reservation target of 15% of the original extent for each forest type (JANIS 1997), all of the native vegetation types within the study area are 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 types at the subject site (after Benson 2008)

Vegetation type	Pre-1750 extent in Bioregion (ha)	Extant area in Bioregion (ha)	Reserved in Bioregion (ha)
White Box Grassy Woodland			
Vegetation ID 266 Tablelands and Slopes Dry Herb/Grass Woodland	800000	35000 - 65000 (4.4 – 8.1 % of 1750 extent)	230 - 420 (0.03 – 0.05% of 1750 extent)
Yellow Box Grassy Woodland			
Vegetation Group 161 Tablelands and Slopes Dry Herb/Grass Woodland	500000	21000 - 39000 (4.2 – 7.8% of 1750 extent)	1100 - 1800 (0.2 – 0.4% of 1750 extent)

4.3 SPECIES AND COMMUNITIES OF CONSERVATION SIGNIFICANCE

4.3.1 Endangered Ecological Communities

The survey identified the presence of one listed threatened community at the subject site:

- White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland ('Box-Gum Woodland') (EPBC and TSC).

Box-Gum Woodland

NSW Endangered Ecological Community (EEC)

The Box-Gum Woodland, listed under the NSW *Threatened Species Conservation Act 1995,* includes intact and disturbed areas such as:

- Woodlands which include Yellow Box or Blakely's Red Gum (with or without native understorey); and
- Grasslands and pastures dominated by native grasses that are derived from this community.

As discussed in Section 4.2, the woodland and native grassland at the site meets the above description.

This community has the potential to be impacted by the Proposal. Pending further advice on the specific impact areas associated with the Proposal, an Assessment of Significance pursuant to the TSC Act will be conducted to characterise the impacts to the EEC.

Commonwealth Critically Endangered Ecological Community (CEEC)

The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) sets more stringent criteria for the recognition of the Box-Gum Woodland Critically Endangered Ecological Community (CEEC) listed under that Act. Under the EPBC Act, Box-Gum Woodland remnants belong to the CEEC if:

- one of the most common overstorey species is/was Yellow Box, Blakely's Red Gum or White Box; and
- the understorey is predominantly native; and
- the patch is greater than 0.1 ha; and either:
    - there are 12 or more non-grass species in the understorey including at least one important species (based on a list issued by the Commonwealth Government); or
    - the patch is greater than 2 ha with an average of 20 or more mature trees per hectare, or natural regeneration of the dominant overstorey eucalypts is present.

Vegetation at the subject site would not meet these criteria and the Commonwealth Box-Gum Woodland CEEC is therefore not present at the site.

4.3.2 Biometric status

Under the DECCW Biometric guidelines (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).

Approval to impact red flag areas may be granted provided:

- All reasonable measures have been considered – to avoid adverse impacts on the red flag area or to retain the viability of the red flag area.
- The contribution that the development site's impacted biodiversity values make to regional biodiversity values is low.
- The development site's biodiversity values are low, or not viable .
- If the development impacts on a vegetation type that has 10% or less remaining in the catchment management area, the area of land containing this highly cleared vegetation type is less than 4 ha in size (DECC 2008a).

According to the BioMetric 2.0 Operations Manual (DECCW 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.

Hence, treeless native pasture derived from an EEC and dominated by native grasses, and trees in woodland formation satisfying the over storey per cent foliage cover over exotic pasture, are considered 'moderate to good' Biometric condition and are red flag areas. However, it should be noted that:

> *Only patches of vegetation >0.25ha are assessed separately (as distinct zones) from surrounding vegetation (e.g. a patch of vegetation with benchmark overstorey cover that is <0.25ha is not assessed separately from surrounding vegetation with sparser overstorey cover)* (DECCW 2008b).

As such small isolated patches of Box-Gum trees (>25% minimum per cent foliage cover) occurring in exotic pasture or crop land that don't meet the minimum patch size would be assessed as per the surrounding vegetation type. In the case of large areas of exotic pasture or crop, these small patches would be considered low condition and not a red flag area.

4.3.3 Threatened flora species

No threatened species were recorded during the field survey. The evaluation presented in Appendix B concludes that three threatened species have at least a low to moderate potential to be present in habitat at the subject site, and at least a low to moderate potential to be impacted by the Proposal. These species are listed in Table 4-3.

Table 4-3 Threatened flora potentially present at the subject site

Species	Status
Austral Toadflax (*Thesium australe*)	Vulnerable (TSC, EPBC)
Small Purple-pea (*Swainsona recta*)	Endangered (TSC, EPBC)
Silky Swainson-pea (*Swainsona sericea*)	Vulnerable (TSC)

All of the three threatened species identified as having potential to be present at the site are perennial. However, species such as Small Purple-pea (*Swainsona recta*) and Silky Swainson-pea (*Swainsona sericea*) may not have been conspicuous during the winter period. Despite the seasonal limitation of the survey, the native pasture of the subject site is considered unlikely to support these grazing-sensitive species. Regardless, a survey during spring (early November) would be required to confirm this assessment.

4.3.4 Regionally significant species

None of the nationally significant (ROTAP - Rare or Threatened Australian Plants) species listed by Briggs and Leigh (1995) were recorded during the survey.

4.4 DISTURBANCE AND WEEDS

The woodland vegetation at the site has been cleared and thinned to provide areas for cropping and pasture. Past clearing and agriculture has produced a range of direct and indirect impacts to flora habitats, including altered microclimate, loss of pollinator and dispersal fauna, erosion of soils, altered hydrological regimes and elevated soil nutrients. Minor gully erosion was evident in the drainage line in the south west of the western section of the site.

Agricultural activities have resulted in the majority of the site being planted with introduced crop species such as Wheat and Canola. The disturbance has led to the colonisation of a range of other introduced plant species. In areas not utilised for cropping, grazing is likely to have reduced or eliminated selectively grazed or grazing sensitive species, such as Kangaroo Grass (*Themeda australis*), terrestrial orchids, wattles and pea shrubs.

Minor pasture weed species were common across the majority of the study area. Three noxious weeds declared for the Cabonne Shire Council Area under the *Noxious Weeds Act 1993* were recorded at the subject site. The status and distribution of these weeds at the site are summarised in Table 4-4.

All of the recorded noxious weeds are listed as Class 4 weeds, meaning that the growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority.

Table 4-4 Noxious weeds at the subject site

Weed species	Status	Abundance and distribution
African boxthorn **Lycium ferocissimum*	Class 4	Few individuals in patch of White Box in southern section of the site (survey point 2)
Bathurst burr **Xanthium spinosum*	Class 4	One dead individual in the patch of White Box in the central northern section of the site (inspection point). Scattered individuals in B5 and THE WESTERN PADDOCK.
Scotch thistle **Onopordum acanthium*	Class 4	One individual detected in B3 (survey point 4) and removed by **ngh**environmental.

5 FAUNA RESULTS

5.1 PRELIMINARY ASSESSMENTS

The Commonwealth EPBC Act Protected Matters search tool indicated 14 threatened terrestrial fauna species and 12 migratory species listed under the EPBC Act which are likely to occur in the search area (refer a.i.1.a.i.Appendix G). The DECCW threatened species database indicates the potential presence of 53 threatened listed under the TSC Act in the Monaro sub-catchment of the Murrumbidgee CMA catchment.

The Threatened Species Evaluation presented in Appendix B.2 concludes that 62 threatened fauna species have at least moderate potential to use habitat at the subject site. An additional four migratory species listed under the EPBC Act have potential to be present at the site. Of these, 12 threatened species have at least low-moderate potential to be impacted by the Proposal. These species include woodland birds that forage in grassland and grassy woodland understorey, hollow-dependent birds and microbats and ground–dwelling reptiles.

5.2 SURVEY RESULTS

A total of 35 species including 1 amphibian, 27 birds and 4 mammals and three reptile species were recorded during the winter survey. A species list is included in a.i.1.a.i.Appendix D. In a previous Statement of Environmental Effects Report for the Manildra Substation study (Terra Consultants 2003) a total of 20 fauna species were recorded at the Manildra Substation site. However, this survey was also habitat based and did not attempt to provide a comprehensive list of all species inhabiting the site.

Two species listed as Vulnerable under the TSC Act were detected on, or adjacent to, the subject site (refer to Section 5.4). These include:

- Superb Parrot (on subject site)
- Flame Robins (on and adjacent to subject site)

General survey areas described in the following sections are the same as those referred to in Section 4.2 and are displayed in Figure 4-1

5.3 HABITAT RESULTS

As described in Sections 2 and 4, the subject site has a long history of disturbance and vegetation structure is simplified. The agricultural landscape matrix extends for at least six kilometres in every direction from the site. In spite of this, some threatened species habitat features exist on site and two threatened species were recorded during surveys (Superb Parrots and Flame Robins).

5.3.1 Habitat types

From the habitat assessments conducted across the subject site (see Appendix B.1) six major habitat types were identified:

- White Box, Yellow Box, Blakely's Red Gum Woodland stands (Box-Gum Woodland)
- Isolated remnant trees

- Rocky outcrops
- Pasture
- Modified aquatic habitat
- Cultivated paddocks

These habitat types are summarised in Table 5-1 below and selected habitat features recorded on the subject site are detailed in Figure 5-1

Table 5-1 Fauna habitat summary

Habitat type	Habitat quality	Location	Habitat features	Potential threatened species[3]
White Box, Yellow Box, Blakely's Red Gum Woodland stands (degraded)	Low - moderate	Seven stands of three or more trees are found across the subject site	Few hollows, foraging and shelter habitat, little fallen timber	Diamond Firetail, Superb Parrot, Turquoise Parrot, Flame Robin, Scarlet Robin
Isolated remnant trees, Kurrajong, Yellow Box, White Box	Low-Moderate	Scattered at a low density across the site	Few hollows, limited foraging and shelter habitat	Superb Parrot
Rocky outcrops Granitic and metamorphic	Low - Moderate	Two linear outcrops of presumably the same rock strata occur on the site running south east to north west in the western paddock and through the woodland stand adjacent to the substation in B1 and B3. In addition surface scatters of rock occur within the central/northern paddocks B4 and B5.	Surface rocks	Pink-tailed Worm Lizard Little Whip Snake
Pasture (native or exotic)	Low-Moderate	Predominantly native pasture in the western paddock, exotic dominated paddocks in the central north (B5)and central east (B2)of the subject site	Seed resources and invertebrate foraging area Cover for reptiles (this feature is likely to change with drought or increased grazing)	Diamond Firetail, Superb Parrot, Turquoise Parrot, Flame Robin, Scarlet Robin, Little Whip Snake
Modified aquatic habitats (dams and ephemeral drainage lines)	Low	Few aquatic habitats were found within subject site. Shallow ephemeral dams were located in the western paddock and the central paddock B3, with a dry drainage line running south east to noth west through the south eastern corner of the western paddock.	Limited breeding opportunities for amphibians, ephemeral water source for fauna	
Cultivated paddocks	Low	Paddocks B4, B6, B8 and B1.	Source of grain for parrots, cultivation provides arthropod foraging for insectivors and generalists	Superb Parrot, Flame Robin, Scarlet Robin

[3] These are species that have been recorded in high quality examples of the habitat type, many have a very low probability of actually occurring on site

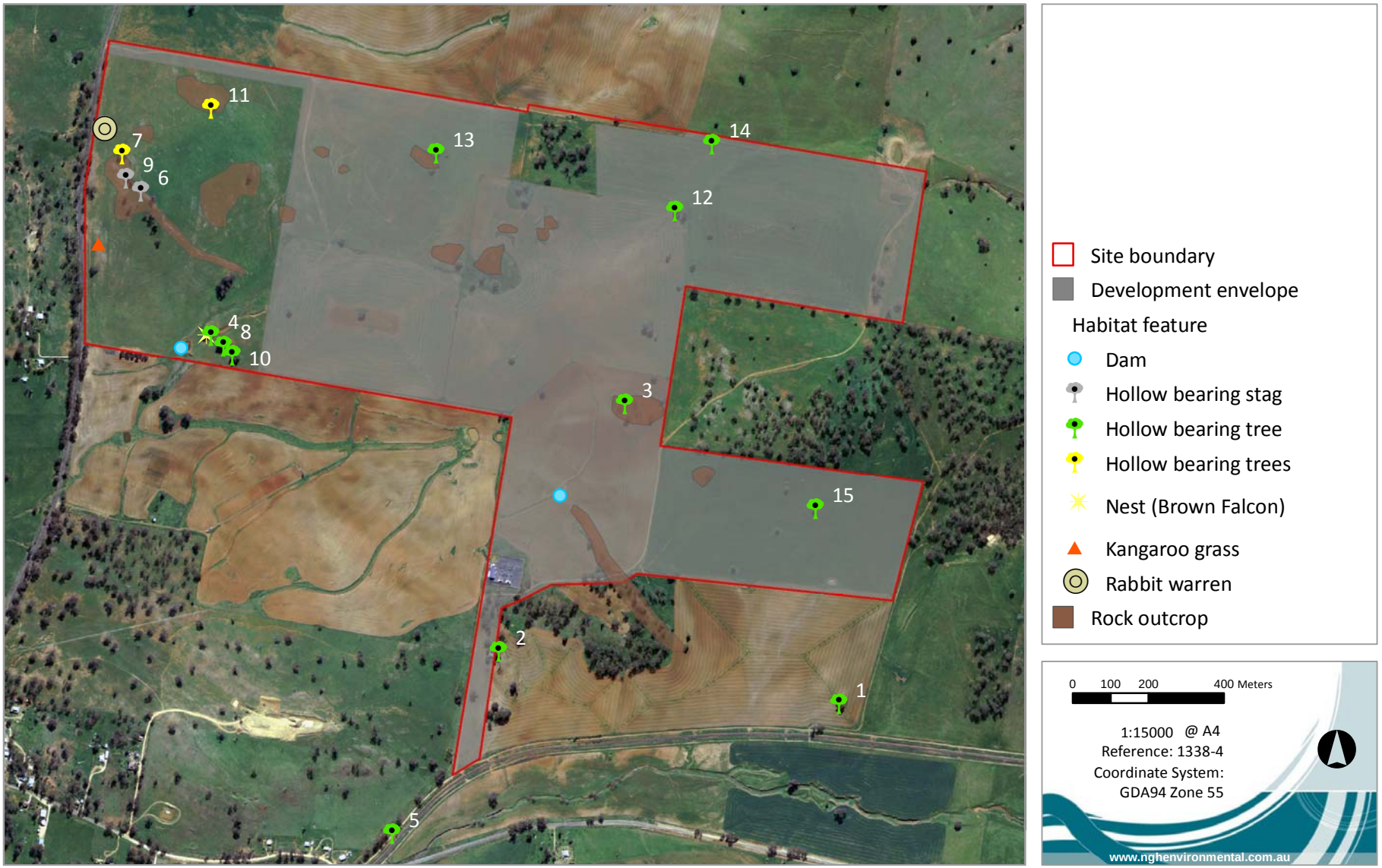

Figure 5-1 Habitat features

5.3.2 Habitat Descriptions

Box-Gum Woodland

Box-Gum Woodland was recorded in several small remnant stands throughout the subject site (as detailed in Section 4.2 and 4.3.1. Woodland remnants on the site were all unfenced and highly modified. Trees were generally mature but not old and hollow bearing trees and stags were rare. There was little fallen timber under the stands and grazing pressure had removed any native mid storey species. Stock camps were found under every stand and there was no evidence of native tree or shrub recruitment. No mistletoe was recorded in the eucalypts however the woodland trees would provide a nectar foraging resource when flowering.

The woodland remnants on site were highly modified compared to the offsite woodland assessed just north of Manildra Township. This site had a diverse native understory and several native shrub species. Regeneration of the dominant canopy species, Yellow Box and White Box was present. Fallen timber and scattered rock outcrops were also present creating a diversity of habitat not found on the subject site.

Isolated shade trees

Isolated shade trees were found at a low density across the subject site. Species included Kurrajong, Yellow Box, White Box or exotic Pepper Trees. Few of these trees were hollow-bearing however many were of an age to start to produce hollows (see Table 5-2 for details of hollow bearing trees on site). These trees provide shade and stepping stones for birds to cross the expanses of cultivated land and provide foraging resources. The hollow-bearing trees have the potential to be roosting sites for microbats such as the Yellow-bellied Sheathtail-bat. Superb Parrots are known to nest in isolated shade trees (Manning et al. 2006).and this species was recorded onsite during the survey. No evidence of parrot nesting was detected during the surveys and it is unlikely that this species breeds onsite.

Table 5-2 Hollow bearing trees (highlighted trees are to be removed by the proposal)

Tree Number (see Figure 5-1)	Tree species	Holow number & size#	Latitude	Longitude
1	Yellow Box	1M	-33.182905	148.726459
2	White Box	1S	-33.181803	148.716791
3	White Box	1S	-33.175842	148.720253
4	White Box	2S	-33.174361	148.708487
5	Yellow Box	1L	-33.186202	148.713853
6	Stag	3S, 2M	-33.170957	148.706440
7	White Box and stag	5M	-33.170069	148.705890
8	Yellow Box	3S, 1M	-33.174605	148.708853
9	Stag	1S	-33.170654	148.706009
10	Pepper tree*	1S	-33.174834	148.709097
11	White Box and stag	3S, 3M, 1L	-33.168951	148.708391
12	White Box and stag	1M	-33.171220	148.721580
13	Pepper Tree*	2S	-33.169930	148.714790
14	Stag	2s, 1M	-33.169614	148.722602
15	Kurrajong	1S	-33.178270	148.725700

#Hollow Size: S = <6cm, M = 6 to 10cm, L = >10cm

*Exotic

Rock outcrops

Rock outcrops are scattered across the subject site. Two large linear outcrops of a granitic rock type occur on the site running southeast to northwest in the western paddock and through the Box-Gum Woodland to the east of the substation (B1 an B3). Smaller localised outcrops and surface scatters of rock occur within the central north grazing paddock and towards the centre of the site (see Figure 5-1).

The large outcrop in the western paddock of the subject site represents the best quality reptile habitat as grazing pressure is low/moderate and native grasses dominate. Across the rest of the site much of the surface rock areas are highly modified by grazing, stock disturbance and weed invasion. The outcrops are periodically isolated by cultivation and grazing. Two habitat assessments were carried out on the large granite outcrops.

Rocks were mostly embedded at both sites with partially embedded surface rocks (suitable for skink and Pink-tailed Worm-lizard shelter sites) generally disturbed by stock or piled up to clear the paddocks for cultivation. Food resources for Pink-tailed Worm-lizards (small ants) and Little Whip Snakes (skinks) were generally scarce. Few small black ant nests were found under rocks during the assessments (two from 70 rocks rolled in the east and three from 50 rocks rolled in the west) suggesting habitat is poor for Pink-tailed Worm-lizards. Several skinks including were found during the assessments (*Ctenotus robustus* and *Morethia boulengeri*), however populations of small skinks are likely to be low due to the periodic exposure from and disturbance by cultivation and stock grazing and trampling.

Pasture

Grazed paddocks were located in the western paddock, central northern (B5) and central eastern paddocks (B2). The latter two paddocks provided little fauna habitat value. As discussed in Section 4.2, the paddock in the far west of the site supports a mosaic of native grass dominated areas as well as areas which are predominately exotic. All three paddocks are likely to have been at least partly cultivated in the past as the northern and western paddocks had rocks piled on some of the rocky outcrops, presumably from surface rock clearing before tillage, and the eastern paddock was largely rock free and quite flat.

Modified aquatic habitats

There were no natural water bodies on the subject site and the two man made dams recorded were either very low or dry. It is likely that during summer the only water sources on the subject site are the stock troughs in the grazing paddocks and a large concrete tank in the woodland adjacent to the substation between B1 and B3). A shallow grassy drainage line runs through the centre of the northern subject site from north east to south west. In spite of recent rain this drainage line was dry at the time of the survey. The two shallow dams supported no fringing vegetation and are likely to provide ephemeral breeding habitat for only the most common and adaptable frog species, such as Common Froglet (*Crinia signifera).*

Cultivated paddocks

The bulk of the subject site comprised cultivated land sown to either Wheat or Canola (B4, B6, B7 and B1). These areas provide little in the way of habitat values for fauna other than foraging for

invertebrates. Several Flame Robins were observed foraging in an adjacent direct drilled Wheat paddock however generally this habitat type was devoid of any fauna. A seasonal seed resource would be provided by these paddocks for parrots such as the Superb Parrot although during this time grain would be in abundance throughout the district.

5.3.3 Other habitat features

A native seeding trial of Yellow Box, White Box, Apple Box (*Eucalyptus bridgesiana)*, Western Grey Box *(Eucalyptus macrocarpa)*, Blakely's Red Gum and Narrow-leafed Hopbush *(Dodonea viscose)* provides some limited, dense, habitat structure adjacent to the southern boundary of the western paddock. This stand, although less than half a hectare in area, had a higher diversity of bird species than many other areas of the site.

5.4 SPECIES OF CONSERVATION SIGNIFICANCE

5.4.1 Threatened species

Two threatened fauna species listed under the *Threatened Species Conservation Act 1995* (TSC Act) were recorded during the survey (see Figure 5-2):

- **Flame Robins** were recorded along the southern boundary of the western paddock in the vicinity of the regeneration seeding trial plots. Seven birds were seen foraging within the site and adjacent sown field.
- Two pairs of **Superb Parrots** were seen on site; one in the remnant Box-Gum Woodland near the substation (between B1 and B3) and another (possibly the same pair) flying over the site from south to north.

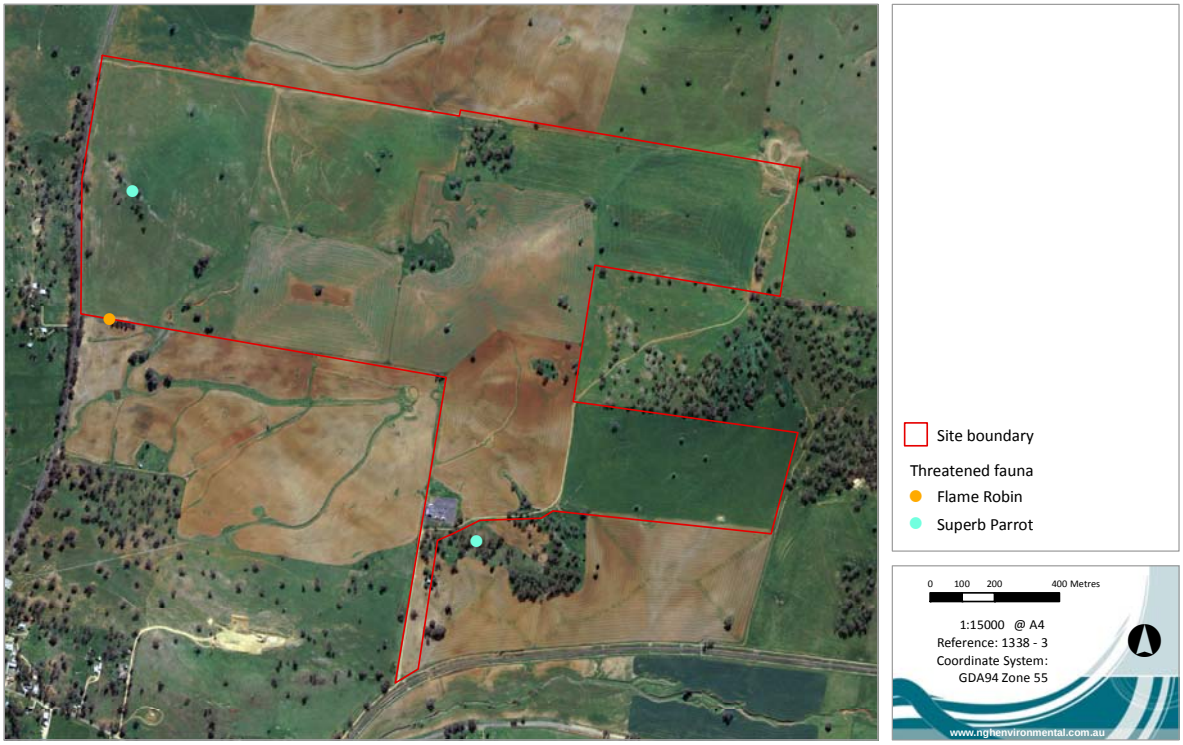

Figure 5-2 Threatened fauna survey results

The Threatened Species Evaluation (Appendix B.2) (informed by desktop assessment and survey results) identifies 12 threatened fauna species with at least a low-moderate potential to be impacted by the proposed development, summarised in Table 5-3 below.

Table 5-3 Potential threatened fauna habitat at the subject site

Species	Key habitat feature	Location
Little Whip Snake Pink-tailed Worm-lizard	Surface rock and native grassland	Proposed solar farm site, western paddock
Flame Robin Scarlet Robin Superb Parrot Diamond Firetail	Native pasture derived from woodland (seed and arthropod food source)	Proposed solar farm site, western paddock
Superb Parrot Brown Treecreeper Yellow-bellied Sheathtail-bat Little Pied Bat Greater Long-eared Bat	Tree hollows	Scattered at a low density across the site
Koala	Feed trees (White Box and yellow Box)	Scattered across the site

5.4.2 Migratory species

No migratory species listed under the EPBC Act were recorded during this survey or previous surveys carried out on site (Terra Consulting 2003), however species such as the White- throated Needletail and Rainbow Bee-eater are likely to be occasional visitors to the site. The Proposal would not impact foraging or breeding habitat for any migratory species.

5.4.3 SEPP 44 Koala Habitat

NSW State Environmental Planning Policy 44 – Koala Habitat Protection aims to identify areas of potential and core Koala Habitat. These are described as follows:

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

Using these definitions the site would be considered Potential Koala Habitat as no resident population is present and White Box is the dominant tree species (listed in Schedule 2 of SEPP 44) and constitutes >15% of the total number of trees on site.

As the subject site is considered Potential Koala Habitat and that Koala records exist in the forested areas within the district an Assessment of Significance was carried out for Koalas (Appendix A.1). This assessment concluded that the Proposal would not have a significant impact upon a local Koala population.

6 CONSTRAINTS ANALYSIS

6.1 METHODS

6.1.1 Approach and methods

An environmental constraint, for the purposes of the analysis, is an environmental condition that reduces the capability of a site to accommodate the specific development proposed. The identification and mapping of biodiversity constraints provides a visual guide to the significance of potential impacts to biodiversity values in different parts of the site. It is a tool to aid the transparent planning and design of the solar farm project, and provides a wider local context for the impact assessment. Biodiversity values at the site have been identified in Table 6-1, against the assessed degree of constraint imposed on the development.

Refer to Appendix G for a map of the biodiversity constraints identified on site overlayed with the final development envelope.

	High constraint – direct and indirect impacts need to be avoided in these areas
	High constraint with the potential for micrositing infrastructure with input from an ecologist – there is potential to carefully manage a small amount of direct and indirect impact
	Further survey is needed to accurately determine the level of constraint
	Moderate constraint – direct and indirect impacts can be managed in these areas with relatively standard mitigation strategies
	Further survey is needed to accurately determine the level of constraint, however the constraint is predicted to be low
	Low constraint – the most appropriate areas to develop, direct and indirect impacts can be managed in these areas with relatively standard mitigation strategies

Biodiversity values associated with higher constraint levels are generally more significant and difficult to replace or offset. The avoidance or mitigation of impacts to these features should be considered in the planning stages of projects.

6.2 DEFINITION AND MAPPING OF CONSTRAINT CLASSES

Key biodiversity features which constrain development at the Manildra solar farm site are indicated in Table 6-1, with corresponding constraint levels. The identified constraint levels are specific to the

types of impacts expected to be required to construct the solar farm[4]. The constraint classes are mapped on Figure 6-1.

Table 6-1 Biodiversity features and constraint levels at the proposed Manildra Solar Farm site.

Biodiversity feature	Main location	Constraint level
Hollow bearing remnant trees (predominantly White Box Yellow Box and Red Gum) • Potential Superb Parrot nest sites • Potential threatened microbat roost sites • Box Gum Woodland EEC	Scattered across site	High
White Box and Yellow Box remnant trees, no hollows • Recruitment for declining hollow bearing trees • Koala feed trees • Box-Gum Woodland EEC	Scattered across site	Moderate
Native pasture (moderate diversity) with occasional rocky outcrops: • Derived from Box Gum Woodland EEC • Potential threatened reptile habitat • Potential threatened flora habitat	Western section of western paddock, areas in the wooded eastern paddock	Further survey required (Potential moderate to high constraint)
White Box woodland remnant stands (not intensively surveyed) • EEC • Potential hollow bearing trees • Foraging habitat for a range of species	Stand in the central north of the site (B7)	Further survey required (Potential moderate to high constraint)
Native pasture (low diversity) • Potential threatened flora habitat (limited)	Western paddock	**Further survey required (Potential low constraint)**
Cropped paddocks with or without occasional Kurrajong trees	Across the site	Low

[4] Based on information supplied by Infigen as of 23 July, 2010.

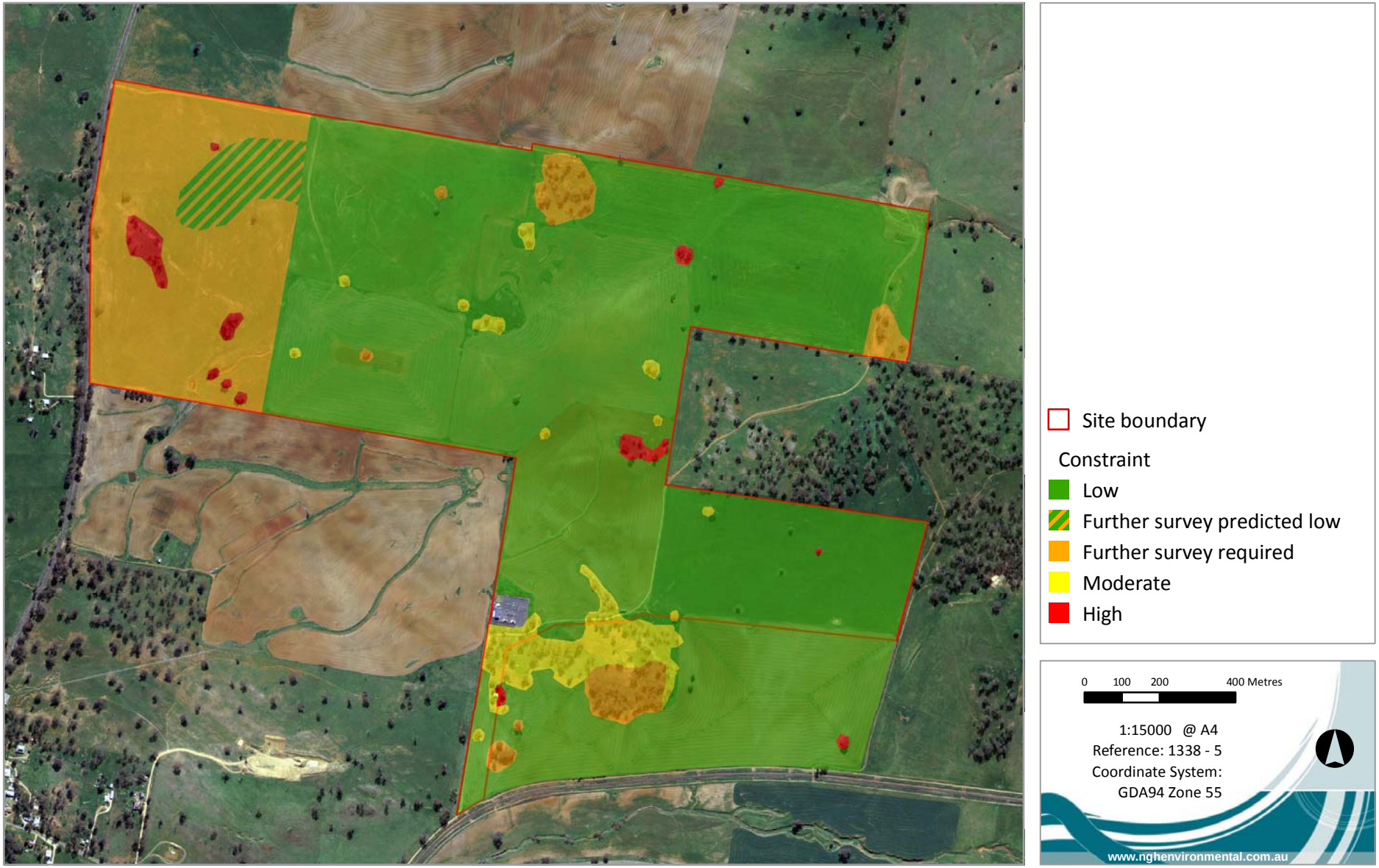

Figure 6-1 Biodiversity constraint classes at the proposed Manildra Solar Farm site

7 IMPACT ASSESSMENT

7.1 IMPACT TYPES

The Proposal would involve the construction, operation and eventual decommissioning of infrastructure, electricity corridors, tracks and site buildings, as detailed in Section 1.2.2. The potential direct and indirect impacts of the Proposal are assessed here.

7.1.1 Direct impacts

Direct impacts are those that directly affect habitat and individuals, usually within the footprint of the Proposal. They include, but are not limited to, clearing and habitat removal.

The Proposal has potential to directly impact biodiversity values at the subject site through:

- Impacts to soils, vegetation and habitats during construction.
- Disturbance to local fauna during construction.
- Altered productivity and microclimatic conditions under the PV array.
- Habitat avoidance behaviour, movement barriers and collision hazards for fauna.
- Potential for introduction and spread of weeds.

Loss of vegetation and habitats during construction

Estimates of the areas affected by each component of the Proposal are indicated in Table 7-1.

Table 7-1 Estimated impact areas of each Proposal component

Component	Quantity	Length (m)	Width (m)	Area (m^2)
Site office and facilities	1	20	20	400
Underground electricity transmission (control room to substation)	1	500	0.5	250
Solar panels	180,000	2	1	360,000 (panel surface) 306,000 (ground coverage assuming 30 degree tilt of panels)
Concrete footing or Pile driven posts	30,000 or 50,000	3.05 or 0.1	0.19 or 0.1	17,385 or 500
Underground cabling (2 circuits)	2	1,250	0.5	1,250
Inverters	72	4.3	2.2	681
Pad-mount transformers	36	3	2	216
Site access track	1	500	8	4,000 of which 2,000 is already cleared (an existing track)
Internal access tracks	1	5,000	8	40,000

Perimeter tracks	1	7,000	8	56,000
Perimeter fencing	1	7,000	1	7,000
Temporary laydown area	1			20,000
Parking	1			750
Operations and maintenance building (operational stage)	1	12	9	108
Total site area - 200 ha				

Table 7-2 Area of impact summary

Total area permanently cleared for the life of the project[1]	**Components**	**% of site area**
124,540 m^2 (12.45 ha) (concrete footing) or 107,655m^2 (10.76 ha) (pile driven posts)	Site office and car park PV array footings Inverter and transformer pads Perimeter and internal tracks Perimeter fencing Operations and maintenance building	6% or 5%
Total area cleared then rehabilitated after construction of the solar farm	**Components**	**% of site area**
21,500m^2 (2.15 ha)	Underground cabling Temporary laydown area	1%

Groundlayer vegetation

Groundlayer vegetation over an estimated area of up to 12.45 ha would be removed during the construction and ongoing maintenance of the solar farm. Most of this clearing will result from the establishment of the perimeter and internal access tracks. Note: this figure is based on all tracks and roads requiring an 8m wide clearing zone and this is likely to be an over estimation of the actual clearing required. Existing farm tracks will be used where ever possible further reducing the impact area. Of the total area cleared of vegetation, 2.15 ha would be rehabilitated after construction.

The areas impacted by the construction of the solar farm are exotic dominated pasture and cultivated paddocks with generally minimal conservation value. Similar vegetation is locally abundant. The loss of this vegetation would not be significant. In view of the land use history and restricted distribution of the higher quality native pasture to small patches in the western paddock, the likelihood of threatened flora species being present at the subject site is considered low. A targeted survey in Spring (early November) would be undertaken as a precautionary measure to confirm this assessment.

Canopy vegetation and hollow bearing trees

A total of approximately 55 mature trees would be removed to reduce shading of the PV arrays. This would include six hollow bearing trees.

Vegetation clearing guidelines, including hollow-bearing tree removal, should be adopted. Example guidelines are provided in Appendix I.

Disturbance to fauna during construction

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. Works should be planned to avoid the breeding season of Superb Parrots (September to January).

Trenching works have the potential to injure or trap native fauna. Trenches are likely to be 0.8m deep and 0.4m wide[5]. Trenches should be backfilled as soon as possible to minimise the chance of fauna becoming trapped. If trenches are left open for any length of time small ramps or ladders should be installed to allow trapped fauna to escape. If left open overnight, trenches should be checked the following morning and trapped fauna should be removed unharmed and released into nearby vegetation.

Construction materials should not be stockpiled on site for extended periods of time as local fauna may take up residence and be injured when the materials are moved.

Alteration to productivity and microclimate under the solar array

An estimated 120 hectares of exotic dominated pasture and cropland would be affected by the proposed PV array. Vegetation and ground habitats would be affected by altered microclimate beneath the array, through reduced insolation and temperature and increased humidity. Wind speeds may also be reduced. If required regular solar module washing, in addition to microclimatic changes, would contribute to an increase in soil moisture under the array.

Changes in rainfall distribution

The vertically projected area under the solar panels is estimated to be 30.6 hectares, or 25% of the total array site. There would be a concentration of rainfall runoff in a strip below the lower edge of the solar panel rows. This would increase rainsplash 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. A rainshadow below the solar panel rows would also be created. Soil in this area may be drier than surrounding soil, but this would be offset by reduced evapotranspiration losses due to shading and reduced air movement, variation in the angle of rainfall and lateral movement of soil water from adjacent rain-exposed areas. Shade tolerant ground cover should be established prior to the installation of the array, and maintained at all times, including during winter and drought periods if possible.

A groundcover management plan should be developed for the site and the proponent should routinely monitor soil condition and vegetation cover below the array and liaise with the landowner regarding stock and vegetation management issues as required. Any localised erosion that develops under the array (for example, due to concentrated rainsplash) should be promptly treated with techniques such as hardening with gravel or organic mulch, reseeding and covering with an open weave jute matting,

[5] Based on indicative trenching information received from Infigen 17 August 2010.

gypsum application to improve structure and infiltration, protection with geotextile fabric or localised flow dispersal and diversion structures.

Shading and groundcover management under the array

The total area of permanent shading is estimated to be 30% of the area under the array (36 hectares). 70% (84 hectares) would be partially shaded depending on the season and time of day.

Shading by the PV arrays will have an impact on the microclimate of 120 ha of the development envelope. Reduced insolation may mean lower rates of plant growth and biological productivity. However, this may be offset by increased soil moisture and reduced evaporative demands due to increased humidity and/or reduced temperature resulting in enhanced plant growth (Prinder and Facelli 2004).

Pasture grasses at the proposed solar array site comprise two physiological groups; cool season C3 grasses and warm season C4 grasses. C3 and C4 refers to the differences in the photosynthetic enzymes that plants use, particularly grasses, to absorb Carbon Dioxide from their surrounding environment. C4 grasses require more sunlight to drive photosynthesis than C3 grasses (Langford *et al.* 2004) and are likely to decline or disappear from under the array. C4 grasses present at the site include Stinking Love Grass (*Eragrostis cilianensis*) (exotic) which dominates the grazing pasture in the north of the site, *Red Grass* (*Bothriochloa macra*) (native) common in the grazing pasture and Kangaroo Grass (*Themeda australis*) (native) which is limited to a small patch in the western paddock. These C4 species may over time be replaced by C3 species present at the subject site due to the effects of shading by the PV arrays. C3 grasses recorded at the site include the natives Wallaby Grasses (*Austrodanthonia* spp.), Spear and Corkscrew Grass (*Austrostipa* spp.) and were generally restricted to the western paddock. Wheat (*Triticum aestivum*) which was dominant in some of the cropped areas and is also a C3 species

Reduced insolation and daytime temperatures are likely to mean lower rates of plant growth and biological productivity, although this will also be affected by any shift in species composition at the site. It may also be offset by increased soil moisture. Shading experiments conducted on the pasture species Perennial Ryegrass (*Lolium perenne,* C3) showed that 50 per cent shading decreased tiller densities and stubble yields, but did not affect mean tiller weights (Thomas and Davies 1978). Shaded swards were also slower to recover when full light was restored. Reduced productivity and slower recovery rates have implications for grazing management under the array.

Given the grass species that dominate the modified pastures are C4 species with the potential to be significantly impacted by shading, it is likely that they will be subject to greater impact by the proposal. In areas dominated by exotic species such as Stinking Lovegrass it is recommended that a new pasture of shade tolerant perennial species be sown and established prior to any infrastructure construction. In areas under cropping by Wheat this practice is also recommended as Wheat is an annual species which will perish, leave bare ground and unlikely recolonise which may lead to erosion and weed invasion. This action will assist with weed control by locking up soil nitrogen and providing competition for soil moisture and will reduce the potential for erosion by providing a more stable ground cover.

Caution needs to be applied when choosing groundcover species to sow prior to infrastructure installations 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. Using a proven pasture mix and ensuring adequate groundcover is of greater importance

than the establishment of a native habitat to protect physical environmental values (pers comm. Warwick Badgery, Research Agronomist NSW Department of Primary Industry Orange 9/8/10).

Maintaining the groundcover under the array would be an important element of site management. Approaches could include the use of cell grazing by sheep or irrigation (pers comm. C. Waters, NSW Department of Primary Industry Research Scientist; pers. comm. A. Southwell, Charles Sturt University Lecturer). It is recommended that consultation be undertaken with a qualified agronomist to inform appropriate groundcover establishment and management under the PV arrays.

Fauna impacts

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 will be following the installation of the PV arrays. The response of local fauna to these changes is equally hard to predict and will 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 eg ants and poikilothermic species such as reptiles. Basking opportunities may be reduced however the structure of the PV arrays may provide fauna with a degree of protection from predation, particularly from raptors. Increased soil moisture may create favourable shelter and foraging habitat for amphibians. As the PV arrays will be located in exotic dominated grazing and cropping paddocks there is little probability of threatened species being impacted by any microclimate and associated vegetation changes that may occur.

Granite outcrops are predominant geological features in agricultural landscapes in south-eastern Australia, and some fauna species, particularly reptiles, are restricted to these habitats (Michael *et al*. 2010). Outcrop habitats can be negatively impacted by physical damage or shading. It is recommended that where possible the small rock outcrops at the site be excluded from the array, together with a minimum 2.5 metre buffer to avoid shading (based on array dimensions in Appendix F).

Fauna habitat loss and collision hazards

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. It is unlikely that any threatened species would be put at risk by this potential impact.

The construction of a perimeter fence has the potential to impact native fauna by creating a barrier to movement and by providing a collision risk. Where security concerns permit, barbed wire should not be used in the fence construction as it is capable of entangling and killing a range of native fauna (van der Ree 1999). 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. Installing coloured streamers, using shade cloth or using coloured wire are recommended as mitigation measures to increase the visibility of this type of fence to parrots (Pfennigwerth 2008). Fencing along Molong Manildra Road should be maintained so as macropods and other large native fauna are not funnelled along the perimeter fence and onto the road creating a traffic hazard and collision risk to the animal.

A perimeter fence would provide a barrier to the movement of many large terrestrial fauna species. Species likely to use the subject site for foraging and dispersal would be capable of covering significant distances of open ground and are unlikely to be greatly effected by the reduction habitat brought about by a perimeter fence. Similar modified grazing habitat is abundant and wide spread in the

district. There is a low possibility that Koalas dispersing from forested areas to the west and north may occasionally cross the subject site. A perimeter fence would limit their movement at a local scale, however the subject site is not considered a fauna movement corridor and the adjacent land carries similar structural characteristics and would provide alternative movement opportunities.

For species that will still have access to the habitat within the perimeter fence 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 loss of 152 ha of this habitat type would not be significant.

Species with the ability to disperse through open country are likely to utilise the remnant trees on the subject site however if clearing of any of the site was required it would not be significant in terms of restricting fauna movement considering the surrounding matrix.

Potential introduction and spread of weeds (general)

The site carries noxious weeds which will require control before and after the proposed works. Best practice hygiene will 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 to ensure weeds are adequately controlled at the site.

With the application of best practice 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 an ATV to access the site for ongoing weed control and pasture renovation, as required.

7.1.2 Indirect impacts

Indirect impacts occur when project related actions affect species, populations or ecological communities in a manner other than direct loss, usually beyond the footprint of the Proposal. Indirect impacts can include loss of individuals through predation by domestic and/or feral animal, deleterious hydrological changes (including increased runoff and raising or lowering the water table), erosion, weed invasion, pollution, trampling, altered fire regimes, habitat fragmentation and disruption of wildlife movement corridors.

Indirect and off-site impacts relevant to the proposal include:

- Fauna habitat avoidance and corridor impacts
- Downstream sedimentation and pollution
- Effects on fire frequency and impact.

Fauna habitat avoidance and corridor impacts

The structure provided by the PV arrays and perimeter fence my deter species from foraging between the PV arrays however they may also increase the habitat value for perching species such as the Flame and Scarlet Robin. Flame robins were recorded foraging from the south western boundary fence and would be likely to use the PV arrays (particularly those on the edges) as a surrogate for the fallen timber that they use in a more natural setting. Post construction site usage studies would be valuable to determine the level of site usage by native fauna.

As the subject site is largely cleared and representative of the adjacent land, connectivity is unlikely to be compromised by the construction of the PV arrays and perimeter fence.

The infrastructure of the solar farm including the perimeter fence and PV arrays may provide shelter from predators such as foxes and raptors.

Downstream sedimentation and pollution

The proposed works have potential to release sediment and pollutants into riparian and aquatic habitats of Mandagery Creek, located 200m to the west of the site. These risks would apply mainly during the construction phase. This can be effectively managed onsite by installation of sediment erosion controls if required.

A continuous grassy groundcover will need to be established and maintained under the array to maximise infiltration of module washing water, reduce sediment runoff and reduce dust during the operational phase of the project.

Module washing

Water for periodic washing of the solar modules will be trucked onto the site.

No detergent will be used when washing the panels and the module washwater is not expected to result in pollution of local waterways or the groundwater resource.

Effects on fire frequency and impact

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 study area.

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 Suntech modules to be used do not have passed the Underwriters Laboratories standard UL1703 (which includes flammability tests) and are inflammable and do not pose a pollution risk in the event of fire.

7.1.3 Cumulative Impacts

Impacts to vegetation at the PV array site would result from the direct effects on microclimate in combination with altered land use patterns, such as grazing. The site would be managed to maintain a dense low groundcover to protect soils and water values, and to minimise dust and fire hazard. The cumulative effects of microclimate and land use changes are not expected to be significant given the current high levels of disturbance at the site.

7.2 IMPACT ASSESSMENT

7.2.1 ASSESSMENTS OF SIGNIFICANCE

Section 5A of the *Environmental Planning and Assessment Act 1979* (EP&A Act) specifies seven 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.

An Assessment of Significance has been completed for the following threatened entities, which were rated as having potential for adverse impact as a consequence of the proposal:

Endangered Ecological Communities
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland ('Box-Gum Woodland')
Flora
Silky Swainson-pea (*Swainsona sericea*)
Small Purple-pea (*Swainsona recta*)
Austral Toadflax *(Thesium australe)*
Fauna
Brown Treecreeper (*Climacteris picumnus*)
Diamond Firetail (*Stagonopleura guttata*)
Flame Robin (*Petroica phoenicea*)
Scarlet Robin (*Petroica boodang*)
Superb Parrot (*Polytelis swainsonii*)
Turquoise Parrot (*Neophema pulchella*)
Greater Long-eared Bat (*Nyctophilus timoriensis*)
Little Pied Bat (*Chalinlobus picatus*)
Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*)
Koala (*Phascolarctos cinereus*)
Little Whip Snake (*Suta flagellum*)
Pink-tailed Worm-lizard (*Aprasia parapulchella*)

The Assessments conclude that with the implementation of the mitigation measures listed in Section 8 and pending follow up spring surveys to confirm the assumptions of this assessment, the proposal would not be likely to significantly impact threatened species and communities.

The focus of the follow up surveys would be to confirm the presence or absence of the following threatened species at the site:

Silky Swainson-pea (*Swainsona sericea*)

Small Purple-pea (*Swainsona recta*)

Austral Toadflax *(Thesium australe)*

Should presence be confirmed, management actions would be incorporated into the proposal to ensure significant impacts are avoided.

8 RECOMMENDATIONS AND CONCLUSION

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.

8.1 INFRASTRUCTURE SITING AND DESIGN

- The PV array, site access tracks and other infrastructure should be sited to avoid:
  - The larger stands of Box-Gum Woodland across the site
  - Hollow bearing trees
  - Isolated shade trees where possible
  - Native grassland and associated rock outcrops in the Western Paddock
  - As far as possible rock outcrops across the subject site
- Areas of high biodiversity value would be clearly identified throughout construction and protected from the direct and indirect impacts of the Proposal. Contractors and staff would be made aware of the significance and sensitivity of these areas.
- The western paddock of the proposed solar farm site should be avoided if possible to minimise impacts to grassy groundcover flora comprising the Box-Gum Woodland EEC.
- Where security concerns permit, perimeter fences should not contain barbed wire, particularly the top strands. If a cyclone mesh fence is to be used efforts should be made to increase the visibility to fast flying parrots.
- Where practicable, power poles and overhead powerlines will be bird-safe using flags or marker balls, large wire size and wire and conductor spacing.

8.1.1 Supplementary surveys

- Supplementary surveys, prior to finalisation of infrastructure layout, are required to confirm the assumptions of this assessment as follows:
  - A supplementary flora survey in spring (November) would be required to confirm if threatened species including Silky Swainson-pea (*Swainsona sericea*), Small Purple-pea (*Swainsona recta*), Austral Toadflax *(Thesium australe)* inhabit areas to be impacted by the development, to confirm the assessment of the EEC derived grassland, and to confirm the quality of threatened reptile habitat in the western paddock if works are to impact on this area (no works are planned in this area.) The probability of these species occurring is considered low and the surveys would be undertaken to validate the assumptions made in the Assessment of Significance. If these species are detected on the site it would be recommended that they be managed to ensure significant impact on local populations does not result (ie exclusion zones or other management).

8.1.2 Offsetting

An Offset plan would be produced prior to any construction impacts to offset the habitat values of areas removed or modified by the project. The aim would be to ensure a 'maintain or improve biodiversity values' outcome.

The western paddock of the site is in better condition than other areas and appears an appropriate offset site to compensate for vegetation / habitat to be removed during construction.

The permanent removal of quality flora and fauna habitat is expected to be minimal, as the infrastructure footprint is comparatively small and areas of conservation significance have been mapped to allow infrastructure placement to avoid them. Offsetting impacts to native pasture would only be undertaken where it is in moderate-good condition as defined by the biometric guidelines and considered to provide quality habitat. Offsite offset areas may be required to achieve this.

The biodiversity offset principles developed by DECCW would guide the development of an Offset Plan, namely:

1. Impacts must be avoided first by using prevention and mitigation measures
2. All regulatory requirements must be met
3. Offsets must never reward ongoing poor performance
4. Offsets will complement other government programs
5. Offsets must be underpinned by sound ecological principles
6. Offsets should aim to result in a net improvement in biodiversity over time
7. Offsets must be enduring - they must offset the impact of the development for the period that the impact occurs
8. Offsets should be agreed prior to the impact occurring
9. Offsets must be quantifiable - the impacts and benefits must be reliably estimated
10. Offsets must be targeted
11. Offsets must be located appropriately
12. Offsets must be supplementary
13. Offsets and their actions must be enforceable through development consent conditions, licence conditions, conservation agreements or a contract

- The final infrastructure layout will determine the precise amount of clearing required. At that time, and prior to construction commencing, formal agreements would be sought with the affected involved land owners to secure offsetting for areas of habitat permanently removed by the proposal. It appears that, by locating infrastructure in areas of lesser habitat value, managing offset areas to improve their biodiversity value for the life of the project and, viewed in terms of the wider environmental benefits of establishing renewable energy generation in rural areas, that the proposal can achieve an overall 'maintain or improve biodiversity outcome'.

8.2 CONSTRUCTION PHASE

- Works should be planned to avoid the breeding season of Superb Parrots (September to January).
- If the removal of any hollow bearing trees was required this activity would be proceeded by a pre clearance check by a qualified ecologist including anabat survey and stag watching
- Existing farm tracks should be used wherever possible.
- Where cement is included in cable trench backfill, at least 20 centimetres of cement-free topsoil will be replaced as the top layer in the backfill.
- Where practicable, whole sods will be removed with an excavator where these areas are well-vegetated with dense root systems. Sods will be stored in moist, shaded conditions and replaced following the works. Sod storage time will be minimised and sods will be replaced in a manner that maximises the chances of re-establishment.
- Excavated topsoil, subsoil and weathered rock will be stored separately and replaced in a manner that replicates the original profile as closely as possible.
- Where practicable, grass surfaces will be retained or restored on infrequently used vehicle routes.
- Site stabilisation, rehabilitation and revegetation of all disturbed areas will be undertaken without delay.
- Works will avoid impacts to mature eucalypts wherever possible. Tree protection standards should comply with Australian standard AS4970-2009 Protection of trees on development sites (Standards Australia, 2009). Wherever practicable, excavations and vehicle/machinery movements will occur outside the canopy dripline of large eucalypts.
- As a general rule, disturbed areas will be used for vehicle and machinery access, materials laydown, stockpiling of cleared vegetation and the deposition and retrieval of spoil whenever practicable.
- Works will be avoided during, and immediately following heavy rainfall events to protect soils and vegetation at the site.
- Appropriate fire fighting equipment will be held on site when the fire danger is high to extreme, and a minimum of one person on site will be trained in its use.
- Weed / pathogen controls will be implemented, including:
    - Machinery and vehicles used in construction works will be washed before and after site access to reduce the introduction and spread of weeds and pathogens.
    - Laydown sites for excavated spoil, equipment and construction materials will be weed-free or treated for weeds wherever practicable.
    - Weed monitoring will be carried out at all sites after the completion of construction works and ongoing weed control will occur where noxious or invasive species are recorded. In particular, monitoring will be undertaken during the following late spring/early summer, and remedial action taken as required.

  - Sediment control materials should be weed free (straw bales, geotextiles).
  - Imported materials such as sand and gravel will be sourced from sites which do not show evidence of noxious weeds or Phytophthora infection.

- Where tree hollows are required to be removed, these should be replaced by nest boxes of similar size in nearby trees.
- Wherever possible small rock outcrops at the site should be excluded from the array, together with a minimum 2.5 metre buffer to avoid shading (based on array dimensions in Appendix F).
- If dams are removed during site development works, alternative watering points should be established to compensate for their loss.
- Rock and log habitat removed during the construction phase will be reinstated following the works.
- Any trench sections left open for greater than a day would be inspected daily, early in the morning and any trapped fauna removed. The use of ramps or ladders to facilitate trapped fauna escape is recommended.

8.3 OPERATIONAL MANAGEMENT

- A shade tolerant perennial groundcover should be established across the cropping and exotic dominated grazing paddocks prior to the installation of the PV arrays. Use of species such as Weeping grass *Microlaena stipoides* (Ovens cultivar) should be considered as this variety has been developed for grazing and the species is shade tolerant and develops a thick groundcover if managed appropriately. Rainfall at the site may not be sufficient for Weeping Grass and caution needs to be applied 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. Using a proven pasture mix and ensuring adequate groundcover is of greater importance than the establishment of a native habitat to protect physical environmental values.(Pers comm. Warwick Badgery, Research Agronomist NSW Department of Primary Industry Orange 9/8/10).
- A groundcover management plan would be developed that would include regular monitoring of vegetation cover and composition and allow for adaptive management. This would include:
  - 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.
- If localised erosion is detected, effective treatments would be applied without delay, 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.
- Efforts should be made to minimise disturbance to the existing groundcover during construction. Construction and maintenance vehicles should not access the site when soils are very wet to minimise soil compaction and disturbance.

- The space between the PV arrays should be maintained and kept clear to enable access by vehicles for ongoing weed control, and pasture renovation if required.
- Fencing along Molong Manildra Road should be maintained so as macropods and other large native fauna are not funnelled along the perimeter fence and onto the road creating a traffic hazard and collision risk to the animal.
- Monitoring of fauna site habitat usage pre and post construction is recommended but not considered essential.

8.4 CONCLUSION

The construction phase of the Proposal is not likely to have a significant impact on flora and fauna values at the subject site.

The construction of the solar farm would affect up to **152 ha** of exotic dominated pasture and cultivated paddocks including approximately 55 mature trees (approximately 3ha of Box-Gum Woodland EEC in total). These impacts are unlikely to be significant in light of the condition, low conservation and habitat values and local abundance of this vegetation.

The operational phase of the project will require careful management of pasture under the PV array to control weeds and maintain good groundcover. This is considered to be readily achievable and biodiversity impacts at the site and off the site are not expected to be significant.

By identifying areas of high biodiversity values early in the planning process and then using this information to develop a sensitive layout design, the Proposal achieves the aim of minimising any impacts to biodiversity. In conjunction with a targeted offset plan, that aims to improve connectivity and habitat values both on site and for the wider locality, the Proposal would maintain or improve biodiversity values. In terms of the significance thresholds identified in the Draft Guidelines for Threatened Species Assessment for Part 3A Applications (DEC/DPI 2005) the project would:

- Be likely to maintain or improve biodiversity values
- Be unlikely to reduce the long-term viability of a local threatened species population or ecological community
- Be unlikely to accelerate the extinction of a species, population or ecological community or place it at risk of extinction
- Not adversely affect critical habitat.

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Appendix A ASSESSMENTS OF SIGNIFICANCE

A.1 ASSESSMENTS OF SIGNIFICANCE

Section 5A of the *Environmental Planning and Assessment Act 1979* (EP&A Act) specifies seven 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.

Although not a legal requirement of a Part 3A development, Assessments of Significance provide a transparent and systematic characterisation of impact for listed entities.

Assessments of significance have been undertaken for the following 16 threatened entities identified from the threatened species evaluation (Appendix B.2) as having low-moderate or higher potential to be impacted by the Proposal:

Common name	Scientific name	Status
FLORA		
Austral Toadflax	*Thesium australe*	V TSC, V EPBC
Small Purple-pea	*Swainsona recta*	E TSC, E EPBC
Silky Swainson-pea	*Swainsona sericea*	V TSC
ECOLOGICAL COMMUNITIES		
Box-Gum Woodland		EEC TSC
FAUNA		
Brown Treecreeper	*Climacteris picumnus*	V TSC
Diamond Firetail	*Stagonopleura guttata*	V TSC
Flame Robin	*Petroica phoenicea*	V TSC
Scarlet Robin	*Petroica boodang*	V TSC
Superb Parrot	*Polytelis swainsonii*	V TSC, V EPBC
Turquoise Parrot	*Neophema pulchella*	V TSC
Greater Long-eared Bat	*Nyctophilus timoriensis*	V TSC
Little Pied Bat	*Chalinlobus picatus*	V TSC
Yellow-bellied Sheathtail-bat	*Saccolaimus flaviventris*	V TSC
Koala	*Phascolarctos cinereus*	V TSC
Little Whip Snake	*Suta flagellum*	V TSC
Pink-tailed Worm-lizard	*Aprasia parapulchella*	V TSC

V TSC = listed as Vulnerable under Schedule 2 of the *TSC Act 1995.*

V EPBC = listed as Vulnerable under the Commonwealth *EPBC Act 1999*

E TSC = listed as Endangered under Schedule 1 of the *TSC Act 1995*

E EPBC = listed as Endangered under the Commonwealth *EPBC Act 1999*

EEC TSC = listed as an Endangered Ecological Community under Schedule 1 of the *TSC Act 1995*

Austral Toadflax (*Thesium australe*), Small Purple-pea (*Swainsona recta*) and Silky Swainson-pea (*Swainsona sericea*)

Ecological information

The natural habitat for these species is grassy woodland and natural grassland and they generally persist in remnants in good condition with no or very light grazing history. Small Purple-pea, Silky Swainson-pea and Austral Toadflax are often associated with Box-Gum Woodland. Typical grassy understorey dominants include Kangaroo Grass and Spear Grasses both of which occur within the western section of the subject site. Kangaroo Grass is a critical keystone species for native grassy communities because it provides long term protection from invasive annual weeds by locking up soil nitrate (Prober and Lunt 2008). The loss of Kangaroo Grass may also trigger the decline of a range of other species in the community, particularly inter-tussock forbs. Austral Toadflax is semi-parasitic on grasses, particularly Kangaroo Grass.

Small Purple-pea, Silky Swainson-pea and Austral Toadflax flower from spring to summer and would have been inconspicuous during the winter survey period and may have gone undetected if present.

Test of significance

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

The native pasture in the western section of the subject site is derived from Box-Gum Woodland, but has a long history of grazing. Grazing sensitive species such as lilies, orchids, tall daisies and pea shrubs were not recorded, although the winter timing of the survey will have made some of these species undetectable. The dominance of Spear Grasses (*Austrostipa* spp.) and Red Grass (*Bothriochloa macra*), and the scarcity of Kangaroo Grass (*Themeda australis*), is consistent with a long period of sustained grazing pressure (Eddy *et al.* 1998). Small Purple-pea, Silky Swainson-pea and Austral Toadflax generally persist in areas of higher quality woodland and grassland which, within the subject site is restricted to a small area in the south-western corner of the western section of the subject site.

In view of degraded condition of the majority of the native pasture and the disturbance history, the likelihood of these species being present at the site is considered low. A targeted survey in Spring (early November) would be undertaken as a precautionary measure to confirm this assumption.

The proposal would not impact upon the higher quality grassland within the western section of the site and, pending the follow-up survey results, it is considered unlikely that the works would adversely affect the life cycle of these species such that viable local populations are likely to be placed at risk of extinction.

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

No populations have been listed for the local area under Part 2 of Schedule 1 of the TSC Act or Part 2

of Schedule 4 of the FM Act.

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 the risk of extinction, or

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

Not applicable.

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

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

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

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

Approximately 0.2 hectares of native pasture derived from Box-Gum Woodland would be cleared for the construction of the access road to the north of the solar farm. These works would involve the upgrade of an existing farm track to minimize biodiversity impacts. The works would not fragment existing remnants. The PV array, transmission lines and other infrastructure would be sited as far as possible to avoid the need to clear areas with tree cover.

Native pasture in a similar degraded condition derived from the Box-Gum Woodland EEC is abundant within the region and locality, and is unlikely to have substantial natural recovery potential. The native pasture at the subject site generally offers very low potential for threatened flora species. A higher diversity patch of Box-Gum Woodland derived grassland located in the south-western corner of the western section of the subject site would be avoided and protected during the works. A targeted survey in Spring (early November) would be undertaken as a precautionary measure to confirm this assumption. Pending the results of this survey the proposal is not expected to not adversely affect the long-term survival of threatened flora species in the locality.

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 these species in the district.

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

No recovery plans have been prepared for these species

Box-Gum Woodland

Ecological information

Box-Gum Woodland is an open woodland community in which one or more of the trees White Box (*Eucalyptus albens*), Yellow Box (*E. melliodora*) and Blakely's Red Gum (*E. blakelyi*) are present. Grasses and herbaceous species generally characterise the ground layer and shrubs are generally sparse or absent although they may be locally common. This community is found on relatively fertile soils on the tablelands and western slopes of NSW.

Test of significance

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

Not applicable.

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

No populations have been listed for the local area under Part 2 of Schedule 1 of the TSC Act or Part 2 of Schedule 4 of the FM Act.

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 the 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

Box-Gum woodland remnants are present at the subject site, generally in the form of sparsely scattered White Box and Yellow Box trees with an exotic understorey and low diversity native pasture. A small area of higher diversity Box-Gum Woodland groundcover dominated by Kangaroo Grass is present in the south-western corner of the western section of the subject site; this area would also not be impacted by the proposed works.

In view of the long grazing history, the majority of the native pasture at the proposed solar farm site is unlikely to be capable of recovering flora diversity. Many native grassy understorey species do not appear to form a long term seed bank in the soil. This is supported by the results of experiments with daisy and lily species (Lunt 1990) and by the loss of species diversity which results from the absence of fire for periods greater than 7-10 years (Scarlett and Parsons 1990).

Approximately 3 hectares of low condition Box-Gum Woodland with tree cover and 0.2 hectares of derived native pasture would be cleared during the construction of the solar farm.

Impacts to vegetation are likely to include:

- Clearing and disturbance during construction and installation of the PV array
- Shading under the PV arrays

- Risk of noxious and environmental weed introduction and spread

Native pasture in a similar degraded condition derived from the Box-Gum Woodland EEC is abundant within the region and locality. The impact of shading on species composition and the loss of 0.2 hectares of this vegetation would not affect the local occurrence of the EEC such that the local occurrence is likely to be placed at risk of extinction.

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

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

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

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

Approximately 3 hectares of low condition Box-Gum Woodland with tree cover and 0.2 hectares of derived native pasture would be cleared during the construction of the solar farm.

Native pasture in a similar degraded condition derived from the Box-Gum Woodland EEC is abundant within the region and locality, and is unlikely to have substantial natural recovery potential. The impact of shading on species composition and the loss of 0.2 hectares of this vegetation would not adversely affect the long-term survival of this threatened ecological community in the locality.

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 this community.

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

A draft national recovery plan for this community has been prepared and is currently available for public comment. The proposal is inconsistent with the objective of the draft recovery plan that aims to '*achieve no net loss in extent and condition of the ecological community throughout its geographic distribution'.* The proposal would result in a net loss of approximately 3.2ha of this community however, as discussed above, this is not considered to be significant.

Superb Parrot (*Polytelis swainsonii*) and Turquoise Parrot (*Neophema pulchella*)

Ecological information

The Superb Parrot occurs in Box-Gum grassy woodland and open forest, and also on the edges of these habitats. This species is long lived with low fecundity and requires tree hollows for nesting (Gibbons and Lindenmayer 2002).

Superb Parrots utilise Box-Gum Woodland for foraging and breeding (summer), mostly nesting in dead trees, particularly Blakely's Red Gum (Manning et al., 2006; Webster, 1988). It appears even isolated paddock trees are important nesting habitat for this species (Manning et al., 2006).

The Superb Parrot forages on the ground or in trees, feeding on lerp, mistletoe berries, eucalypt flowers and grass seed (Higgins, 1996).

The Turquoise Parrot is endemic to eastern Australia. The species occurs in eucalyptus woodlands and open forests, with a ground cover of grasses and low understorey of shrubs. The species has also been recorded in a variety of other habitats, including savannah and riparian woodlands and farmland, preferring edges of forest and pasture or other grassland (NPSW, 1999). The Turquoise Parrot feeds on the seeds of grasses, herbaceous plants and shrubs and requires a reliable supply of drinking water (Higgins, 1999). Nests are usually less than two meters above the ground and may be located in hollows of small trees, dead eucalyptus or in holes or stumps, fence posts or even logs lying on the ground (Quinn & Baker-Gabb, 1993)

Threats for both species include: habitat loss (including breeding, foraging and roosting areas), degradation (including overgrazing) of habitat, fragmentation of habitat and loss of hollow bearing trees. Competition from aggressive generalists over foraging and nesting areas may be exacerbated by forest fragmentation and decline of important habitat features, such as hollows (Higgins, 1996; NSW Scientific Committee 2008; Manning et al. 2006).

Test of significance

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

Potential impacts arising from the Proposal are habitat loss and degradation, specifically the loss of hollow bearing trees. The loss of some foraging areas is a further potential impact but this is unlikely to be significant considering the abundance of cropping and pasture land surrounding the subject site.

Two pairs of Superb Parrots were observed during the surveys, one in the White Box stand. Adjacent to the Manildra substation and another (possibly the first pair) flying over the site from south to north.

The site falls within the Birds Australia South-west slopes of NSW Important Bird Area[6] (Birds Australia 2009), an area defined by the breeding distribution of Superb Parrots. Lone paddock trees have been identified as a valuable breeding resource for this species (Manning 2006, Manning 2009). Superb Parrots breed and have low fecundity, therefore loss or degradation of habitat suitable for breeding, is considered to be a **high risk** to a local population. Potential Superb Parrot breeding habitat occurs at a low frequency across the subject site as hollow bearing trees are relatively uncommon. No hollows with obvious signs of parrot nesting (chewing around the entrance) were noted however as a precautionary measure hollow bearing trees should be retained wherever possible on site.

[6] Important Bird Areas (IBA) are sites of global bird conservation significance (Birds Australia 2009). IBAs in Australia have been established by Birds Australia together with Bird Life International. The *South-west Slopes of NSW IBA* has been based upon core distribution and breeding records for the Superb Parrot.

Turquoise Parrots have been recorded from Goobang National Park 30km to the east of the subject.

Several dead stags with low hollows and Turquoise Parrot foraging habitat with known feed species[7] were recorded on the subject site. The presence of records in nearby Goobang National Park suggests that a local Turquoise Parrot population may exist.

As the subject site is representative of a large expanse of cleared agricultural land supporting foraging habitat in the form of crops and pasture the loss of the foraging habitat that the site represents would not be considered likely to effect on the life cycle of either species such that a viable local population of the species is likely to be placed at risk of extinction.

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

Not applicable.

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

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

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

Not applicable.

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

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

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

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

i) The proposal would impact up to 152 ha of exotic dominated pasture and cultivated land and up to six hollow bearing trees (only two hollows suitable for Superb Parrot breeding based on size).

ii) The Proposal would not increase habitat fragmentation for these mobile species.

iii) In terms of foraging habitat, the loss of up to 152 ha of pasture and cultivated paddocks would not impact these species as this habitat is not considered important due to the abundance

[7] The diet of the Turquoise Parrot includes introduced weeds and common native grasses (NPWS 1999) found across much of the district

of this habitat in the area. Up to six hollow bearing trees could be removed by the Proposal, however these are unlikely to be used for nesting considering the low quality of the hollows, size of the hollows and the lack of parrot nesting sign.

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 these species.

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

No recovery plans have been prepared for these species however there is a draft national recovery plan for the Superb Parrot in preparation.

Diamond Firetail (*Stagonopleura guttata*), Flame Robin (*Petroica phoenicea*), Scarlet Robin (*Petroica boodang*)

Ecological information

Diamond Firetail, Flame Robin and Scarlet Robin are all capable of foraging in modified farmland and the loss of foraging habitat is the major potential impact to these species from the Proposal.

Diamond Firetails live in scattered groups of five to 40 birds in the open eucalypt woodlands of South Eastern Australia. They forage exclusively on the ground for seeds and insects. This species is sedentary, though some populations move locally. Diamond Firetail populations appear unable to persist in areas which lack remnants of native vegetation larger than 200ha (NSW Scientific Committee 2001) although they are able to utilise areas around towns and farms (DECCW 2010).

Each year the Flame Robin migrates up to the highlands of southeastern Australia to breed in alpine and subalpine woodlands and scrubby forest. In winter it moves to more open lowland habitats such as grassland with scattered trees and open woodland on the inland slopes and plains (Higgins and Peter 2002).

The Scarlet Robin breeds in drier eucalypt forests and temperate woodlands, often on ridges and slopes, within an open understorey of shrubs and grasses and sometimes in open areas. Abundant logs and coarse woody debris are important structural components of its habitat. In autumn and winter it migrates to more open habitats such as grassy open woodland or paddocks with scattered trees. It forages from low perches, feeding on invertebrates taken from the ground, tree trunks, logs and other coarse woody debris (NSW Scientific Committee 2010b).

Test of significance

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

Diamond Firetail, Flame Robin and Scarlet Robin are all capable of foraging in modified farmland and have a high probability of frequenting the subject site as local records exist (Flame Robins were recorded on site during the winter survey, Diamond Firetails have been recorded within 10km and Scarlet robins have been recorded with in 50km of the subject site). Breeding habitat is absent for all three species and the foraging habitat found on the subject site is common in the surrounding district. It is likely that the pv arrays and perimeter fence would provide perching opportunities for the Flame Robin and Scarlet Robins, replacing the fallen timber that these species commonly use as foraging platforms in natural settings.

Diamond Firetails have adapted to feed on a range of introduced weed and pasture species (Read, 1994) and foraging habitat is not considered limiting for this species. Establishment of a pasture groundcover under the pv arrays is a recommended mitigation measure to reduce weed establishment and soil erosion and would also provide suitable foraging habitat for this species.

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

Not applicable.

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

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

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

Not applicable.

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

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

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

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

i) The project will impact up to 152 ha of pasture/cropping land, potential foraging habitat for these species.

ii) No habitat fragmentation would occur as a result of the Proposal.

iii) As described in a) above the habitat to be removed is considered marginal and would not be limiting for these species based on its common occurrence throughout the district

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 these species.

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

No recovery plans have been prepared for these species

Brown Treecreeper (*Climacteris picumnus*)

Ecological information

Brown Treecreepers inhabit drier forests and woodlands. They appear to rely on relatively undisturbed stands of remnant vegetation and require areas of >200ha to maintain viable populations (Barrett et al. 1994). This species often forages on the ground or on fallen timber as well as the more typical treecreeper foraging habitat of tree trunks and branches (Norske 1979). Brown Treecreepers are reliant on hollows for nesting and roosting. They are sedentary species holding permanent territories and are usually found in pairs or in family groups.

Test of significance

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

There are numerous records of Brown Treecreepers in Goobang National Park >20km to the west and two records within 10km of the subject site.

Potential impacts of the Proposal include the removal of hollow bearing trees and woodland remnants important for nesting/roosting and foraging/dispersal.

It is unlikely that Brown Treecreepers are resident on site due to the highly fragmented and degraded nature of the woodland, however some hollow bearing trees are present and the species has been recorded locally so there is a low probability of a viable resident population. The site is more likely to be used occasionally by dispersing birds.

Further targeted surveys for this species would be required if any hollow bearing trees other than isolated paddock trees were to be removed. A preclearance tree removal policy is recommended if there is a requirement to remove any hollow bearing trees. By planning infrastructure to avoid hollow bearing trees and the larger woodland stands the Proposal is unlikely to affect this species such that a local population is placed at risk of extinction.

b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such

that a viable local population of the species is likely to be placed at risk of extinction

Not applicable.

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

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

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

Not applicable.

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

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

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

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

i) The Proposal will impact up to 152 ha of grazing and croplands. The Proposal will not directly impact habitat for this species other than the removal of up to 55 isolated trees including six hollow bearing trees. It is highly unlikely that these trees would be used for foraging and/or roosting/nesting due to the lack of connectivity and the exposed matrix surrounding them and they would be described as low quality habitat at best.

ii) No habitat for this species would become more isolated or fragmented by the Proposal.

iii) The removal of habitat is unlikely to be significant as the PV arrays will be located in grazed and cultivated paddocks that would not be suitable foraging areas for this species as they lack fallen timber and are likely to be low in invertebrate numbers due to lack of leaf litter, stock impacts and lack of vegetation diversity. The removal of up to 55 isolated paddock trees is unlikely to impact any local population as this habitat is considered poor and it is highly unlikely that these trees would be used for foraging and/or roosting/nesting due to the lack of connectivity and the exposed matrix surrounding them.

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 these species.

f) whether the action proposed is consistent with the objectives or action of a recovery plan or

threat abatement plan

No recovery plans have been prepared for this species

Greater Long-eared Bat (*Nyctophilus species 2*), Little Pied Bat (*Chalinlobus picatus*), Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*)

Ecological information

The Greater Long-eared bat is known to inhabit vegetation with a distinct canopy and a dense cluttered understorey. They inhabit a wide variety of vegetation types including open woodlands (Churchill2008). This species is a low flying agile bat, utilising the understorey to hunt non-flying prey - especially caterpillars and beetles - and will even hunt on the ground (DECCW 2010). Greater Long-eared bats roost in tree hollows, under loose bark and in fissures in branches (Churchill 2008).

Little is known about the ecology of Little Pied Bats which are one of the few bats to occur primarily in the arid and semiarid areas of eastern Australia. This species was thought to be a cave and rock-outcrop roosting species but subsequent captures suggest it also uses tree hollows, mine shafts and tunnels, and abandoned buildings (Ayers et al. 1996). The Little Pied Bat has been found in a wide variety of woodland and forest habitats in western NSW and needs ready access to water in a creek and/or tank (Smith et al. 1998).

The Yellow-bellied Sheathtail-bat is found in almost all habitats from woodland to forest to grassland. This species migrates to southern Australia in the summer. It roosts and breeds in hollow trees with colonies of up to 30 individuals recorded (commonly around six) (Churchill 2008). There is speculation that the larger colonies of this species may occur where habitat is limiting as a colony of 29 individuals was found in an isolated paddock tree in cleared grazing land (Rhodes and Hall 1997).

Test of significance

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

Little Pied Bats have been recorded >60km to the north and west of the subject site, these are six scattered records of Yellow-bellied Sheathtail-bats within 100km of the subject site and Greater Long-eared bats have been recorded from Nanbar National Park 30km to the south west of the subject site.

The major potential impact from the Proposal is the loss of hollow bearing trees that provide potential roost sites for these species.

Few hollows were recorded on the subject site suggesting this resource may be limited in the local area. If a hollow bearing tree containing a colony of threatened microbats was removed impacts to the local population of that species could be significant. Designing infrastructure to avoid hollow bearing trees is the best mitigation strategy in this case. If hollow bearing trees were to be removed anabat surveys and then the adoption of a preclearance tree removal policy (such as the one listed in Appendix I) would be required to determine the significance of the impact.

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 the risk of extinction, or

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

Not applicable.

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

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

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

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

i) A total of six hollow bearing trees would be removed by the Proposal.

ii) The Proposal would not increase habitat fragmentation for these mobile species.

iii) The habitat to be removed, in the form of isolated paddock trees is considered marginal for Greater Long-eared bats, Little Pied Bats and the Yellow-bellied Sheathtail-bats. If a roost tree was to be removed however, this could be important to a local population. Follow-up surveys are required on hollows that would be removed.

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 these species.

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

No recovery plans have been prepared for these species

Koala (*Phascolarctos cinereus*)

Ecological information

The Koala occupies woodlands and forest and appears able to occupy moderately disturbed environments (DECC 2008; Gordon et al. 1988; McAlpine et al 2006; Wintle et al. 2008). Home range size varies with quality of habitat, ranging from less than 2 hectares to several hundred hectares in size (DECCW 2009). Connectivity is important to Koala persistence in an area. Koalas are less able than many other mammals to travel between fragments due to their low energy diet however young koalas commonly disperse three to four kilometres from their natal area (Dique etal 2003). Koala Secondary habitat has been found to be highly important, as it is more common and can aid dispersal (McAlpine et al 2006).

The following regional feed tree species are present on site (based on DECC 2008): Yellow box (*E. melliodora*) and White box (*E. albens*) (classed as secondary feed species). As no primary feed tree species are present , the habitat in the subject site can be classified as Secondary Habitat (Class B) under the Phillips (2000) system (in DECC 2008).

Using the definitions in the State Environmental Planning Policy No 44 - Koala Habitat Protection (SEPP44) the subject site would qualify as Secondary Koala Habitat as White Box and Yellow Box are listed as feed tree species and constitute >15%of the trees present but no resident Koala population is present.

Test of significance

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

The subject site can be defined as secondary habitat as it is dominated by secondary feed tree species (White Box and Yellow Box). The site is unlikely to constitute part of the home range of a viable, low density koala population due to the expanse of modified farmland within which the subject site is located. There are numerous records of Koalas from the larger tracts of remnant vegetation in the district including Goonbang National Park which is connected to forest found 6km to the west of the subject site and the remnant White Box and Yellow Box trees on site provide potential habitat for dispersing individuals. The Proposal will remove approximately 45 White and Yellow Box feed trees. The loss of the 152 ha of scattered secondary Koala habitat is unlikely to impact any local population of Koalas such that they would be placed at risk of extinction as the modified nature of the vegetation and distance from larger tracts of suitable habitat would result in the site being infrequently used by dispersing individuals and this Koala movement can be maintained through remnant vegetation surrounding the site.

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 the risk of extinction, or

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

Not applicable.

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

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

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

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

i) A total approximately 45 secondary feed trees would be removed by the proposal over an area of 152ha

ii) As the habitat to be removed is abundant in the district the proposal would not increase fragmentation for this species.

iii) As discussed above the habitat to be removed is unlikely to be used by this species. Dispersing individuals have a low probability of occurring on site and the abundance of similar habitat on the adjacent land and in the wider district ensure that the habitat to be removed would not be significant to Koalas.

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 these species.

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

The Proposal is not inconsistent with the approved recovery plan for this species (DECC, 2008).

Little Whip Snake (*Suta flagellum*), Pink-tailed Worm-lizard (*Aprasia parapulchella*)

Ecological information

Little Whip Snake has been found in grasslands, grassy woodlands, and secondary grasslands. It requires well-drained slopes with loose scattered rocks or rocky outcrops to provide shelter and foraging habitat (NSW Scientific Committee 2008). This species is nocturnal and feeds on primarily on

skinks. The Little Whip Snakes cryptic nature and low density results in a lack of ecological information for this species.

Pink-tailed Worm-lizards occur in open grassland habitats that have a substantial cover of small rocks (Osborne & Jones 1995). This species also shows a preference for sunny aspects, avoiding south facing slopes. Pink-tailed Worm-lizards are only found at sites with good numbers of invertebrates under rocks (Barrer 1992), particularly small ants upon which it feeds. Most sites occur in relatively open vegetation (Osborne & McKergow 1993). The species is occasionally recorded from grassland sites that are dominated by exotic species. Populations may extend into adjacent woodland but remain undetected (Barrer 1992).

Pink-tailed Worm-lizards are most commonly found sheltering under small rocks (150 - 600 mm basal area) shallowly embedded in the soil (2 - 5 cm). Some individuals have been found under larger rocks embedded up to 30 cm deep. Rocks are used for thermoregulation, with lizards preferring rocks that receive direct sunlight (Barrer 1992). Individuals may be faithful to the same rock for long periods of time. The lizards utilise ant burrows underneath the rocks, possibly retreating deep into burrows in hot, dry weather (Osborne & Jones 1995) (in DEWHA 2010).

Test of significance

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

One record of a Pink-tailed Worm-lizard exists from Bogan Gate, 70km to the west of the subject site and a Little Whip Snake has been recorded approximately 100km to the north west of the subject site.

Neither species was detected during the brief winter survey however survey effort was limited and seasonal timing was not appropriate for detection of either species.

Potential impacts of the Proposal include localized soils compaction and surface rock disturbance from machinery and during the installation of pylons and other infrastructure. Long term impacts from shading and the associated changes to the microclimate under the PV arrays may make these areas unsuitable for many reptile species including Pink-tailed Worm-lizards and Little Whip Snakes.

Marginal habitat for both species exists in the western paddock of the subject site where grazing pressure is low - moderate and small patches of moderate - high diversity grassland were recorded. Across the rest of the site much of the surface rock areas are highly modified by grazing, stock disturbance and weed invasion. The out crops are periodically isolated by cultivation and grazing of the surrounding pasture and cropland. Two habitat assessments were carried out on the major outcrops in the east and west of the subject site to determine how embedded the surface rocks were and the abundance of food resources for Pink-tailed Worm-lizards (small black ants) and Little Whip Snakes (skinks). Rocks were largely embedded at both sites with lightly embedded surface rocks (suitable for skink and Pink-tailed Worm-lizard shelter sites) generally disturbed by stock or piled up following paddock clearances. Few small black ant nests were found under rocks during the assessments (two from 70 rocks rolled in the east and three from 50 rocks rolled in the west) suggesting habitat is poor for Pink-tailed Worm-lizards. Several skinks including were found during the assessments (*Ctenotus robustus* and *Morethia boulengeri*) however populations of small skinks are likely to be low due to the

periodic exposure from and disturbance by stock grazing and trampling and cultivation.

Further surveys would be required if infrastructure was to impact the western paddock of the subject as limited habitat for both species exists, however the presence of local populations is considered unlikely. Over the rest of the site the probability of either species occurring is considered very low due to the quality of the habitat and history of disturbance. However as a precautionary measure rock out crop areas as mapped in the habitat map (Figure 5-1) should be avoided if possible. If these areas were used to site infrastructure the Proposal is unlikely to impact any local population of either species such that it would become extinct.

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 the risk of extinction, or

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

Not applicable.

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

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

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

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

i) 152 ha of very low quality habitat would be impacted by the Proposal. Marginal habitat is present on site in the western paddock, however the likelihood of either species occurring there is low and the Proposal has been designed to avoid this area.

ii) The area of native grassland in the western paddock is isolated by cultivation and an adjacent road. The Proposal would not increase the fragmentation of this habitat.

iii) The proposal will modify areas of surface rock in cultivated and exotic dominated paddocks with a long history of disturbance due to agricultural production. These areas are considered poor habitat and the modification of these areas would not impact either species.

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 these species.

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

The Proposal is not inconsistent with the ACT Recovery plan for the Pink-Tailed Worm Lizard (*Aprasia parapulchella*) (Osbourne and Jones, 1995).

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

Four listed Key Threatening Processes are relevant to this Proposal:

1. **Bush Rock Removal.** Includes removal of rocky outcrops or rock within areas of native vegetation. Impacts of bush rock removal includes loss or disturbance of native flora and fauna species habitat (e.g. Pink-tailed Legless Lizard and Little Whip Snake*).* Potential impacts arising from the Proposal include habitat modification due to microclimate changes brought about by shading and changed moisture levels under the pv arrays. The project is unlikely to directly advance this process as the small amount of rock that is likely to be impacted has been subjected grazing, cropping and subsequent fragmentation for several decades. The subject site is unlikely to support threatened fauna dependent on bush rock (refer to sections above) and similar habitat (likely to be in a similar low quality state) appears to be widespread in the district. The loss/modification of small areas of rocky outcrop at the subject site is not expected to significantly exacerbate bush rock removal as a threatening process in the study area.
2. **Clearing of native vegetation**. In the determination, the NSW Scientific Committee found that 'clearing of any area of native vegetation, including areas less than two hectares in extent, may have significant impacts on biological diversity'. Clearing can lead to direct habitat loss, habitat fragmentation and associated genetic impacts, habitat degradation, loss of the leaf litter layer increased habitat for invasive species and off-site impacts such as downstream sedimentation. The Proposal would not contribute significantly to the operation of clearing as a threatening process at the local or regional level, since the bulk of the subject site is already cleared and highly modified by agricultural practices such as tillage. The Proposal would remove up to 3 ha of low quality box gum woodland, an endangered ecological community. Some localised areas of low diversity native grassland derived from box gum woodland exist as grazed pasture and approximately 0.2 ha of this habitat type would be removed to widen the existing farm track to form the site access road.
3. **Loss of hollow-bearing trees.** In NSW, terrestrial vertebrate species that are reliant on tree hollows for shelter and nests include at least 46 mammals, 85 birds, 32 reptiles and 16 frogs (Gibbons and Lindenmayer 2002). Of these, 45 species are listed as threatened. Hollow-nearing trees are in decline for reasons including lack of recruitment and clearing. Trees bearing large hollows in particular are increasingly rare. Medium and small hollows were found in woodland patches and isolated trees and stags across the site however few hollow bearing trees were recorded in total. There is little or no woodland tree regeneration across the subject site and tree cover and associated habitat values are likely to be lost when the current generation die. Conserving the existing trees and promoting regeneration via fencing/planting are important actions to reduce the impact of this key threatening process on site.

A total of six hollow bearing trees will be removed by the Proposal. Offset measures identified in an Offset plan, to be produced prior to the works, will ensure this loss is compensated for by the protection of remnant vegetation.

4. **Removal of dead wood and dead trees.** The removal of standing or fallen dead wood removes hollows as well as forest floor litter. The forests and woodlands of Western Slopes are considered most at risk from this process mainly due to firewood collection. Standing dead timber is present at a very low density across the site. The existing degraded and disturbed nature of the site (the few examples of fallen timber found during the assessment had been piled up) precludes the proposed development from significantly increasing the impact of this key threatening process.

Conclusion of NSW Assessments of Significance

Flora

The majority of the vegetation on the site is in a degraded state due to past and present agricultural practices. The proposal would result in the removal of approximately 3.2 hectares of Box-gum Woodland EEC that is in generally poor condition with little chance of recovery. This is not considered to be significant with respect to its degraded state and the extent of similar vegetation in the locality. It is unlikely that threatened flora species would occur on the bulk of the site due to the high amounts of disturbance however, there is the potential for threatened species to occur in areas of better habitat in the western paddock. The proposal would impact upon only a small proportion of this area. There would be no significant impacts to threatened flora if these species do not occur within the development envelope. A spring survey is required to confirm their presence or absence.

Fauna

The habitat on site is degraded by a long history of modification due to agricultural production. By planning the infrastructure layout to avoid higher quality habitat, such as the native pasture in the western paddock, the Proposal minimises any biodiversity impacts. Follow up surveys for threatened reptiles would be required if impacts to the higher diversity grassland in the west of the western paddock or the adjacent rocky outcrops was anticipated. The Proposal will remove six hollow bearing trees however, with the adoption of pre clearance checks to confirm no threatened microbats or Superb Parrots are utilising these hollows, this impact is manageable and is considered unlikely to impact any threatened species. The assessments above conclude that if mitigation measures detailed in this report are adopted there would be no significant impact to threatened fauna species. With the implementation of offset measures a net increase in biodiversity values will be achieved.

A.2 ASSESSMENTS UNDER THE EPBC ACT (COMMONWEALTH)

The following assessment of significance is undertaken according to the Significant Impact Guidelines for Matters of National Environmental Significance listed under the *Environment Protection and Biodiversity Conservation Act 1999*, for species with potential to occur (and thereby be impacted).

Small Purple-pea *Swainsona recta*	E EPBC
Austral Toadflax *Thesium australe*	V EPBC
Superb Parrot *Polytelis swainsonii*	V EPBC

Endangered or Critically Endangered Species Assessment - Small Purple-pea (*Swainsona recta*)

Please refer to the TSC Act assessment for ecological information used herein.

Will the action ...

a) *Lead to a long-term decrease in the size of a population?*

In view of the long grazing history, the majority of the native pasture at the proposed solar farm site is unlikely to support threatened flora species and unlikely to be capable of recovering flora diversity. An area of higher diversity in the south-western corner of the western section of the site is more likely to support a population of this species but this area will be avoided and protected by the proposal. As such, it is unlikely that the proposal will lead to a long-term decrease in the size of a potential population of this species. A targeted survey in Spring (early November) would be undertaken as a precautionary measure to confirm this assumption.

b) Reduce the area of occupancy of the species?

Approximately 0.2 hectares of potential habitat would be cleared for the construction of the site access track. The majority of the native pasture on the site is unlikely to support this species and areas of higher diversity with a higher potential of supporting the species will be avoided and protected by the proposal. It is unlikely that the action will reduce the area of occupancy of the Small Purple-pea.

c) Fragment an existing population into two or more populations?

The proposal will not result in the fragmentation of suitable habitat for this species and therefore would not fragment any existing population that may occur within the subject site.

d) Adversely affect habitat critical to the survival of a species?

Habitat within the subject site suitable for this species has been subject to a long history of grazing and is generally in a modified and degraded state. No habitat exists within the subject site that is considered critical to the survival of the Small-Purple-pea.

e) Disrupt the breeding cycle of a population?

The proposal will not impact upon higher quality habitat for this species and as such is unlikely to disrupt the breeding cycle of a population should one exist.

f) Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?

Approximately 0.2 hectares of potential (marginal) habitat would be cleared for the construction of the site access track. The majority of the native pasture on the site is unlikely to support this species and areas of higher diversity with a higher potential of supporting the species will be avoided and protected by the proposal. It is unlikely that the action will result in the decline of the Small Purple-pea.

g) Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat?

The majority of the subject site has a groundcover dominated by introduced exotic species. Weeds are common within the native dominated pasture in the western section of the site which provides suitable habitat for the Small Purple-pea. The proposal has the potential to introduce and/or further distribute weeds within the subject site through the movement of vehicles, people and equipment. Mitigation measures have been described in Section 8 of this report to minimise the impacts from invasive species. Given the current level of disturbance and providing the recommendations contained within this report are adhered to, it is unlikely that the proposal will result in additional harmful invasive species becoming established in the habitat of the Small Purple-pea.

h) Introduce disease that may cause the species to decline?

The movement of vehicles, plant, equipment and people on and off the subject site has the potential to introduce disease that may impact upon the Small Purple-pea. However, higher quality areas of habitat suitable for this species, and more likely where the species may occur, will be avoided and protected during the proposed works and it is unlikely that disease would be introduced that may cause the species to decline in these areas.

i) Interfere with the recovery of the species?

The majority of the habitat suitable for this species is in a disturbed and degraded state and is unlikely to support the species. The recovery potential of these areas is low and it is unlikely that the species would recolonise these areas with current land management practices. Areas of higher quality habitat would be avoided and protected during the proposed works and recovery of the species would be possible in these areas. Large areas of similar suitable habitat occur within the locality. The proposal is unlikely to interfere with the recovery of the Small Purple-pea.

Vulnerable Species Assessment - Austral Toadflax (*Thesium australe*)

Please refer to the TSC Act assessment for ecological information used herein.

Will the action ...

j) *Lead to a long-term decrease in the size of an important population?*

In view of the long grazing history, the majority of the native pasture at the proposed solar farm site is unlikely to support threatened flora species and unlikely to be capable of recovering flora diversity. An area of higher diversity in the south-western corner of the western section of the site containing Kangaroo Grass is more likely to support a population of this species but this area will be avoided and protected by the proposal. As such, it is unlikely that the proposal will lead to a long-term decrease in the size of a potential population of this species. A targeted survey in Spring (early November) would be undertaken as a precautionary measure to confirm this assumption.

k) Reduce the area of occupancy of an important population?

Approximately 0.2 hectares of potential (marginal) habitat would be cleared for the construction of the site access track. The majority of the native pasture on the site is unlikely to support this species and areas of higher diversity with a higher potential of supporting the species will be avoided and protected by the proposal. It is unlikely that the action will reduce the area of occupancy of Austral Toadflax.

l) Fragment an existing population into two or more populations?

The proposal will not result in the fragmentation of suitable habitat for this species and therefore would not fragment any existing population that may occur within the subject site.

m) Adversely affect habitat critical to the survival of a species?

Habitat within the subject site suitable for this species has been subject to a long history of grazing and is generally in a modified and degraded state. No habitat exists within the subject site that is considered critical to the survival of Austral Toadflax.

n) Disrupt the breeding cycle of an important population?

The proposal will not impact upon higher quality habitat for this species and as such is unlikely to disrupt the breeding cycle of a population should one exist.

o) Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?

Approximately 0.2 hectares of potential (marginal) habitat would be cleared for the construction of the site access track. The majority of the native pasture on the site is unlikely to support this species and areas of higher diversity with a higher potential of supporting the species will be avoided and protected by the proposal. It is unlikely that the action will result in the decline of Austral Toadflax.

p) Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat?

The majority of the subject site has a groundcover dominated by introduced exotic species. Weeds are common within the native dominated pasture in the western section of the site which provides suitable habitat for the Small Purple-pea. The proposal has the potential to introduce and/or further distribute weeds within the subject site through the movement of vehicles, people and equipment. Mitigation measures have been described in Section 8 of this report to minimise the impacts from invasive species. Given the current level of disturbance and providing the recommendations contained within this report are adhered to, it is unlikely that the proposal will result in additional harmful invasive species becoming established in the habitat of Austral Toadflax.

q) Introduce disease that may cause the species to decline?

The movement of vehicles, plant, equipment and people on and off the subject site has the potential to introduce disease that may impact upon Austral Toadflax. However, higher quality areas of habitat suitable for this species, and more likely where the species may occur, will be avoided and protected during the proposed works and it is unlikely that disease would be introduced that may cause the species to decline in these areas.

r) Interfere substantially with the recovery of the species?

The majority of the habitat suitable for this species is in a disturbed and degraded state and is unlikely to support the species. The recovery potential of these areas is low and it is unlikely that the species would recolonise these areas with current land management practices. Areas of higher quality habitat would be avoided and protected during the proposed works and recovery of the species would be possible in these areas. Large areas of similar suitable habitat occur within the locality. The proposal is unlikely to interfere with the recovery of Austral Toadflax.

Vulnerable Assessment - Superb Parrot (*Polytelis swainsonii*)

Please refer to the TSC Act assessment for ecological information used herein.

Will the action ...

a) *Lead to a long-term decrease in the size of an important population?*

Superb Parrots breeding range extends in a triangle bounded by Molong, Yass and Young and along the Murray and Murrumbidgee Rivers in NSW.

The proposed development has the potential to cause habitat alienation by increasing human activity adjacent to potential breeding sites and potential breeding habitat may be physically removed during construction (a total of six hollow bearing trees). However, the hollows to be removed are unlikely to be used by parrots as only two hollows were large enough to be utilized as nest sites, neither of these displayed signs of parrot nesting and the species prefers to nest in areas of open woodland where Blakely's Red Gum is a major component (Manning et al. 2006). The Proposal would be unlikely to

negatively impact this species.

b) Reduce the area of occupancy of an important population?

The habitat to be impacted by the Proposal (agricultural land with scattered remnant trees) is the dominant habitat type found throughout the district. The loss of 152ha of this habitat would not impact Superb Parrots or reduce their area of occupancy.

c) Fragment an existing population into two or more populations?

The superb parrot is highly mobile. The proposed development is unlikely to restrict movement of this species such that the local population is fragmented.

d) Adversely affect habitat critical to the survival of a species?

No areas of critical habitat have been declared for this species. It is recommended that hollow bearing trees are retained wherever possible as these are important to the species. The Proposal is unlikely to impact any breeding hollows of this species following the removal of 6 hollow bearing trees .

e) Disrupt the breeding cycle of an important population?

As discussed above potential breeding habitat in the form of six hollow bearing trees are to be removed by the Proposal (of these only two hollows are large enough to be used for breeding by this species). It is unlikely that these trees are used for nesting by Superb Parrots as the hollows are of poor quality and displayed no signs of parrot nesting (chewing around the entrance) there fore the Proposal would not impact the breeding cycle of this species..

f) Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?

The Proposal is unlikely to impact the breeding of this species due to the low number of hollows to be removed and the lack of signs of occupation. The Foraging habitat to be removed is the dominant habitat type in the district and the loss of 152ha is not significant. The Proposal is unlikely to impact this species or cause the local population to decline.

g) Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat?

Biosecurity measures to ensure weed spread is minimised will be used. The Proposal is unlikely to result in the introduction of an invasive species not already found on site.

h) Introduce disease that may cause the species to decline?

Psittacine beak and feather disease (BFD) is a potential threat to Superb Parrots, however the development is unlikely to cause an increase in this disease and the main threat lies with disease spread via common parrot species in the local area.

i) Interfere substantially with the recovery of the species?

The Proposal is unlikely to impact the breeding of this species due to the low number of hollows to be removed and the lack of signs of occupation. The Foraging habitat to be removed is the dominant habitat type in the district and the loss of 152ha is not significant. For these reasons the Proposal is not considered likely to impact on Superb Parrots or interfere with the recovery of this species.

Appendix B EVALUATION

B.1 HABITAT EVALUATION

Sixteen habitat evaluations targeting threatened species habitat were undertaken across the subject site including one assessment undertaken in adjacent woodland. Results of these assessments are found below and were used to inform the threatened species evaluation which identifies the threatened species with potential to be impacted by the Proposal. The locations of these assessments are shown in Figure 9-1.

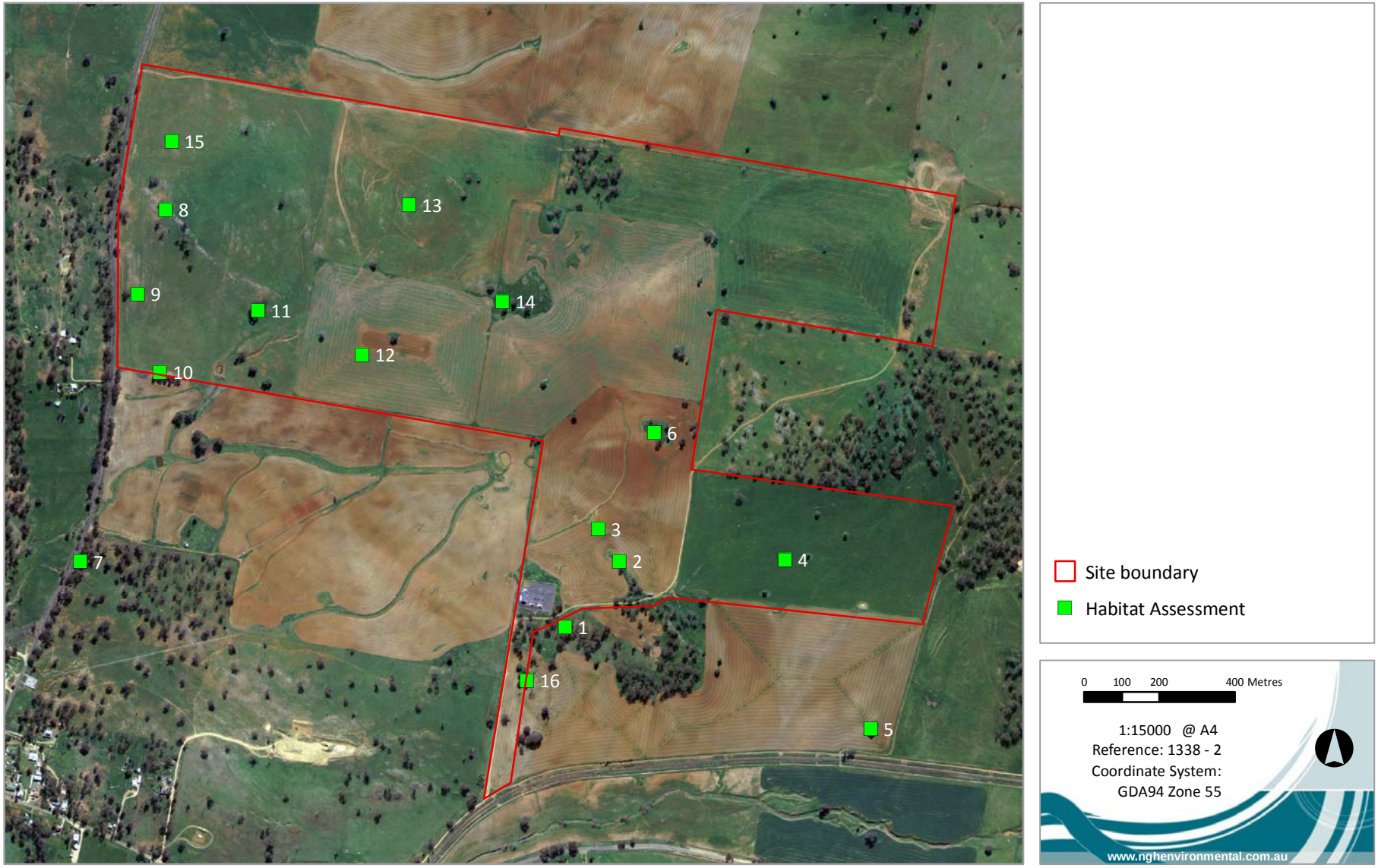


Figure 9-1 Fauna habitat assessment points

Habitat Assessment 1	
Habitat Type:	Remnant White Box woodland
Area:	9Ha approx
Landscape position:	Slight knoll in undulating farmland. Manildra substation is located on the edge of the stand to the NW.
Connectivity:	loosely connected to larger remnant woodland to the NW via lone paddock trees and to the SW via cleared woodland to wooded areas around Manildra township
Land use/disturbance:	Grazing within (not fenced) and cropping around (wheat/canola). Highly modified – cleared, exotic dominated understorey.
Dominant Overstorey:	White Box (*Eucalyptus albens*) with one Kurrajong (*Brachychiton populneus*) and possibly the odd Gray Box. Trees have an average DBH of <60cm and while mature would be considered young.
Regeneration:	No regeneration present – grazed out.
Understorey:	Exotic grasses (Brome) and forbs Pattersons curse (*Echium plantagineum)* , stinging nettle, volunteer canola. No midstorey structure.
Water sources:	Stock water troughs located 100m to the east. Large concrete tank with no top located within the stand. Small creek line 300-400m south.
Habitat features:	rocky out crop running NW-SE
Comments:	Currently little fauna habitat values present other than the trees themselves (nectar, arthropods, foliage).No hollows, no mistletoe, little fallen timber. Cultivation has occurred around and within the stand. Non tilled areas have been grazed by sheep and cattle.

Habitat Assessment 2	
Habitat Type:	Rock out crop (granitic)
Area:	0.5 Ha approx, 300m not continuous by 20m wide.
Landscape position:	On slight knoll in undulating farmland. Out crop extends out into cultivated paddock to the north. Manildra substation is located 200m to the West. A farm track crosses the outcrop.
Connectivity:	isolated by cultivated paddocks. Potential for larger more mobile species to utilise once crops provide cover.
Land use/disturbance:	Grazing and cropping around (wheat/canola). Highly modified – cleared, exotic dominated understorey.
Dominant Overstorey:	White Box with one Kurrajong
Regeneration:	No regeneration present – grazed out.
Understorey:	Exotic: Stinking Love Grass and forbs eg Patterson's Curse, stinging nettle.
Water sources:	Stock water troughs located 100m to the east. Large concrete tank with no top located within the stand. Small creek line 300-400m south.
Habitat features:	>A4 surface rocks, granitic, rounded, embedded to partially embedded. Loose piles of smaller rocks collected off the cultivated field. Few black ants (5 out of 70 rocks).
Comments:	Little possibility of threatened species presence due to surrounding cultivation, heavy grazing and modification by weeds

Habitat Assessment 3		
Habitat Type:	Shallow ephemeral dam within cultivated wheat crop	
Area:	20Ha approx paddock size, dam 30x30m	
Landscape position:	On slight NW facing slope within undulating farmland. Manildra substation is located in the SW corner of the paddock.	
Connectivity:	forms part of the modified agricultural land surrounding the remnant vegetation.	
Land use/disturbance:	Currently sown to wheat (at approximately the 4 leaf stage) . History of cultivation.	
Dominant Overstorey:	Small stand of White Box in the northern corner of the paddock.	
Regeneration:	No regeneration present – grazed out.	
Understorey:	wheat crop	
Water sources:	the small dam has limited water in it but appears ephemeral.	
Habitat features:	Power poles run through the paddock providing perching for birds of prey	
Comments:	Few habitat values. No fringing veg around dam – stock trampling around edge. Seed resource pre and post harvest for parrots including the Superb Parrot.	

Habitat Assessment 4		
Habitat Type:	Native pasture (sprayed out?)	
Area:	25Ha approx paddock size,	
Landscape position:	Midslope on shallow sloping SW facing slope	
Connectivity:	forms part of the modified agricultural land surrounding the remnant vegetation but remnant Kurrajong trees provide a loose link between the wood ridge to the east and the remnant stand beside the sub station.	
Land use/disturbance:	Grazing –sheep. This paddock is likely to have been cultivated in the past.	
Dominant Overstorey:	isolated Kurrajong trees, small (4 trees) stand of White Box on small rocky outcrop in NW of the paddock.	
Regeneration:	Nil	
Understorey:	Native pasture (red grass present) with Brome grass	
Water sources:	Stock water trough.	
Habitat features:	One of the Kurrajongs has a small hollow	
Comments:	Few habitat values. No rock outcrops	

Habitat Assessment 5		
Habitat Type:	Lone Yellow Box Paddock tree in paddock sown to canola.	
Area:	20Ha approx paddock size	
Landscape position:	lower slope on shallow south facing slope	
Connectivity:	forms part of the modified agricultural land surrounding the remnant vegetation. Only one paddock tree present	
Land use/disturbance:	Previous grazing –sheep and cattle. Cultivation.	
Dominant Overstorey:	Isolated mature Yellow Box tree	
Regeneration:	Nil	
Understorey:	Sown wheat. Nettle, Pattersons curse, Stinking Lovegrass under tree (from stock camp)	
Water sources:	creek line 100m to the south	
Habitat features:	One low quality hollow in the Yellow Box. Some fallen timber under the tree.	
Comments:	Few habitat values. No rock outcrops. Yellow Box community likely to dominate these lower slopes as other mature trees present off site.	

Habitat Assessment 6		
Habitat Type:	White Box woodland remnant (small).	
Area:	0.5Ha approx	
Landscape position:	mid slope on shallow west facing slope towards the edge of a cultivated paddock	
Connectivity:	isolated by cultivated paddock, 150m from the western most limit of a larger woodland remnant to the east	
Land use/disturbance:	Evidence of previous grazing –sheep and cattle. Cultivation surrounding the stand.	
Dominant Overstorey:	White Box with a lone White Cyprus Pine	
Regeneration:	Nil	
Understorey:	Exotic dominated with nettle, Stinking Love grass, Small-flowered Mallow (**Malva parviflora*), volunteer canola	
Water sources:	Stock troughs in adjacent paddock	
Habitat features:	Some fallen timber and logs. Small sedimentary rock out crop –embedded.	
Comments:	Stock camps under trees, fox scat present – all invertebrates – no fur or feathers. Evidence of fire wood gathering	

Habitat Assessment 7	
Habitat Type:	White Box Yellow Box woodland, moderate – good condition
Area:	10 ha approx
Landscape position:	Lower slopes – flats. Travelling stock reserve beside Packham Drive north of Manildra township
Connectivity:	Separated from the Mandagery Creek vegetation corridor by the road but linked to the forested areas to the west of Manildra by this corridor. Also loosly linked to the White Box stand adjacent to the Manildra sub station to the east.
Land use/disturbance:	Fenced from stock but likely to be lightly grazed from time to time. Some clearing and removal of shrubby mid storey.
Dominant Overstorey:	White box and Yellow Box
Regeneration:	Many regenerating eucalypts from pole sized to seedlings.
Understorey:	Native grass dominated (Red Grass (*Bothriochloa macra*) and Spear Grasses (*Austrostipa spp.*).), some native forbs and postrate woody natives, also a sparse mid storey shrub layer.
Water sources:	200m from Mandagery creek
Habitat features:	Some structural diversity providing cover and foraging opportunities. Some fallen timber. Good grass cover (to 30cm). Some small rock outcrops. Some hollows but few very old trees.
Comments:	Few weeds, some grazing likely as the road verge supported a greater diversity of native species than in the stand, however the rgeneration present suggests a low grazing pressure.

Habitat Assessment 8	
Habitat Type:	Rock out crop with White Box stand and native grass understorey
Area:	2 ha, the out crop extends 120m with scattered surface stones 20 to 40m wide and larger outcrops 20m wide
Landscape position:	Low rocky ridge in native pasture paddock to the west of the subject site.
Connectivity:	Isolated but close to Mandagery creek (400m) and other remnant woodland towards the creek (100m)
Land use/disturbance:	Grazed by sheep and cattle. Rock piles suggest past localised cultivation within the paddock. The paddock is largely cleared .
Dominant Overstorey:	White Box, some Kurrajong and a large White Cyprus stag.
Regeneration:	Nil
Understorey:	Native grass dominated, red grass, some Wallaby Grass (*Austrodanthonia sp.*) and Spear Grass
Water sources:	Mandagery Creek (400m) west, dry dam 300m south.
Habitat features:	Rock on rock habitat within the medium sized granite outcrops. Surface stones present, many disturbed by stock. Grasses moderately grazed but providing good ground cover between the rocks. Small and medium hollows present in the remnant trees.
Comments:	Moderate reptile habitat but isolated from other suitable habitat. Single large Sweet Briar present,

Habitat Assessment 9		
Habitat Type:	Moderate diversity native grassland, Themeda dominated.	
Area:	<0.5ha, thin strip along embedded rock outcrop	
Landscape position:	Moderate west facing mid slope	
Connectivity:	Currently connected to the larger rock outcrop to the north (Habitat Assessment 8) by good cover of red grass but this is likely to be compromised during drought or heavy grazing pressure.	
Land use/disturbance:	Grazed, cleared. Some exotic forbs and grasses but predominately natives.	
Dominant Overstorey:	Lone mature Yellow Box on edge of rock outcrop.	
Regeneration:	Nil	
Understorey:	Native grasses and forbs (Kangaroos Grass (*Themeda australis*) dominated in localised patches) red grass dominates the wider paddock with some Wallaby and Spear Grass.	
Water sources:	Mandagery Creek (400m) west, dry dam 300m SW.	
Habitat features:	Very limited rock habitat (largely embedded). Moderate diversity native grass land (Box-Gum Woodland derived), light to moderate grazing – tussock shelter sites.	
Comments:	The small size of this remnant patch suggests it would not support viable populations of species (particularly reptiles) that require diverse native grassland however the matrix of low diversity native pasture may enable recolonisation of the area during low grazing pressure from offsite (if local populations exist off site).	

Habitat Assessment 10	
Habitat Type:	Native vegetation seeding trial plots
Area:	<0.5ha
Landscape position:	Lower slope/ flats adjacent to the south western boundary of the subject site (outside the subject site)
Connectivity:	Isolated in a cultivated/pasture matrix but close to the road verge remnant vegetation and Mandagery Creek
Land use/disturbance:	Seeding trials sown into cleared cropping land in the 1990's. Fenced from stock.
Dominant Overstorey:	Yellow Box, White Box, Apple Box, Western Grey Box, Blakely's Red Gum - young trees DBH <15cm
Regeneration:	Nil
Understorey:	Narrow leafed hop bush midstorey, little ground cover but good leaf litter.
Water sources:	Small dam 200m south
Habitat features:	Rare example of midstorey bushy structure. Lots of birds around the area including Flame Robins and Rufus Songlarks. Good leaf litter
Comments:	The trial, although small in area, was quite dense (hence the lack of ground cover) and had a diverse assemblage of birds presumably utilising the habitat structure for shelter and foraging.

Habitat Assessment 11	
Habitat Type:	Yellow Box – Red Gum remnant woodland patch
Area:	<0.5 ha (9 trees)
Landscape position:	Low on a south easterly slope in the western paddock of the subject site
Connectivity:	Isolated patch in native pasture. Scattered trees within 200m and the Mandagery Creek lying 800m west
Land use/disturbance:	Clearing and grazing with stock camps under the trees. Native groundcover displaced by weeds,
Dominant Overstorey:	Yellow Box – Red Gum, 9 trees
Regeneration:	Nil
Understorey:	Exotics – nettle, mallow, horehound
Water sources:	Small dam 500m south
Habitat features:	Some fallen timber. Two small hollows. On the southern end of the rock outcrop described in Habitat Assessment 8. More grazing pressure at this end and less diversity in the native grass and forbs.
Comments:	Degraded woodland patch. Trees all close to hollow bearing age so potential to provide nesting resources for species like the Superb Parrot into the future.

Habitat Assessment 12		
Habitat Type:	Cultivated paddock sown to canola	
Area:	40 ha for the entire area sown to canola	
Landscape position:	Flat country in a slight drainage line sloping gently from east to west	
Connectivity:	Forms the matrix within which remnant trees are situated. These trees are widely spaced (7 in the 40 Ha)	
Land use/disturbance:	Clearing, cultivation.	
Dominant Overstorey:	Widely spaced Yellow Box, Kurrajong, Blakely's Red Gum and White Box	
Regeneration:	Nil	
Understorey:	Sown canola	
Water sources:	Small farm dams in adjacent paddocks	
Habitat features:	One possible hollow in one of the Yellow Box trees.	
Comments:	Little habitat value	

Habitat Assessment 13		
Habitat Type:	Low diversity exotic/native pasture	
Area:	22 ha	
Landscape position:	Slightly elevated undulating paddock in the central north of the subject site	
Connectivity:	Forms the matrix within which remnant trees are situated. These trees are widely spaced (4 in the 22 ha)	
Land use/disturbance:	Grazing, potentially past cultivation (rock piles from paddock clearing evident	
Dominant Overstorey:	Yellow Box, Kurrajong and exotic Pepper trees	
Regeneration:	Nil	
Understorey:	Stinking Lovegrass with some Red grass	
Water sources:	Stock water trough present and small farm dams in adjacent paddocks	
Habitat features:	Rocky outcrops exist throughout the paddock. Small surface rocks are generally disturbed by stock .Small hollow in one of the Pepper trees.	
Comments:	Although rocky habitat is present the intensity of grazing and evidence of past cultivation suggest that the habitat is not suitable for threatened reptile species.	

Habitat Assessment 14		
Habitat Type:	Small Yellow Box stand within cultivated canola paddock	
Area:	4 trees	
Landscape position:	In shallow drainage line in the central area of the subject site	
Connectivity:	Limited to widely spaced paddock trees	
Land use/disturbance:	Grazed and stock camps under trees. Cultivated land surrounds the trees.	
Dominant Overstorey:	Yellow Box	
Regeneration:	Nil	
Understorey:	Exotic forbs and Stinking Love Grass	
Water sources:	small farm dams in adjacent paddocks	
Habitat features:	No hollows. The trees provide some structure and a limited foraging resource in a highly modified matrix. Rocky outcrops exist to the north of the stand. These outcrops are isolated by cultivation and grazed following cropping. Surface rocks are largely embeded providing little shelter for terrestrial reptiles..	
Comments:	The stand provides a stepping stone for dispersing birds and a foraging resource, especially when flowering.	

Habitat Assessment 15		
Habitat Type:	Low Diversity native pasture (Box-Gum Woodland derived)	
Area:	The entire western paddock is 37 ha (approx)	
Landscape position:	NW slope of rocky ridge (Habitat Assessment 8)	
Connectivity:	Matrix with pasture to the north and west and cultivated paddocks to the south and north east	
Land use/disturbance:	Glow to moderate grazing – sheep (with cattle sign present)	
Dominant Overstorey:	Occasional White Box and Yellow Box scattered trees.	
Regeneration:	Nil	
Understorey:	Native grasses, (Red Grass, Spear Grasses dominate). Occasional small rock outcrop with larger outcrop to the south.	
Water sources:	Mandagery Creek 500m to the west	
Habitat features:	Occasional small rock outcrop (granitic) with largely embedded rocks. Reasonable ground cover of native grass.	
Comments:	Small rabbit warren nearby. Rocky outcrops have cleared rocks piled on them suggesting past cultivation of this paddock (around the larger rock outcrops).	

Habitat Assessment 16		
Habitat Type:	Old homestead ruin	
Area:	<0.5ha	
Landscape position:	Mid slope on a south facing gentle slope 200m south of the Manildra substation	
Connectivity:	On the edge of the White Box stand described in Habitat Assessment 1	
Land use/disturbance:	Old dwelling in cultivated paddock. Some remnant woodland vegetation to the east and north	
Dominant Overstorey:	White Box with a row of pepper trees to the west of the homestead. Also a stand of 5 Yellow Box around small dam 100m south of the homestead	
Regeneration:	Nil	
Understorey:	Sown wheat with exotic forbs and grasses in the thin uncultivated strip surrounding the homestead	
Water sources:	Small dam 150m south	
Habitat features:	Corrugated iron sheets and other rubbish provide shelter sites for reptiles. The window and door less homestead provides roosting opportunities for microbats. These is a White Box with a small active hollow 20m east of the east of the homestead	
Comments:	Stock shelter in the homestead as it is in a state of ruin. Geckos , snakes and microbats may use this structure for shelter	

B.2 THREATENED SPECIES EVALUATION

The tables below evaluate the potential for threatened species, ecological communities and endangered populations that occur or have the potential to occur within or near the study area to be adversely affected by the works. Threatened entities with potential to occur were identified by the following searches;

- **Lachlan CMA Region – Upper Slopes and Orange sub-regions (DECCW threatened species tool)**
- **Central West CMA Region – Upper Slopes and Orange sub-regions (DECCW threatened species tool)**
- **EPBC Act Matters of National Significance search tool - 25 kilometre radius**
- **NSW Wildlife Atlas – additional records in the local region**

Ecology and presence of habitat has been determined using the DEWHA and DECCW species habitat profiles, including vegetation types, for the Lachlan and Central West Bioregions. The likelihood of occurrence is based on presence of habitat, proximity of nearest records and mobility of the species (where relevant). Whether there may be a potential impact is based on the nature of the Proposal, the ecology of the species and whether it is likely to occur. Species with the potential to be impacted are highlighted.

NB Marine and migratory wetland species were not included as the Proposal is unlikely to impact on these species.

Flora and ecological communities

Species and status	Ecology and distribution	Vegetation community	Presence of habitat	Likelihood of occurrence	Recorded during survey?	Potential to be impacted
Trees and Shrubs						
Eucalyptus aggregata Black Gum V TSC	A small to medium woodland tree to 18 m. It is distributed in the NSW Central and Southern Tablelands with small isolated populations in Victoria and the ACT. It has a narrow distribution, occurring predominately in the wetter, cooler and higher parts of the tablelands. Prefers alluvial soils on cooled, poorly drained flats and hollows adjacent to small waterways. Although usually in a woodland formation, it also occurs as isolated paddock trees in native and exotic pasture. Often grows with other cold-adapted eucalypts, such as Snow Gum or White Sallee (*Eucalyptus pauciflora*), Manna or Ribbon Gum (*E. viminalis*), Candlebark (*E. rubida*), Black Sallee (*E. stellulata*) and Swamp Gum (*E. ovata*)	• Montane Bogs and Fens • Eastern Riverine Forests • Southern Montane Heaths • Subalpine Woodlands • Tableland Clay Grassy Woodlands • Temperate Montane Grasslands	Yes (marginal)	Low	No	No
Bossiaea fragrans CE TSC	An erect shrub to 1-2.5 m high. It is only known from the Abercrombie Karst Conservation Reserve south of Bathurst. Occurs on slate and volcanic substrates preferring open White Box (*Eucalyptus albens*) woodland. Flowers from September to October.	• Upper Riverina Dry Sclerophyll Forest • Western Slopes Grassy Woodlands	Yes	Low	No	No

Species and status	Ecology and distribution	Vegetation community	Presence of habitat	Likelihood of occurrence	Recorded during survey?	Potential to be impacted
Philotheca ericifolia V EPBC V TSC	Known only from the upper Hunter Valley and Pilliga to Peak Hill districts of NSW. The records are scattered over a range of over 400 km between West Wyalong and the Pilliga Scrub. Site localities include Pilliga East State Forest, Goonoo State Forest, Hervey Range, Wingen Maid Nature Reserve, Toongi, Denman, Rylestone district and Kandos Weir. Grows chiefly in dry sclerophyll forest and heath on damp sandy flats and gullies. It has been collected from a variety of habitats including heath, open woodland, dry sandy creek beds, and rocky ridge and cliff tops. Associated species include *Melaleuca uncinata, Eucalyptus crebra, E. rossii, E. punctata, Corymbia trachyphloia, Acacia triptera, A. burrowii, Beyeria viscosa, Philotheca australis, Leucopogon muticus and Calytrix tetragona.* Flowering time is in the spring. Fruits are produced from November to December.	• Pilliga Outwash Dry Sclerophyll Forests • Sydney Hinterland Dry Sclerophyll Forests • Southern Tableland Dry Sclerophyll Forest • Western Slopes Dry Sclerophyll Forests • Northern Montane Heaths • Inland Rocky Hill Woodlands	No	Nil	No	No
Vines and twiners						

Species and status	Ecology and distribution	Vegetation community	Presence of habitat	Likelihood of occurrence	Recorded during survey?	Potential to be impacted
Tylophora linearis E EPBC V TSC	Found in the Barraba, Mendooran, Temora and West Wyalong districts in the northern and central western slopes of NSW. Records include Crow Mountain near Barraba, Goonoo SF, Pillaga West SF, Cumbil SF, Eura SF, Coolbaggie NR, Goobang NP and Beni CCA. Also occurs in Qld, from near Glenmorgan in the western Darling Downs. Grows in dry scrub and open forest. Recorded from low-altitude sedimentary flats in dry woodlands of *Eucalyptus fibrosa, Eucalyptus sideroxylon, Eucalyptus albens, Callitris endlicheri, Callitris glaucophylla* and *Allocasuarina luehmannii*. Also grows in association with *Acacia hakeoides, Acacia lineata, Melaleuca uncinata, Myoporum species* and *Casuarina species*. Flowers in spring, with flowers recorded in November or May with fruiting probably 2 to 3 months later. Very low number of confirmed populations and has been recorded in very low abundances.	• North-west Slopes Dry Sclerophyll Woodlands • Pilliga Outwash Dry Sclerophyll Forests • Western Slopes dry Sclerophyll Forests • Western Slopes grassy Woodlands	No	Nil	No	No
Herbs						
Ammobium craspedioides Yass Daisy V EPBC V TSC	This species is found on the Southern Tablelands and South West Slopes near Wagga Wagga and Yass, most often in dry sclerophyll forest, Box-Gum Woodland and grasslands derived from clearing of these communities however, may be found in moister situations. Grows in association with a large range of eucalypts (*Eucalyptus blakelyi*, *E. bridgesiana*, *E. dives*, *E. goniocalyx*, *E. macrorhyncha*, *E. mannifera*, *E. melliodora*, *E. polyanthemos*, *E. rubida*) and can tolerate light grazing.	• Upper Riverina Dry Sclerophyll Forests • Southern Tableland Dry Sclerophyll Forests • Western Slopes Dry Sclerophyll Forests • Temperate Montane Grasslands • Southern Tableland Grassy Woodlands • Western Slopes Grassy Woodlands	Yes (marginal)	Low	No	Low

Species and status	Ecology and distribution	Vegetation community	Presence of habitat	Likelihood of occurrence	Recorded during survey?	Potential to be impacted
Swainsona recta Small Purple Pea E EPBC E TSC	An erect perennial herb to 30 cm high. Predominately known from Queanbeyan and Wellington-Mudgee areas it is typically associated with the grassy understorey of woodlands and open forests typical of Yellow Box – Blakely's Red Gum Woodland and associated Dry Grass Forests. Associated understorey dominants include Kangaroo Grass *Themeda australis*, poa tussocks *Poa* spp. and spear-grasses *Austrostipa* spp. Flowers through spring, peaking in October.	• Western Slopes Dry Sclerophyll Forests • Floodplain Transition Woodlands • Southern Tableland Grassy Woodlands • Western Slopes Grassy Woodlands	Yes	Moderate	No	Moderate
Swainsona sericea Silky Swainson-pea V TSC	This species has been recorded from the Northern Tablelands to the Southern Tablelands and further inland on the slopes and plains, but its stronghold is on the Monaro. It is found in Natural Temperate Grassland and Snow Gum (*Eucalyptus pauciflora*) Woodland on the Monaro and in Box-Gum Woodland in the Southern Tablelands and South West Slopes.	• North-west Slopes Dry Sclerophyll Woodlands • Upper Riverina Dry Sclerophyll Forests • Western Slopes Dry Sclerophyll Forests • Various Grassland, Grassy Woodland, Semi-arid Woodland formations	Yes	Low-moderate	No	Low-moderate
Thesium australe Austral Toadflax V TSC V EPBC	This species is found in small populations across eastern NSW, along the coast and from the Northern to Southern Tablelands. It occurs in grassland or grassy woodland (DECCW 2009), often in damp sites, and is closely associated with Kangaroo Grass (*Themeda australis*), on which it is a partial root-parasite.	Not indicated in DECCW Central West or Lachlan CMA searches	Yes	Low-moderate	No	Low - moderate
Grasses						

Species and status	Ecology and distribution	Vegetation community	Presence of habitat	Likelihood of occurrence	Recorded during survey?	Potential to be impacted
Austrostipa wakoolica A Spear-grass E EPBC E TSC	A densely-tufted, perennial spear-grass that grows to 1 m tall. Confined to the floodplains of the Murray River tributaries of central-western and south-western NSW, with localities including Manna State Forest, Matong, Lake Tooim, Merran Creek, Tulla, Cunninyeuk and Mairjimmy State Forest. Recorded as common in the Mairjimmy State Forest population. Grows on floodplains of the Murray River tributaries, in open woodland on grey, silty clay or sandy loam soils; habitats include the edges of a lignum swamp with box and mallee; creek banks in grey, silty clay; mallee and lignum sandy-loam flat; open Cypress Pine forest on low sandy range; and a low, rocky rise. Associated species include ***Callitris glaucophylla, Eucalyptus microcarpa, E. populnea, Austrostipa eremophila, A. drummondii, Austrodanthonia eriantha*** and ***Einadia nutans***. Flowers from October to December, mainly in response to rain.	• North-west Slopes Dry Sclerophyll Woodlands • Pilliga Outwash Dry Sclerophyll Forests • Western Slopes Dry Sclerophyll Forests • Various Grassland, Grassy Woodland, Semi-arid Woodland formations	No	Nil	No	No
Dichanthium setosum Bluegrass V EPBC V TSC	An upright grass less than 1m tall. Occurs on the New England tablelands, North West Slopes and Plains and the Central Western Slopes of NSW. It is associated with Heavy basaltic black soils and often found in moderately disturbed areas such as cleared woodland, grassy roadside remnants and highly disturbed pasture. 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.	• Riverine Plain Grasslands • Semi-arid Floodplain Grasslands • Western Slopes Grasslands • Western Slopes Grassy Woodlands	Yes (marginal)	Low	No	Low
Orchids						

Species and status	Ecology and distribution	Vegetation community	Presence of habitat	Likelihood of occurrence	Recorded during survey?	Potential to be impacted
Caladenia concolor Crimson Spider Orchid V EPBC	The Crimson Spider Orchid, Caladenia concolor is confined to granite ridge country in the Nail Can Hill Crown Reserve near Albury, and two localities in Victoria (DECCW 2009). There is a similar undescribed species from near Cootamundra (Caladenia sp. Bethungra) and another undescribed species (Burrinjuck Spider Orchid) occurs in Burrinjuck Nature Reserve and Burrinjuck Waters State Park, and possibly in other locations on private property nearby. It grows in dry open forest or tall open forest dominated by E. goniocalyx, E. dives, E. mannifera, E. macrorhyncha or E. rossii (NSW NPWS 2002). Neither of the undescribed species are currently listed as threatened, but they appear to be similarly restricted in distribution to C. concolor, and may face some similar threats (e.g. collection by orchid enthusiasts). Flowering period is late August to October.	• Upper Riverina Dry Sclerophyll Forests • Southern Tableland Dry Sclerophyll Forests • Western slopes Dry Sclerophyll Forests • Western Slopes Grassy Woodlands	Yes (marginal)	Low	No	Low
Diuris tricolor (Syn. *D. sheaffiana*) Pine Donkey Orchid V TSC V EPBC	Sporadically distributed from Narrandera across the western slopes to northern NSW, usually in grassy Callitris woodland on sandy soils in flat country or on top of small hills. There is a 1906 record from the Goulburn area. Flowering period is Sept-Nov (Bishop 1996).	• North-west Slopes Dry Sclerophyll Woodlands • Floodplain Transition Woodlands • Western Slopes Grassy Woodlands • North-west Alluvial Sand Woodlands	No	Nil	No	No

Species and status	Ecology and distribution	Vegetation community	Presence of habitat	Likelihood of occurrence	Recorded during survey?	Potential to be impacted
Prasophyllum petilum Tarengo Leek Orchid E TSC E EPBC	Known from three sites on the Southern Tablelands, at Boorowa and Captain's Flat in NSW and Hall in the ACT, growing in Natural Temperate Grassland, Box-Gum Woodland or moist grassy flats, with kangaroo grass or wallaby grasses (*Austrodanthonia spp*). The Captains Flat population occurs in an area with a high watertable. Flowering period is Oct-Nov (Bishop 1996), with 22 October recorded as a time when this species was flowering profusely at Booroowa (FOG, 2006).	• Southern Tableland Grassy Woodlands • Western Slopes Grassy Woodlands • Temperate Montane grasslands	Yes (marginal)	Low	No	Low

E TSC = listed as Endangered under Schedule 1 of the NSW *TSC Act 1995*

E EPBC = listed as Endangered under the Commonwealth *EPBC Act 1999*

V TSC = listed as Vulnerable under Schedule 2 of the *TSC Act 1995.*

V EPBC = listed as Vulnerable under the Commonwealth *EPBC Act 1999*

Ecological communities	Presence of habitat	Likelihood of occurrence	Recorded during survey?	Potential to be impacted
Artesian Springs Ecological Community (TSC)	No	Nil	No	No
Fuzzy Box on alluvials of South West Slopes, Darling Riverine Plains and the Brigalow Belt South (TSC)	No	Nil	No	No
Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions (EPBC & TSC)	Yes	Moderate	No	Low
Mt Canobolas Xanthoparmelia Lichen Community (TSC)	No	Nil	No	No

Species and status	Ecology and distribution	Vegetation community	Presence of habitat	Likelihood of occurrence	Recorded during survey?	Potential to be impacted
Natural Temperate Grassland of the Southern Tablelands of NSW and the ACT (EPBC & TSC))			No	Nil	No	No
White Box Yellow Box Blakely's Red Gum Woodland (EPBC & TSC)			Yes	High	Yes	Yes

Fauna

Species and status*	Ecology and distribution	Presence of habitat	Likelihood of occurrence	Recorded during survey?	Potential to be impacted
Amphibians					
Booroolong Frog *Litoria booroolongensis* E TSC E EPBC	Lives along permanent streams with some fringing vegetation cover such as ferns, sedges or grasses. It typically inhabits rocky western-flowing creeks and their headwaters, although a small number of animals have also been recorded in eastern-flowing streams (DECCW 2010). Adults occur on or near cobble banks and other rock structures within stream margins. Shelters under rocks or amongst vegetation near the ground on the stream edge. Sometimes basks in the sun on exposed rocks near flowing water during summer. Eggs are laid in submerged rock crevices and tadpoles grow in slow-flowing connected or isolated pools.	No	Nil	No	No
Sloane's Froglet *Crinia sloanei* V TSC	A small ground-dwelling frog, typically associated with periodically inundated areas in grassland, woodland and disturbed habitats: similar to habitats occupied by the related *Crinia parasignifera* (NSW Scientific Committee Determination).	No	Nil	No	No
Yellow-spotted Bell	The Yellow-spotted Bell Frog had not been recorded in the wild since the 1970s. It has two	No	Nil	No	No

Species and status*	Ecology and distribution	Presence of habitat	Likelihood of occurrence	Recorded during survey?	Potential to be impacted
Frog *Litoria castanea* CE TSC E EPBC	separate highland ranges, on the New England Tableland and on the southern highlands from Lake George to Bombala. This species require large permanent ponds or slow flowing streams with plenty of emergent vegetation such as bullrushes. Shelter during autumn and winter under fallen timber, rocks, other debris or thick vegetation (DECCW 2009)				
Aves					
Australasian Bittern *Botaurus poiciloptilus* V TSC	This species is considered widespread in their distribution, however, they are uncommon in south-eastern Australia (DEC 2006). They are known to inhabit permanent freshwater wetlands with tall, dense vegetation, particularly bullrushes (*Typha* spp.) and spikerushes (*Eleoacharis* spp.) (DECCW, 2009).	No	Nil	No	No
Australian Painted Snipe *Rostratula australis* V EPBC	Inhabits shallow terrestrial freshwater (occasionally brackish) wetlands, including temporary and permanent lakes, swamps and claypans. They also use inundated or waterlogged grassland or saltmarsh, dams, rice crops, sewage farms and bore drains. Typical sites include those with rank emergent tussocks of grass, sedges, rushes or reeds, or samphire; often with scattered clumps of lignum *Muehlenbeckia* or canegrass or sometimes tea-tree (*Melaleuca*).	No	Nil	No	No
Barking Owl *Ninox connivens* V TSC	This is a species that, although is found throughout Australia except for the central arid regions and Tasmania, it is rarely recorded in the coastal and escarpment forests (NPWS 2003c). The species can be found in open forests and woodlands and along watercourses. During the day, Barking owls will roost along creeklines, especially where Acacia forms dense thickets (NPWS 2003c). They live alone or in pairs and occupy territories from 30 to 200 hectares where birds are present all year round (NPWS 2003c).	Yes	Low-moderate	No	Low
Black Breasted Buzzard *Hamirostra*	Found sparsely in areas of less than 500mm rainfall; in NSW found inland. 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. Breeds from August	Yes	Low	No	Low

Species and status*	Ecology and distribution	Presence of habitat	Likelihood of occurrence	Recorded during survey?	Potential to be impacted
melanosternon V TSC	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 (DECCW 2010)				
Black-chinned Honeyeater (eastern subspecies) *Melithreptus gularis gularis* V TSC	This species is widespread west of the Great Dividing Range, although has declined throughout its range due to removal and fragmentation of habitat. It inhabits the upper levels of drier open forests or woodlands most often dominated by box and ironbark eucalypts, particularly Mugga Ironbark, White Box, Grey Box, Yellow Box and Forest Red Gum (DECCW 2009). A gregarious species usually seen in pairs and small groups of up to 12 birds and occupies large home ranges of at least 5 hectares. Local populations appear not to persist in remnants less than 200 ha in area (NSW Scientific Committee, 2001).	Yes	Moderate	No	Low
Black-necked Stork *Epphippiorhynchus asiaticus* E TSC	Associated with forested and freshwater or saline wetlands, grasslands and semi-arid woodland. Breeds in live or dead trees within or near foraging habitat, including isolated paddock trees. May occur in marginal vegetation surrounding wetlands including farm dams, grassland and paddocks. Mainly forage in still shallow water. Known from the Upper Slopes subregion of the Central West CMA (DECCW 2010).	No	Nil	No	No
Black-tailed Godwit *Limosa limosa* V TSC	This species is a migratory wading bird that breeds in the northern hemisphere, visiting Australia during summer and leaving in March (NSW NPWS 1999a). It is primarily found on coastal sandspits, mudflats and lagoons and prefers shallow water where it feeds on a variety of invertebrates.	No	Nil	No	No
Blue-billed Duck *Oxyura australis* V TSC	This species is widespread in NSW although is most common in the southern Murray-Darling Basin area. During spring and summer birds travel up to 300km from non-breeding areas on the Murray River system and coastal lakes to breed in deep swamps of inland NSW. They are often seen in coastal areas in summer and during drought (DECCW 2009). Feeding occurs in permanent freshwater wetlands and swamps with deep water and dense aquatic vegetation. Nesting occurs in *Cumbungi* over deep water or in dense wetland vegetation.	No	Nil	No	No
Brolga	Brolgas are dependant on wetlands although will also feed in dry grassland, desert claypans	No	Nil	No	No

Species and status*	Ecology and distribution	Presence of habitat	Likelihood of occurrence	Recorded during survey?	Potential to be impacted
Grus rubicunda V TSC	or ploughed paddocks. It is known from the Upper Slopes subregion of the Lachlan CMA, where it may occur in arid shrublands, forested and freshwater wetlands, grasslands and semi-arid woodland (DECCW 2010).				
Bush Stone-curlew *Burhinus grallarius* E TSC	This is a species of open woodland, forest edges and sparsely treed ranges throughout most of mainland Australia. (Schodde and Tidemann, 2007). Roost on ground during day in litter, fly up to 20km to forage (Schodde and Tidemann, 2007).	Marginal	Low	No	Low
Brown Treecreeper *Climacteris picumnus* V TSC	This species is found in a variety of eucalypt woodlands (including Box-Gum Woodland and River Red Gum) and dry open forest across the inland slopes and plains west of the Great Dividing Range where it enjoys an open grassy understorey. The presence of fallen timber is an important habitat component for foraging for this species. It is less commonly recorded on the coastal plains and ranges in similar woodland habitats (DECCW, 2009).	Yes	Moderate	No	Low-moderate
Diamond Firetail *Stagonopleura guttata* V TSC	This species is considered to be found across most of NSW with a concentration of these records on the western slopes of the Great Dividing Range. It is generally found in grassy eucalypt woodlands such as box-gum woodlands and snow gum woodlands. It can often be seen around riparian areas and lightly wooded agricultural areas (DECCW, 2009).	Yes	High	No	Low-moderate
Flame Robin *Petroica phoenicea* V TSC	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. In winter lives in dry forests, open woodlands and in pastures and native grasslands, heathland and coastal shrubland. Prefers clearings or areas with open understoreys (DECCW 2010).	Yes	High	No	Low-moderate
Freckled Duck *Stictonetta naevosa*	This species can be found primarily in south-eastern and south-western Australia, otherwise occurring as a vagrant. During drier periods, they have been known to move from ephemeral breeding swamps to more permanent waters such as lakes, reservoirs, farm dams and sewage ponds (DECCW, 2009). Species depends on dense vegetation (Cumbungi,	No	Nil	No	No

Species and status*	Ecology and distribution	Presence of habitat	Likelihood of occurrence	Recorded during survey?	Potential to be impacted
V TSC	Lignum or Tea-tree) in large shallow swamps and permanent waters during times of drought (DECCW, 2009; Schodde and Tidemann, 2007).				
Gang Gang Cockatoo *Callocephalon fimbriatum* V TSC	This species is generally found in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. It occurs at lower altitudes in drier, more open eucalypt forests and woodlands (particularly box-ironbark assemblages) (Shields and Crome 1992). This species requires large hollows in which to breed (Gibbons 1999, Gibbons and Lindenmayer 2000).	Yes	Moderate	No	Low
Gilbert's Whistler *Pachycephala inornata* V TSC	This species is sparsely distributed from the western slopes of NSW to the Western Australian. Occurs in a range of habitats; key feature seems to be dense shrub layer. In woodland habitats, the understorey comprises dense patches of shrubs, particularly thickets of regrowth *Callitris* pine, native cherry' (*Exocarpus* species) appear to be an important habitat component. Forages on or near the ground in shrub thickets and in tops of small trees. Pairs may hold and defend territories all year round (DECCW 2010)	No	Nil	No	No
Glossy Black Cockatoo *Calyptohynchus lathami* V TSC	This is a species of open forests and woodland, dependent mainly on the seeds of Allocasuarina trees as a food source (Blakers et al., 1984). Large trees with hollows are required for breeding sites (DECCW, 2009; Emison et al., 1987). Competition for hollows increases with openness of habitat and can be a threat to this species (DECCW, 2009).	No	Nil	No	No
Grey-crowned Babbler (eastern subspecies) *Pomatostomus temporalis temporalis* V TSC	This species. In NSW this species occurs west of the Great Dividing Range and on the coast near the Hunter Valley and several locations on the north coast of NSW. It prefers Box-Gum Woodlands although also inhabits open forests, scrub lands, even farmlands and suburbs (DECCW 2009; Pizzey et al., 2003). The species is gregarious and forage on the ground on invertebrates on tree trunks and branches and by foraging amongst litter and tussocks. Territories of family groups range from one to fifty hectares (DECCW 2009).	Marginal	Low	No	Low
Grey Falcon	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	Marginal	Low	No	Low

Species and status*	Ecology and distribution	Presence of habitat	Likelihood of occurrence	Recorded during survey?	Potential to be impacted
Falco hypoleucos V TSC	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 (DECCW 2010).				
Hooded Robin (south-eastern form) *Melanodryas cucullata cucullate* V TSC	Widespread, occurring in pairs or solitary in lightly timbered country (Schodde and Tidemann 2007). Spends much of its time on the ground in woodland foraging for insects. It frequents places with dead trees and fallen timber (Schodde and Tidemann 2007), nesting on dead limbs or stumps. Populations are unable to survive in remnants smaller than 100-200 hectares (DECCW 2009).	Marginal	Low	No	Low
Little Eagle *Hieraaetus morphnoides* V TSC	The Little Eagle is found throughout the Australian mainland except the most densely forested parts of the Dividing Range escarpment. It occurs as a single population throughout NSW (DECCW 2010).	Yes	Moderate-high	No	Low
Little Lorikeet *Glossopsitta pusilla* V TSC	In New South Wales Little Lorikeets are distributed in forests and woodlands from the coast to the western slopes of the Great Dividing Range. Mostly occur in dry, open eucalypt forests and woodlands. They have been recorded from both old-growth and logged forests in the eastern part of their range, and in remnant woodland patches and roadside vegetation on the western slopes. Generally considered to be nomadic, with irregular large or small influxes of individuals occurring at any time of year, apparently related to food availability (Scientific Committee)	Yes	Moderate	No	Low
Malleefowl *Leipoa ocellata* E TSC	There are occasional records outside of known population areas (refer to DECCW 2010). Inhabit mostly mallee communities, may also occur in other inland woodland. They are known to occur in the Upper Slopes subregion of the Central West CMA (DECCW 2010).	No	Nil	No	No

Species and status*	Ecology and distribution	Presence of habitat	Likelihood of occurrence	Recorded during survey?	Potential to be impacted
Magpie Goose *Anseranas semipalmate* V TSC	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 (DECCW 2010). Known from several Lachlan CMA subregions and predicted in the Upper Slopes of the Central Western CMA.	No	Nil	No	No
Masked Owl *Tyto novaehollandiae* V TSC	This species forages in a range of forest and woodland types but requires large tree hollows for nesting. Forested areas adjacent to areas of dense and sparse ground cover within close proximity are required for foraging (Garnett 1992 & Peake *et al.* 1993). Also occurs in fragmented forest-pastoral land usually near creek lines and in open grassy woodland (Kavanagh 2004). This owl forages on ground-dwelling prey, particularly Bush Rats, introduced Black Rat and House Mouse.	No	Nil	No	No
Painted Honeyeater *Grantiella picta* V TSC	This species primarily occurs on the inland slopes of the Great Dividing Range, although is nomadic and may occur in low densities in other parts of NSW in suitable habitat. It inhabits dry open forests and woodland including Boree, Brigalow and Box-Gum Woodlands and Box-Ironbark open forests, also paperbark and casuarinas (DECCW 2009; Pizzey et al., 2003). It is a specialist feeder on mistletoe, particularly of genus *Amyema*, and generally requires 5 or more mistletoes per hectare (DECCW 2009). Seasonal migrant, movements are linked to the fruiting of mistletoe.	Marginal	Low	No	Low
Pink Cockatoo *Cacatua leadbeateri* V TSC	Dependant on tree hollows for nesting, otherwise inhabits a wide range of treed and treeless inland habitats, always near water. Feeds on seeds including from saltbush, wattle and cypress pine. Known from the Upper Slopes subregion of both Lachlan and Central Western CMAs, occurring in arid shrubland, dry sclerophyll forest, grasslands, grassy and semi-arid woodland, dry rainforest and forested wetlands (DECCW 2010).	Yes	Low	No	Low
Powerful Owl *Ninox strenua*	This species is dependent on large territories in coastal and mountain eucalypt forest (Blakers *et al.* 1984). Territories are usually centred around gullies, with roost and nest site located centrally (Fleay 1968). Large tree hollows are required in which to nest (Emison *et*	No	Nil	No	No

Species and status*	Ecology and distribution	Presence of habitat	Likelihood of occurrence	Recorded during survey?	Potential to be impacted
V TSC	*al.* 1987). Abundant arboreal mammals (which form about 80% of the diet of this species) are a requirement of this species (Blakers *et al.* 1984). Pairs of Powerful Owls are believed to have high fidelity to a small number of hollow-bearing nest trees and will defend a large home range of 400-1450 ha (DECCW, 2009).				
Rainbow Bee-eater *Merops ornatus* M EPBC	A common species that occurs mainly in open forests and woodlands, shrublands, and in various cleared or semi-cleared habitats, including farmland and areas of human habitation. It usually occurs in open, cleared or lightly-timbered areas that are often, but not always, located in close proximity to permanent water. On migration, the Rainbow Bee-eater may also fly over the top of non-preferred habitats such as rainforest or treeless plains (DEWHA 2010).	Yes	Moderate	No	No
Regent Honeyeater *Xanthomyza Phrygia* E TSC E EPBC M EPBC	This species inhabits eucalypt forests and woodlands (Blakers *et al.* 1984). It is highly nomadic and relatively large numbers can arrive at and vacate areas depending on local and regional flowering of favoured species. It feeds mostly on the flowers of eucalypts (particularly box and ironbark species), but also eats invertebrates and exotic fruits (Blakers *et al.* 1984).	Yes	Low	No	Low
Satin Flycatcher *Myiagra cyanoleuca* M EPBC	Normally found in heavily vegetated gullies in forests, woodlands wherever a shrub layer is present. During migration it is often found in coastal forests. This species breeds mostly in south-east Australia, and usually departs in March to winter in northern QLD, PNG and the Torres Strait Islands. Occasional vagrant to New Zealand.	No	Nil	No	No
Scarlet Robin *Petroica boodang* V TSC	The Scarlet Robin lives in dry eucalypt forests and woodlands from the coast to the inland slopes. The understorey is usually open and grassy with few scattered shrubs. Habitat usually contains abundant logs and fallen timber. This species lives in both mature and regrowth vegetation (DECCW 2010).	Yes	High	No	Low-moderate

Species and status*	Ecology and distribution	Presence of habitat	Likelihood of occurrence	Recorded during survey?	Potential to be impacted
Speckled Warbler *Pyrrholaemus saggitatus* V TSC	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 greatest decline where no vegetation remnants larger than 100ha remain. The Speckled Warbler inhabits a wide range of *Eucalyptus* dominated woodland communities with 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 (DECCW, 2009; Schodde and Tidemann, 2007).	No	Low	No	No
Spotted Harrier *Circus assimilis* V TSC	The Spotted Harrier occurs throughout the Australian mainland, except in densely forested or wooded habitats of the coast, escarpment and ranges, including highly disturbed areas. Individuals disperse widely in NSW and comprise a single population (DECCW 2010).	Yes	Low	No	Low
Square-tailed Kite *Lopoitinia isura* V TSC	This species' preferred habitat is open eucalypt forest and woodland (DECCW, 2009). Here it predates in and above the forest canopy, nesting in tall trees (Klippel, 1992). Resident pairs have territories of greater than 100 km². The species is partially nomadic and utilises a range of habitats (Schodde and Tidemann, 2007).	Yes	Low	No	Low
Superb Parrot *Polytelis swainsonii* V TSC V EPBC	Nesting habitat on SW Slopes is often open Yellow Box, Blakely's Red Gum Woodland or isolated paddock trees. Nest in small colonies, often with more than one nest in a single tree. May forage up to 10 km from nesting sites. Feed in trees and understorey shrubs and on the ground and their diet consists mainly of grass seeds and herbaceous plants	Yes	High	Yes	Moderate-high
Swift Parrot *Lathamus discolor* E TSC E EPBC	This species is non-breeding winter migrant to the south-eastern mainland. In NSW, Swift Parrots mostly occur on the coast and south west slopes. On the mainland they occur in areas where eucalypts are flowering profusely or where there are abundant lerp infestations. Favoured feed trees include winter flowering species such as Swamp Mahogany *Eucalyptus robusta*, Spotted Gum *Corymbia maculata*, Red Bloodwood *C. Gummifera*, Mugga Ironbark *E. Sideroxylon*, and White Box *E. Albens*. Commonly used lerp	Yes	low	No	Low

Species and status*	Ecology and distribution	Presence of habitat	Likelihood of occurrence	Recorded during survey?	Potential to be impacted
M EPBC	infested trees include Grey Box *E. Microcarpa*, Grey Box *E. Moluccana* and Blackbutt *E. Pilularis* (DECCW, 2009).				
Turquoise Parrot *Neophema pulchella* V TSC	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. Nests in tree hollows, logs or posts, from August to December (DECCW 2010).	Yes	Low-moderate	No	Low-moderate
White-bellied Sea eagle *Haliaeetus leucogaster* M EPBC CAMBA	This species occurs around coastal areas, islands and estuaries, but is also found in inland areas where it is known from large rivers, wetlands and reservoirs (DECCW, 2009). Usually forages, perches and roosts around waterways(Schodde and Tidemann, 2007).	No	Nil	No	No
White-fronted Chat *Epthianura albifrons* V TSC	White-fronted Chats are distributed across southern Australia from Western Australia to NSW. This species inhabits salt marshes, heaths, lake edges, agricultural land and other damp habitats with low vegetation. They often feed in flocks where insect prey is at high densities. Breeding begins in late winter and several clutches can be raised during the breeding season in low nests built in shrubs. Breeding birds can form loose colonies with nests being as close as 5m. Generally sedentary however nomadic movements are thought to occur, particularly in the drier parts of it's range.	No	Low	No	No
White-throated Needletail *Hirundapus caudacutus* M EPBC	The White-throated Needletail is almost exclusively aerial, from heights of less than 1 m up to more than 1000 m above the ground. They are recorded most often above wooded areas, including open forest, rainforest, heathland, and may also fly between trees or in clearings, below the canopy. They are less commonly recorded flying above woodland, grassland, beaches, mudflats and swamps. Over cleared areas, they often recorded above remnant vegetation at the edge of paddocks. Often use coastal cliffs and other areas with	Yes	High	No	No

Species and status*	Ecology and distribution	Presence of habitat	Likelihood of occurrence	Recorded during survey?	Potential to be impacted
	prominent updraughts, such as ridges and sand-dunes (DEWHA 2010)				
Varied Sittella *Daphoenositta chrysoptera* V TSC	Varied Sitellas inhabit eucalypt forests and woodlands, especially rough-barked species and mature smooth-barked gums with dead branches, mallee and *Acacia* woodland. They are a sedentary species and feed 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. Varied Sitellas build a cup-shaped nest of plant fibers and cobweb in an upright tree fork high in the living tree canopy, and often re-use the same fork or tree in successive years (NSW Scientific Committee 2010a).	Yes	High	No	Low
Mammalia					
Brush -tailed Phascogale *Phascogale tapoatafa* V TSC	This arboreal insectivore is found in open forests and woodlands of mainland Australian (Rhind 2003; Soderquist and Ealey 1994). May also forage in moist, low-lying forested areas. Nocturnal and solitary, it forages mostly on trees searching for invertebrates on and beneath bark of tree trunks and major branches (Scarff and Bradley 2006). Builds nests in hollows, usually in *Eucalyptus* trees.	No	Nil	No	No
Brush-tailed Rocky Wallaby *Petrogale penicillata* V EPBC E TSC	Occurs in rocky escarpments, outcrops and cliffs, showing preference for complex structures with fissures, caves and north-facing ledges. Known from Upper Slopes subregion of Central West CMA, where is associated with dry and wet sclerophyll forest, forested wetlands, grassy and semi-arid woodlands. It forages on vegetation in and adjacent to rocky areas eating grasses and forbs as well as the foliage and fruits of shrubs and trees. Shelter or bask during the day in rock crevices, caves and overhangs and are most active at night (DECCW 2010).	No	Nil	No	No
Eastern Bent-wing Bat *Miniopterus schreibersii oceanensis*	This species is a common although a vulnerable species that is likely to be widely distributed throughout the region. It roosts and raises its young in caves and mine tunnels (Strahan 1995). The species appears to forage above the forest canopy in rainforest, wet and dry sclerophyll forest, monsoon forest, open woodland, *Melaleuca* forests and open grasslands	Yes	High	No	No

Species and status*	Ecology and distribution	Presence of habitat	Likelihood of occurrence	Recorded during survey?	Potential to be impacted
V TSC	(Churchill 2008).				
Eastern Pygmy-possum *Cercartetus nanus* V TSC	Feeding largely on nectar, and insects, the species is found from rainforest through sclerophyll forest to tree heath. *Banksias* and myrtaceous shrubs and trees are favoured as food sources (Turner & Ward from Strahan 1995). Its small size allows it to nest in very small spaces during the day, and hollows in trees are favoured (Turner & Ward from Strahan 1995).	No	Nil	No	No
Greater Long-eared Bat *Nyctophilus timoriensis* V EPBC	Inhabits a variety of vegetation types including dry and riparian forest, mallee and woodland communities. Roosts in tree hollows, crevices or under loose bark. Hunts within the understorey or on the ground. It is predicted to occur in Upper Slopes subregion of both Lachlan and Central West CMAs (DECCW 2010).	Marginal	Low-Moderate	No	Moderate
Koala *Phascolarctos cinereus* V TSC	This species utilises a wide range of forest and woodland types. However in this district they are generally seen only in large areas of continuous forest. They are solitary with distinct home ranges (Strahan 1995) and must utilise a diverse range of eucalypt trees typically present on high nutrient soils (Klippel 1992). On the Western Slopes and Plains, primary feed tree are River Red Gum *(Eucalyptus camaldulensis)* and Collabah *(E.coolabah)*. Secondary/supplementary feed species include Bimble Box *(E.populnea)*, Blakely's Red Gum *(E.blakelyi)*, Yellow Box *(E.melliodora)*, White Box *(E.albens)*, Orange Gum *(E.prava)*, Black Box *(E.largiflorens)*, amongst many other species (Recovery Plan 2008).	Yes (the site qualifies as potential koala habitat as defined in SEPP 14 Koala Habitat Protection)	Low	No	Low-moderate
Large-eared Pied Bat *Chalinolobus dwyeri* V TSC	This species has a very patchy distribution in NSW, with scattered records from the New England Tablelands and North West Slopes. This species roosts and breeds in caves and disused mines (DECCW, 2009). Known to forage in dry, wet and tall open sclerophyll forests as well as woodlands and along rainforest margins (Churchill, 1998).	No	Low	No	No
Large-footed Myotis	This species forages on the surface of water bodies such as rivers, lakes and swamps and roosts in caves, mine, tunnels, old buildings and tree hollows (Churchill, 1998; Hall and	No	Low	No	No

Species and status*	Ecology and distribution	Presence of habitat	Likelihood of occurrence	Recorded during survey?	Potential to be impacted
Myotis macropus (formally *M.adversus*) V TSC	Richards, 1979). Usually found at low elevation in flat or undulating country that is vegetated rather than cleared (Churchill 2008).				
Little Pied Bat *Chalinlobus picatus* V TSC	Occurs in wetlands, dry and riparian forest, grassy and arid woodland, semi-arid shrubland, mallee and roosts in caves, rock outcrops, mine shafts, tunnels, tree hollows and buildings. Predicted to occur in both CMA regions (DECCW 2010).	Yes	Low	No	Moderate
Squirrel Glider *Petaurus norfolcensis* V TSC	This species is found in dry sclerophyll woodland, preferring dense, white-barked eucalyptus country (Klippel 1992) and is generally absent from closed forest (Menkhorst *et al.,* 1988). A mix of eucalypts, banksias and acacias including some winter flowering species and abundant hollows are required by this species. Fragmentation, predation by foxes and cats and inappropriate fire regimes are listed as threats to this species (NSW NPWS 1999b*).*	No	Low	No	Low
Spotted-tail Quoll (Tiger Quoll) *Dasyurus maculatus* V TSC E EPBC	Sclerophyll forest, rainforest in mountainous country, and coastal habitats can be utilised by this species (Le Souef & Burrell 1926). Habitat attributes which are likely to be critical to the life cycle for the Tiger Quoll are large areas of undisturbed habitat which provide a variety of key food and other resources such as large hollow logs, or small caves (dens) at ground level for denning. Females occupy home ranges up to about 750 hectares and males up to 3500 hectares; usually traverse their ranges along densely vegetated creek lines (DECCW 2009). Quolls appear to be most abundant in areas with few roads and where foxes are either absent or kept in check by dingoes (Resource and Conservation Assessment Council, 1996). Fleming (1996) suggests that foxes may be a threat to Tiger Quolls through predation and competition.	No	Low	No	No
Yellow-bellied Glider *Petaurus australis* V TSC	This species is found in a range of habitat types, preferring tall mature moist eucalypt forest but also inhabiting coastal and dry forests, where it uses tree hollows for shelter. It may prefer forest of high species diversity. Eucalypts that provide hollows, sap flow and flower in winter are preferred by this species (DECCW, 2009). These include *Eucalyptus viminalis*,	No	Nil	No	No

Species and status*	Ecology and distribution	Presence of habitat	Likelihood of occurrence	Recorded during survey?	Potential to be impacted
	Corymbia maculata, E.robusta and winter flowing ironbarks.				
Yellow-bellied Sheathtail-bat *Saccolaimus flaviventris* V TSC	This wide-ranging species roosts in tree hollows, burrows and buildings, foraging above the canopy (DECCW, 2009). It appears to be a summer migrant to the southern mainland and occurs in a range of sclerophyll forest and woodland (Churchill, 1998).	Yes	Low	No	moderate
Reptilia					
Little Whip Snake *Suta flagellum* V TSC	This species occurs in Natural Temperate Grasslands and grassy woodlands, including those dominated by Snow Gum or Yellow Box as well as secondary grasslands derived from clearing of woodlands. It is commonly found on well-drained hillsides with loose scattered rocks.	Yes	Low	No	Moderate
Pink-tailed Worm-lizard *Aprasia parapulchella* V TSC	Inhabits open grassland habitats that have a substantial cover of small rocks (Osborne and Jones 1995). Show a preference for sunny aspects, avoiding south facing slopes, only at sites with good numbers of invertebrates under rocks (DECCW 2009). Favoured sites have relatively open vegetation, including grassland sites supporting no native grasses. Shelters under small rocks which are exposed to sunlight and shallowly embedded in the soil.	Yes	Low	No	Moderate
Rosenberg's Goanna *Varanus rosenbergi* V TSC	This species occurs on the Sydney Sandstone in Wollemi National Park to the north-west of Sydney, in the Goulburn and ACT regions and near Cooma in the south. It is found in heath, open forest and woodland. It is known to nest in termite mounds and feeds on carrion, birds, eggs, reptiles and small mammals. Individuals require large areas of habitat.	Marginal	Low	No	No
Invertebrates					

Species and status*	Ecology and distribution	Presence of habitat	Likelihood of occurrence	Recorded during survey?	Potential to be impacted
Golden Sun Moth *Synemon plana* E TSC CE EPBC	This species is distributed in an area of NSW between Queanbeyan, Gunning, Young and Tumut (DECCW 2009). It occurs in grassy Box-Gum woodlands and natural temperate grasslands, typically low, open and dominated by several wallaby grass species. Also may be associated with spear-grasses (*Austrostipa* spp.) or Kangaroo Grass (*Themeda australis*).	No	Nil	No	No

Appendix C FLORA SPECIES LIST

The survey area was stratified into 3 relatively homogeneous survey zones based on Proposal elements, vegetation structure and topography:

NP Native and exotic pasture with scattered trees (western area): sites 7, 8, 9, 10

EP Exotic pasture (northern area): site 6

CA Cropped areas with scattered trees: sites 1, 2, 3, 4, 5

Cover/abundance assessments are based on visual estimates of foliage cover (after Carnahan 1997), scored using a modified Braun-Blanquet 6-point scale:

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.

Where the cover/abundance of a particular species varies markedly over the random meander survey area, a range of values is provided. In these cases, abundance is based on a standard 20 metre x 20 metre quadrat scale.

Species of conservation significance are bolded. Introduced species are denoted by an asterisk. Noxious weeds declared for the Cabonne Shire Council control area under the *Noxious Weeds Act 1993* are indicated with a 'Δ' symbol. Where uncertainty exists due to the unavailability of mature reproductive material, the taxon is preceded by a question mark, or plants are identified to genus level only. Botanical nomenclature follows G.J. Harden (ed) (1990-2002) Flora of New South Wales, UNSW Press, except where recent changes have occurred.

Scientific name	Common name	Family	Abundance		
			NP	EP	CA
TREES					
Brachychiton populneus	Kurrajong	Sterculiaceae		0-2	0-1
Eucalyptus albens	White Box	Myrtaceae	0-2	0-1	2-3
Eucalyptus blakelyi	Blakely's Red gum	Myrtaceae	0-1		
Eucalyptus melliodora	Yellow Box	Myrtaceae	0-1	0-1	0-1
Eucalyptus microcarpa	Grey Box	Myrtaceae			0-1
?Notelaea microcarpa var. microcarpa	Native Olive	Oleaceae	0-1		
**Schinus areira*	Pepper Tree	Anacardiaceae	0-1	0-1	
SHRUBS, SUB-SHRUBS					
Astroloma humifusum	Cranberry Heath	Ericaceae			0-1
Amyema pendulum	Mistletoe	Loranthaceae	0-1		
Enchylaena tomentosa	Ruby Saltbush	Chenopodiaceae			1
Eremophila debilis	Amulla	Myoporaceae	0-1		
Δ**Lycium ferocissimum*	African boxthorn	Solanaceae	1		1
**Marrubium vulgare*	Horehound	Lamiaceae	0-2	0-2	1
Δ**Xanthium spinosum*	Bathurst Burr	Asteraceae	2	1	1
VINES AND TWINERS					
Glycine sp.		Fabaceae	0-1		
FORBS					
Acaena ?echinata		Rosaceae	1		
**Acetosella vulgaris*	Sheep Sorrel	Polygonaceae			1
**Arctotheca calendula*	Capeweed	Asteraceae			1
**Brassica sp.*	Canola	Brassicaceae			0-5
**Capsella bursa-pastoris*	Shepherd's Purse	Brassicaceae	2	2	2-3
**Carthamus lanatus*	Saffron Thistle	Asteraceae	0-2		
Chamaesyce drummondii	Caustic Weed	Euphorbiaceae	2	1	
**Chenopodium murale*	Nettle-leaf Goosefoot	Chenopodiaceae	0-1	0-1	0-2
Chenopodium pumilo	Small Crumbweed	Chenopodiaceae	2	2	
**Cirsium vulgare*	Black or Spear Thistle	Asteraceae		1	1
Cotula australis	Carrot Weed	Asteraceae	2		
Crassula sieberiana	Stonecrop	Crassulaceae			1
**Cucumis myriocarpus*	Paddy Melon	Cucurbitaceae		0-2	
Dichondra repens	kidney Weed	Convolvulaceae	0-2		
**Echium plantagineum*	Paterson's curse	Boraginaceae	2	2	2-4
Einadia nutans	Climbing Saltbush	Chenopodiaceae			0-1
**Erodium cicutarium*	Common Storksbill	Geraniaceae	2	2	2
Geranium solanderi	Native Geranium	Geraniaceae	2	1	

Scientific name	Common name	Family	Abundance		
			NP	EP	CA
Hydrocotyle laxiflora	Stinking Pennywort	Apiaceae	2		
**Hypochaeris glabra*	Smooth Cat's Ear	Asteraceae			1
**Hypochaeris radicata*	Cat's Ear, Flatweed	Asteraceae	1	2	2
**Lepidium africanum*	Peppercress	Brassicaceae	2	2	2
**Malva parviflora*	Small-flowered Mallow	Malvaceae	2	2-5	2-5
**?Medicago arabica*	Spotted Burr-medic	Fabaceae	2	2	1
Δ**Onopordum acanthium*	Scotch Thistle	Asteraceae			0-1
Oxalis perennans	Oxalis	Oxalidaceae	1-2		1
Rumex brownii	Native Dock	Polygonaceae			1
**Salvia verbenaca*	Vervain	Lamiaceae	1	2	2
**Silybum marianum*	Variegated Thistle	Asteraceae	1	2	2
**Sisymbrium orientale*	Indian Hedge Mustard	Brassicaceae	2	2-3	2-5
**Solanum chenopodioides*	Whitetip Nightshade	Solanaceae			
**Sonchus oleraceus*	Common Sowthistle	Asteraceae			2
**Taraxacum officinale*	Dandelion	Asteraceae			1
**Trifolium repens*.	White Clover	Fabaceae	0-2	2-3	2-3
**Trifolium* sp.	Clover	Fabaceae	0-22	2-3	2-3
**Urtica urens*	Small Nettle	Urticaceae	0-3	0-5	0-5
Vittadinia muelleri		Asteraceae	0-2		
GRASSES					
**Avena sp*	Oats	Poaceae		1	2
Austrodanthonia eriantha	Wallaby Grass	Poaceae	0-2	0-2	
Austrodanthonia richardsonii	Wallaby Grass	Poaceae	0-2		
Austrostipa scabra subsp. falcata	Spear Grass	Poaceae	3-5	2	
Austrostipa nodosa	Spear Grass	Poaceae	0-2		
**Bromus sp.*	Brome	Poaceae	0-2		0-2
Bothriochloa macra	Red Grass	Poaceae	0-4	2-3	
Chloris truncata	Windmill Grass	Poaceae	2	2	
**Cynodon dactylon*	Couch	Poaceae	2-3		
Elymus scaber	Common Wheatgrass	Poaceae	1		
**Eragrostis cilianensis*	Stinking Love-grass	Poaceae	0-3	2-6	
**Hordeum leporinum*	Barley Grass	Poaceae			0-6
Lachnagrostis filiformis	Blown Grass	Poaceae	2	1	
Microlaena stipoides	Weeping Grass	Poaceae			2
Panicum effusum	Hairy Panic	Poaceae	0-2	1	
Themeda australis	Kangaroo Grass	Poaceae	0-3		
Triticum aestivum	Common Wheat	Poaceae			0-5
GRAMINOIDS					
Carex ?inversa	Knob Sedge	Cyperaceae	0-2		
Lomandra filiformis ssp	Wattle Mat-rush	Lomandraceae	2		

Scientific name	Common name	Family	Abundance		
			NP	EP	CA
coriacea					
FERNS					
Cheilanthes sieberi ssp *sieberi*	Rock or Mulga Fern	Sinopteridaceae		1	1

Appendix D FAUNA SPECIES LISTS

Common Name	Scientific Name
Amphibians	
Common Froglet	*Crinia signifera*
Birds	
Australian Magpie	*Gymnorhina tibicen*
Australian Raven	*Corvus coronoides*
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*
Black-shouldered Kite	*Elanus axillaris*
Brown Falcon	*Falco berigora*
Common Starling	*Sturnus vulgaris*
Crested Pigeon	*Ocyphaps lophotes*
Eastern Rosella	*Platycercus eximius*
Flame Robin	*Petroica phoenicea*
Galah	*Cacatua roseicapilla*
Laughing Kookaburra	*Dacelo novaeguineae*
Little Corella	*Cacatua sanguinea*
Little Raven	*Corvus mellori*
Magpie-lark	*Grallina cyanoleuca*
Nankeen Kestrel	*Falco cenchroides*
Noisy Miner	*Manorina melanocephala*
Pied Butcherbird	*Cracticus nigrogularis*
Red-rumped Parrot	*Psephotus haematonotus*
Richard's Pipit	*Anthus novaeseelandiae*
Rufous Songlark	*Cincloramphus mathewsi*
Striated Pardalote	*Pardalotus striatus*
Sulphur-crested Cockatoo	*Cacatua galerita*
Superb Parrot	*Polytelis swainsonii*
White-plumed Honeyeater	*Lichenostomus penicillatus*
White-winged Chough	*Corcorax melanorhamphos*
Willie Wagtail	*Rhipidura leucophrys*
Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*
Mammals	
Eastern Grey Kangaroo	*Macropus giganteus*
European Rabbit	*Oryctolagus cuniculus*
House Mouse	*Mus musculus*
Red Fox	*Vulpes vulpes*
Reptiles	
Boulenger's Skink	*Morethia boulengeri*
Cunningham's Skink	*Egernia cunninghami*
Large Striped Skink	*Ctenotus robustus*

Appendix E SITE PHOTOS

Photo 1 Themeda patch Western Paddock

Photo 2 Pile of rocks cleared from B5

Photo 3 Stock water trough in B2

Photo 4 Small dry dam in the western paddock

Photo 5 Native seed trial sign adjacent to the Western Paddock

Photo 6 Large Striped Skink (*Ctenotus robustus*) found in the western paddock

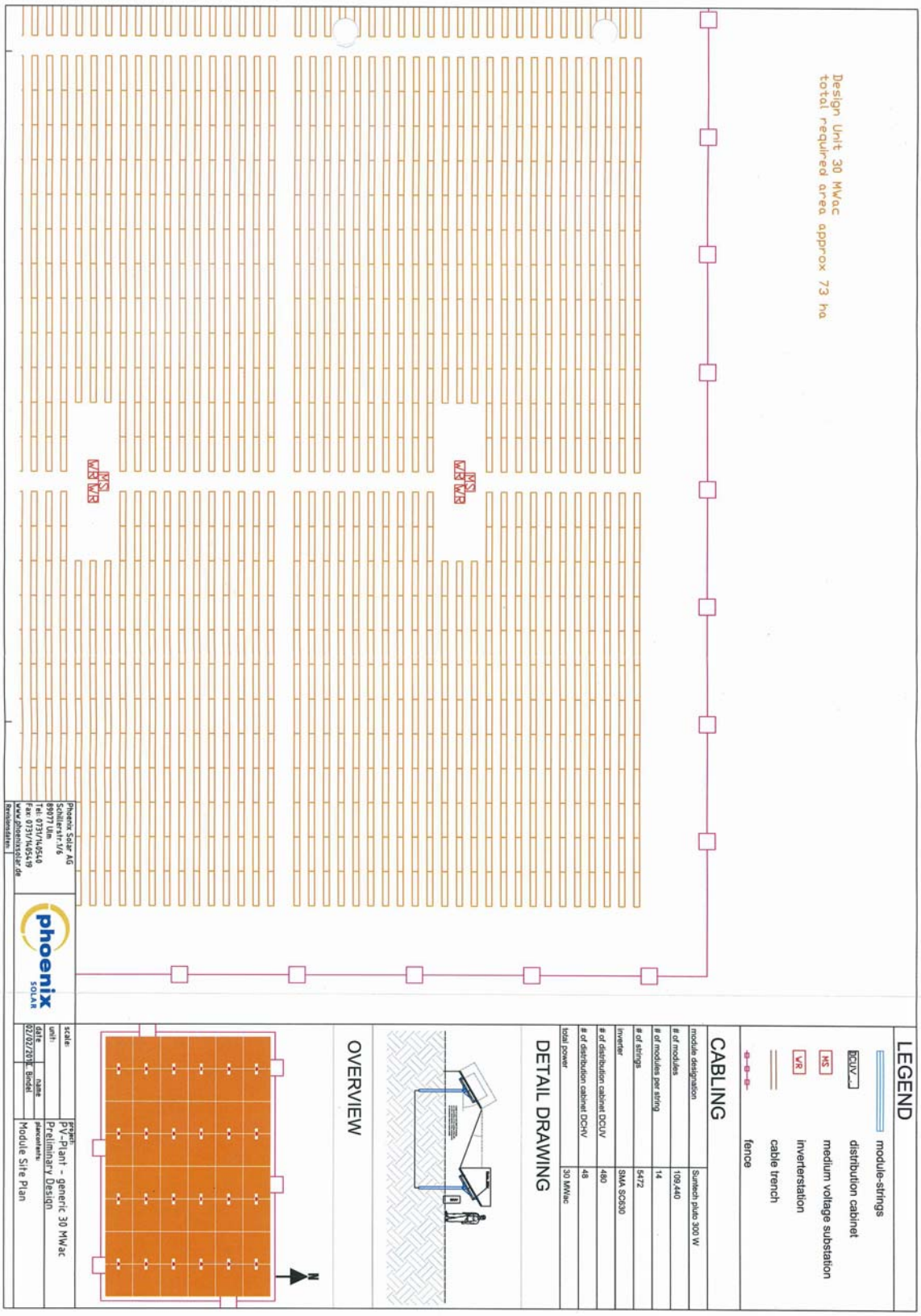
Photo 7 The old homestead ruin sth of B3

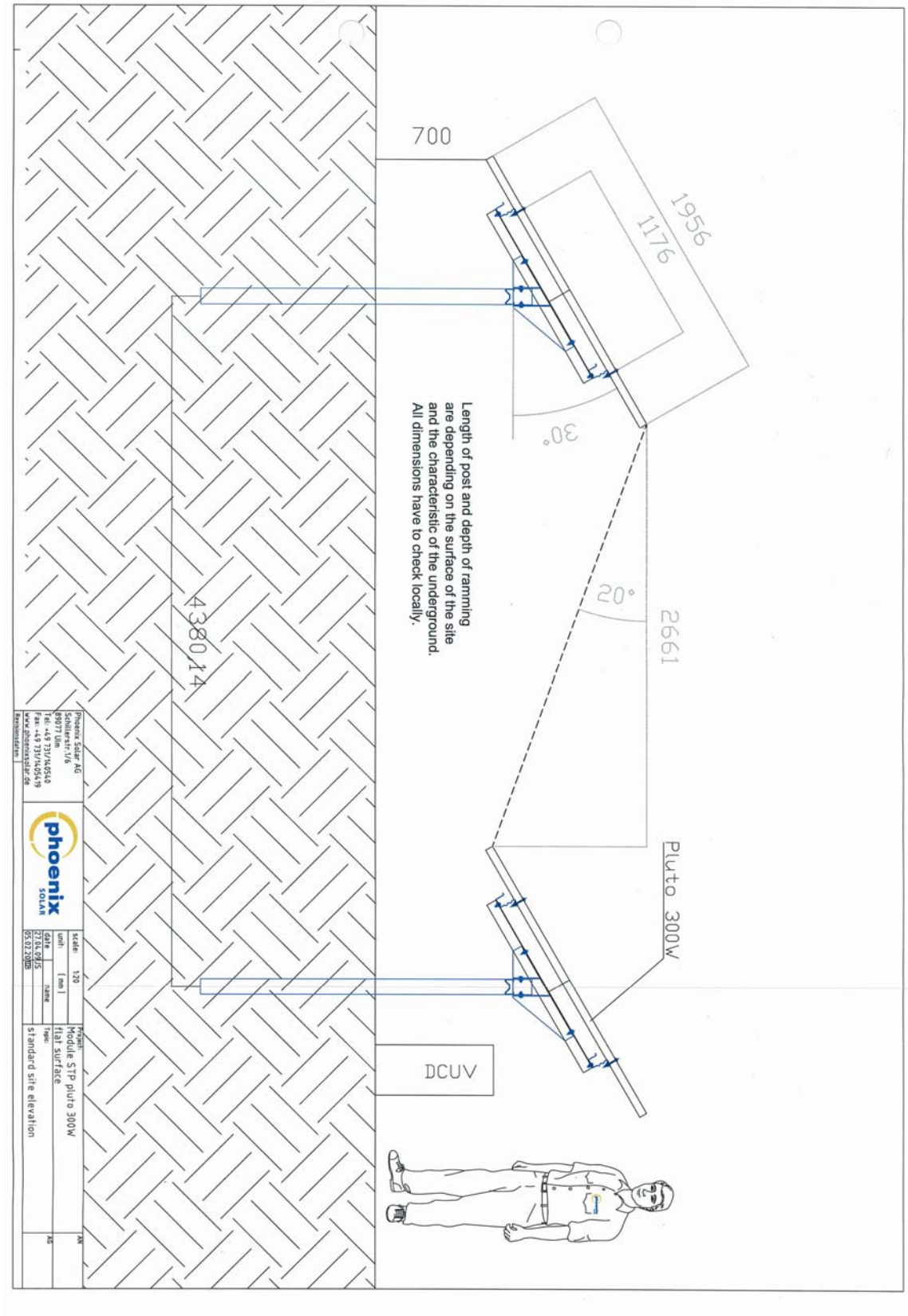
Photo 8 Manildra Substation

Photo 9 Farm track between B1 and B3, substation in the background

Photo 10 Rock out crop in B4 - low habitat quality

Appendix F Layout and Structural Plans




700
1956
1176
30°
20°
2661
4380,14
Length of post and depth of ramming
are depending on the surface of the site
and the characteristic of the underground.
All dimensions have to check locally.
Pluto 300W
DCUV
Phoenix Solar AG
Schillerstr. 1/6
89077 Ulm
Tel: +49 731/140540
Fax: +49 731/1405419
www.phoenixsolar.de
phoenix
SOLAR
scale: 1:20
unit: [mm]
date
27.04.09
05.02.2010
name
JS
Project:
Module STP pluto 300W
flat surface
Topic:
Standard site elevation
AN
AS

Appendix G Additional Maps

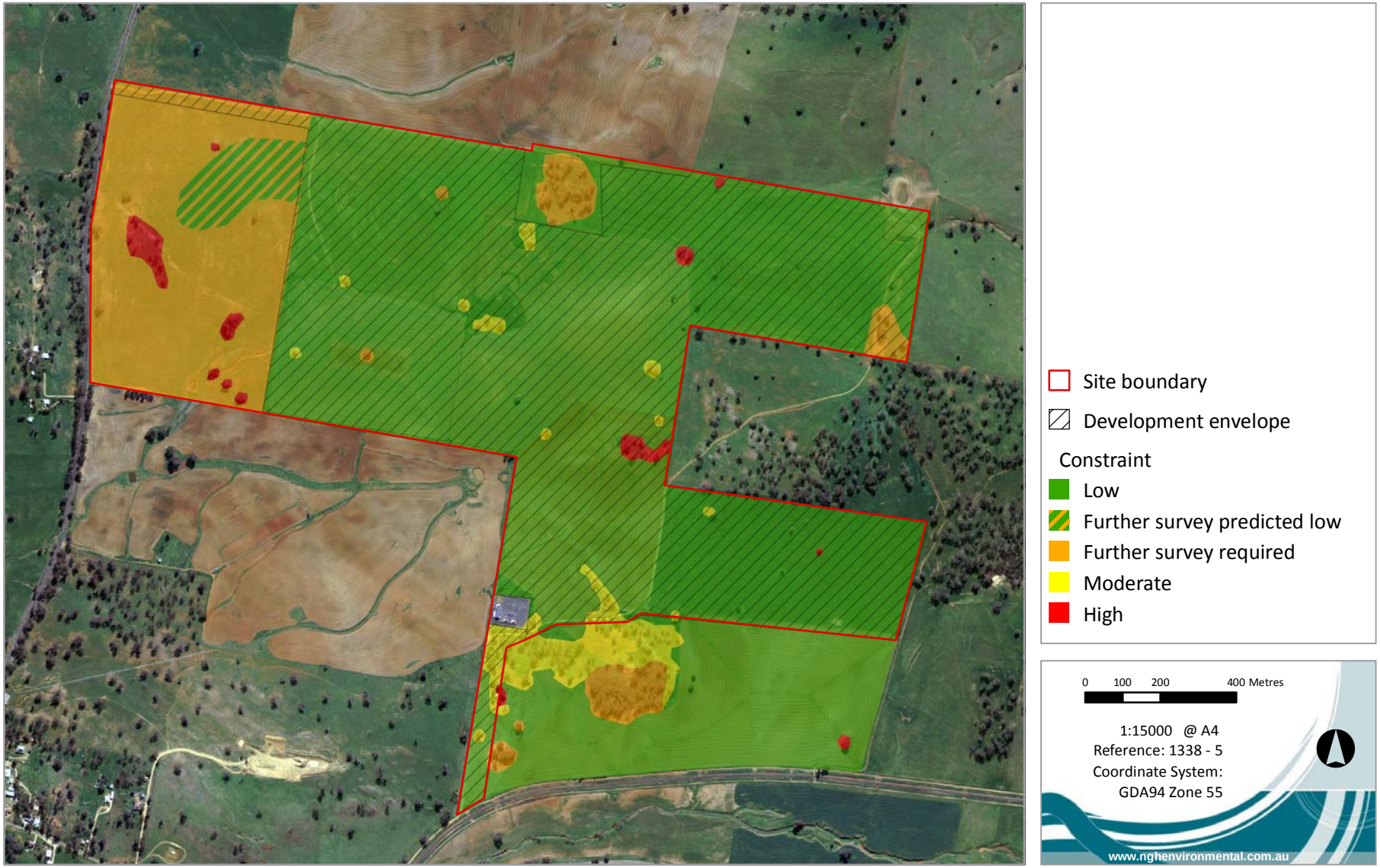


Figure 9-2 Biodiversity constraints overlayed with the development envelope

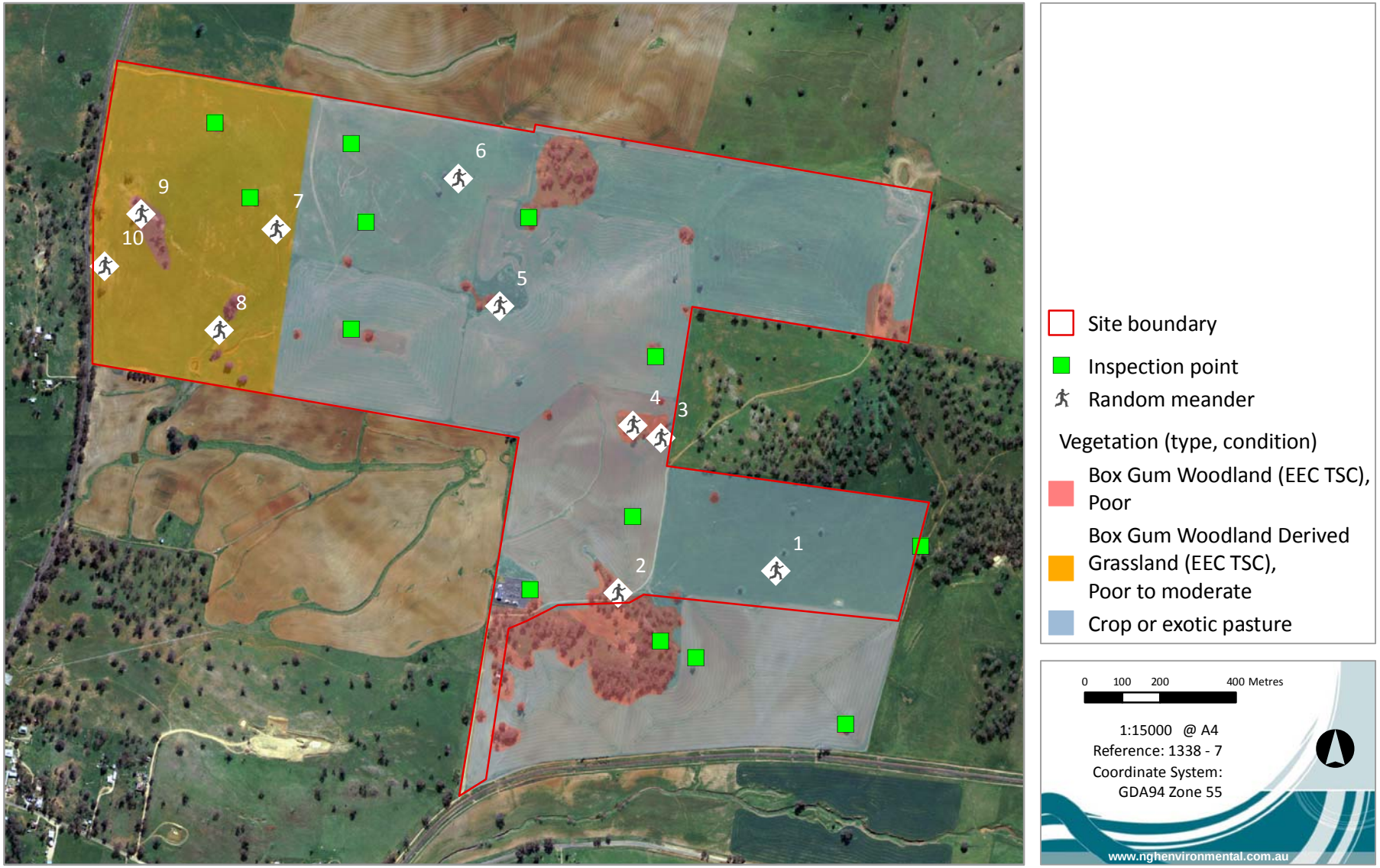


Figure 9-3 Flora survey points and vegetation type

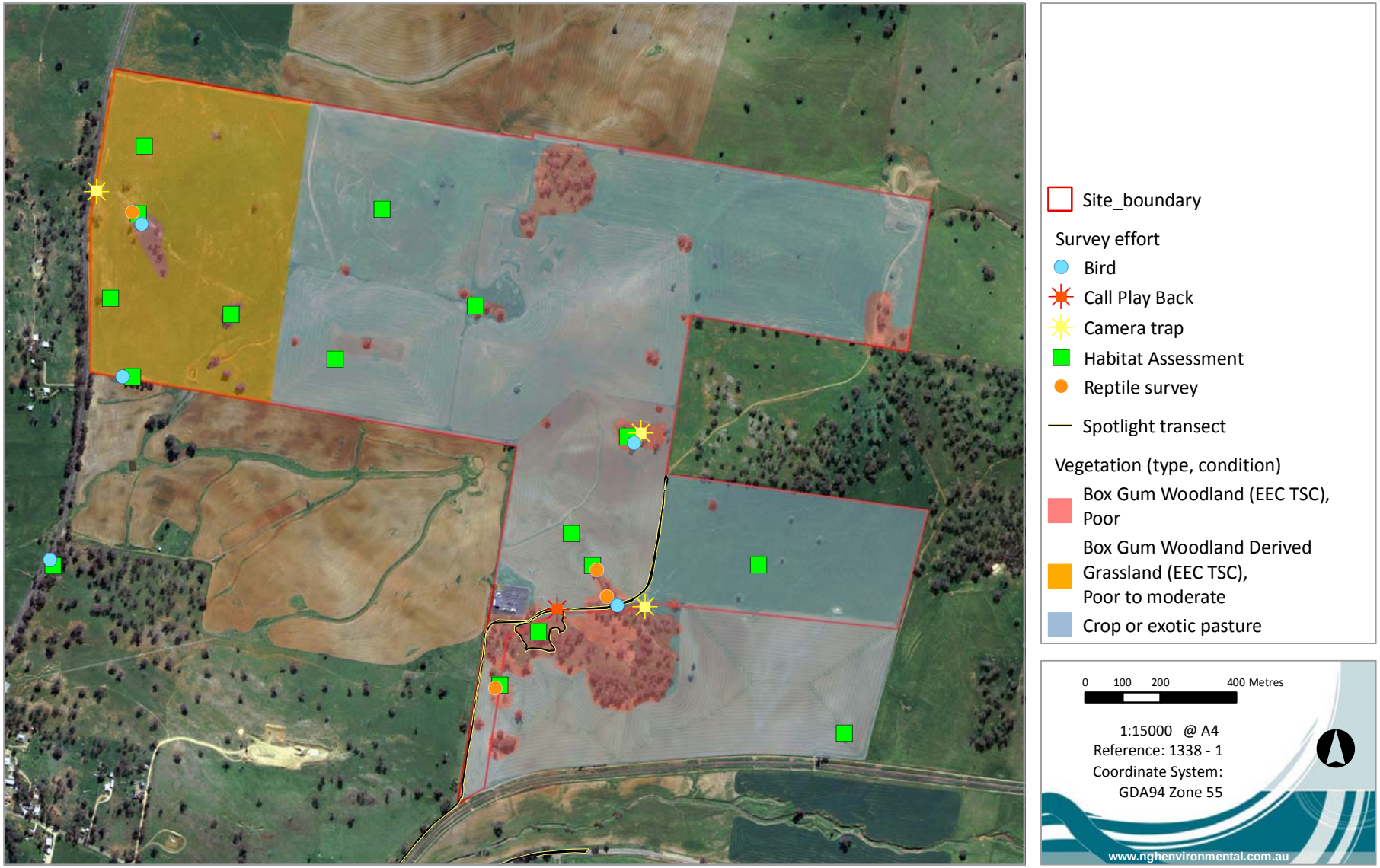


Figure 9-4 Fauna survey effort with vegetation type

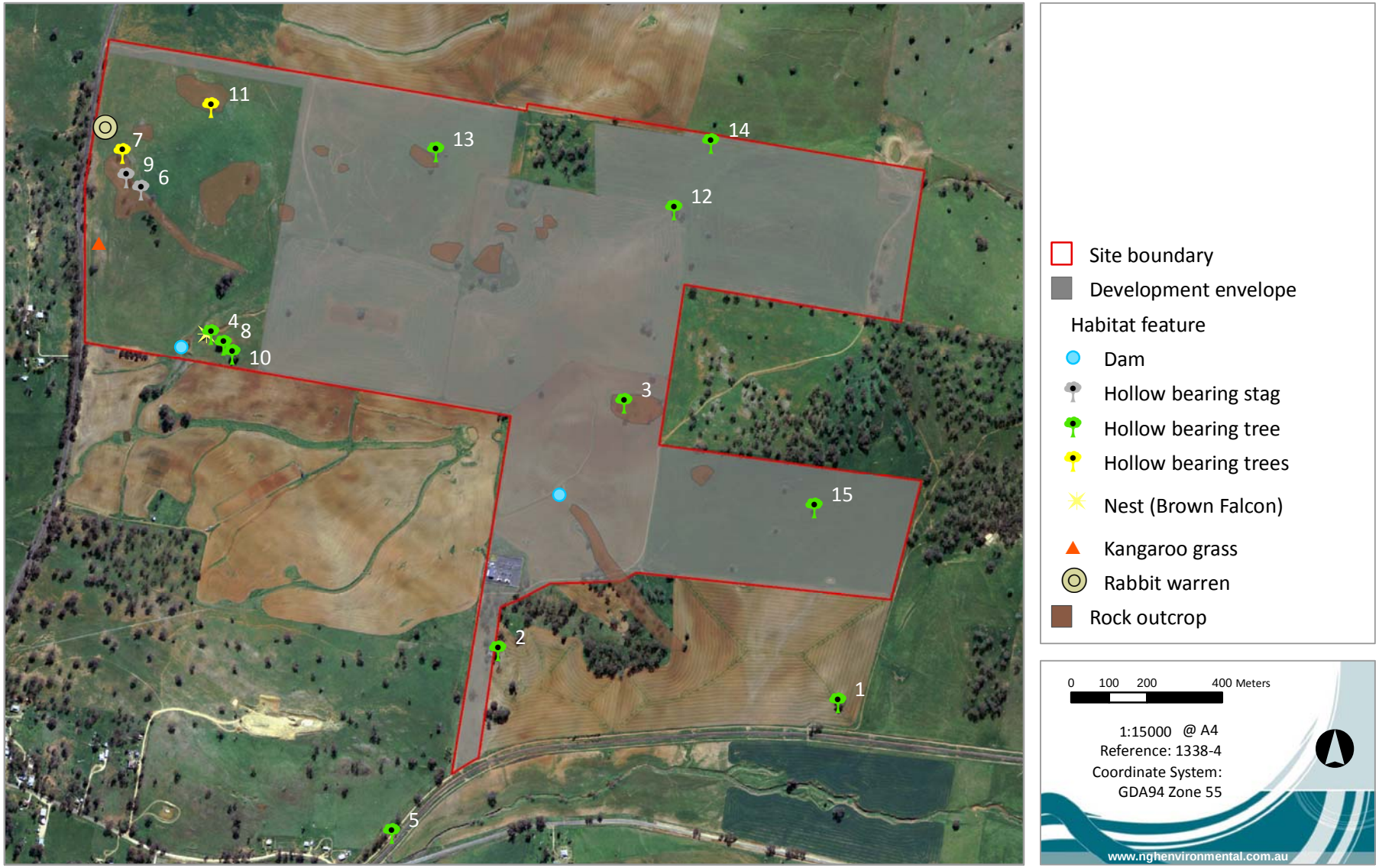


Figure 9-5 Habitat features

Appendix H DATABASE SEARCHES

EPBC Database Report

29 June 2010 10:48

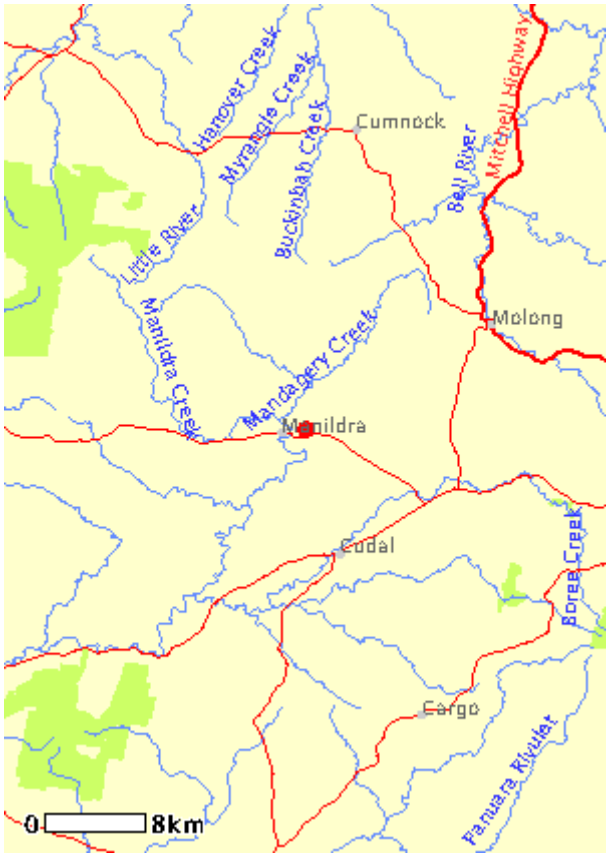
This report includes places of national environmental significance that are registered in the Department of the Environment and Water Resources' databases, for the selected area. The information presented here has been provided by a range of groups across Australia, and the accuracy and resolution varies.

Search Type: Point

Buffer: 25 km

Coordinates: -33.18156,148.71235

Report Contents: Summary >> Details >> Caveat >> Acknowledgment



This map may contain data which are © Commonwealth of Australia (Geoscience Australia) © PSMA Australia Limited

Biodiversity

Threatened Species:	14
Migratory Species:	12
Listed Marine Species:	10
Invasive Species:	14
Whales and Other Cetaceans:	None
Threatened Ecological Communities:	2

Heritage

World Heritage Properties:	None
Australian Heritage Sites:	7

Wetlands

Ramsar sites: **(Internationally important)**	1
Nationally Important Wetlands:	None

National Pollutant Inventory

Reporting Facilities:	None
Airsheds:	None
Catchments:	1

Protected Areas

Reserves and Conservation Areas:	3
Regional Forest Agreements:	None

Biodiversity

Threatened Species [Dataset Information]	Status	Comments
Birds		
Anthochaera phrygia	Endangered	Species or species habitat may

Regent Honeyeater		occur within area
Lathamus discolor Swift Parrot	Endangered	Species or species habitat likely to occur within area
Polytelis swainsonii Superb Parrot	Vulnerable	Breeding likely to occur within area
Rostratula australis Australian Painted Snipe	Vulnerable	Species or species habitat may occur within area
Frogs		
Litoria booroolongensis Booroolong Frog	Endangered	Species or species habitat may occur within area
Mammals		
Dasyurus maculatus maculatus (SE mainland population) Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population)	Endangered	Species or species habitat may occur within area
Nyctophilus timoriensis (South-eastern form) Greater Long-eared Bat, South-eastern Long-eared Bat	Vulnerable	Species or species habitat may occur within area
Petrogale penicillata Brush-tailed Rock-wallaby	Vulnerable	Species or species habitat may occur within area
Ray-finned fishes		
Maccullochella peelii peelii Murray Cod, Cod, Goodoo	Vulnerable	Species or species habitat may occur within area
Macquaria australasica Macquarie Perch	Endangered	Species or species habitat may occur within area
Plants		
Diuris sheaffiana Tricolour Diuris	Vulnerable	Species or species habitat may occur within area
Philotheca ericifolia	Vulnerable	Species or species habitat likely to occur within area
Thesium australe Austral Toadflax, Toadflax	Vulnerable	Species or species habitat likely to occur within area

Tylophora linearis	Endangered	Species or species habitat likely to occur within area
Migratory Species [Dataset Information]	Status	Comments
Migratory Terrestrial Species		
Birds		
Haliaeetus leucogaster White-bellied Sea-Eagle	Migratory	Species or species habitat likely to occur within area
Hirundapus caudacutus White-throated Needletail	Migratory	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater	Migratory	Species or species habitat may occur within area
Myiagra cyanoleuca Satin Flycatcher	Migratory	Breeding likely to occur within area
Xanthomyza phrygia Regent Honeyeater	Migratory	Species or species habitat may occur within area
Migratory Wetland Species		
Birds		
Ardea alba Great Egret, White Egret	Migratory	Species or species habitat may occur within area
Ardea ibis Cattle Egret	Migratory	Species or species habitat may occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe	Migratory	Species or species habitat may occur within area
Rostratula benghalensis s. lat. Painted Snipe	Migratory	Species or species habitat may occur within area
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift	Migratory	Species or species habitat may occur within area
Ardea alba Great Egret, White Egret	Migratory	Species or species habitat may occur within area
Ardea ibis Cattle Egret	Migratory	Species or species habitat may occur within area

Listed Marine Species [Dataset Information]	Status	Comments
Birds		
Apus pacificus Fork-tailed Swift	Listed - overfly marine area	Species or species habitat may occur within area
Ardea alba Great Egret, White Egret	Listed - overfly marine area	Species or species habitat may occur within area
Ardea ibis Cattle Egret	Listed - overfly marine area	Species or species habitat may occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe	Listed - overfly marine area	Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle	Listed	Species or species habitat likely to occur within area
Hirundapus caudacutus White-throated Needletail	Listed - overfly marine area	Species or species habitat may occur within area
Lathamus discolor Swift Parrot	Listed - overfly marine area	Species or species habitat likely to occur within area
Merops ornatus Rainbow Bee-eater	Listed - overfly marine area	Species or species habitat may occur within area
Myiagra cyanoleuca Satin Flycatcher	Listed - overfly marine area	Breeding likely to occur within area
Rostratula benghalensis s. lat. Painted Snipe	Listed - overfly marine area	Species or species habitat may occur within area

Appendix I Vegetation clearing guidelines

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.
- Non-hollow bearing vegetation should only be removed between January and July to avoid the breeding seasons of most forest and woodland fauna.
- 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 will 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.
- Large tree trunks and limbs, particularly hollows, may be useful for ground habitat restoration or resnagging projects either near or distant from the clearing site. These resources may be stored at an appropriate site until a suitable project is found.
- 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.
- 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 J Raw Data

Listed threatened species are highlighted.

Coordinates:

Collected with a Magellan Triton hand held GPS using GDA94 datum - average error 5m

Activity:

CPB= Call play back

Foot spot= foot spotlight

Vehicle spot= vehicle spotlight

Location:

H#= habitat assessment site (see Appendix B.1 for site descriptions)

Onsite:

Describes if the species was detected onsite or offsite in adjacent vegetation (for example a call was heard offsite from an onsite sampling point)

Obs. (Observations):

O= observed

H= heard

S=sign

No. = number of that species see during the particular survey

Latitude	Longitude	Date	Activity	Start Time 24 hr	Finish Time 24 hr	TOTAL MINUTES	Common Name	*Scientific Name*	Location	Staff	Observations	No.	conditions
-33.1791211	148.7193813	5/07/2010	herp search	1545	1615	30	Boulenger's Skink	*Morethia boulengeri*	*HA2*	AM	O	1	cool, o'cast, slight breeze
-33.1799720	148.7199900	5/07/2010	bird survey	1515	1545	20	Black-shouldered Kite	*Elanus axillaris*	*HA1*	AM	O	1	cool, o'cast, slight breeze
-33.1799720	148.7199900	5/07/2010	bird survey				Noisy Miner	*Manorina melanocephala*	*HA1*	AM	O	5	cool, o'cast, slight breeze
-33.1799720	148.7199900	5/07/2010	bird survey				Little Raven	*Corvus mellori*	*HA1*	AM	O	6	cool, o'cast, slight breeze
-33.1799720	148.7199900	5/07/2010	bird survey				Australian Magpie	*Gymnorhina tibicen*	*HA1*	AM	O	3	cool, o'cast, slight breeze
-33.1799720	148.7199900	5/07/2010	bird survey				Galah	*Cacatua roseicapilla*	*HA1*	AM	H	4	cool, o'cast, slight breeze
-33.1799720	148.7199900	5/07/2010	bird survey				Eastern Rosella	*Platycercus eximius*	*HA1*	AM	O	4	cool, o'cast, slight breeze
-33.1799720	148.7199900	5/07/2010	bird survey				Striated Pardalote	*Pardalotus striatus*	*HA1*	AM	H	2	cool, o'cast, slight breeze
-33.1799720	148.7199900	5/07/2010	bird survey				Magpie-lark	*Grallina cyanoleuca*	*HA1*	AM	O	2	cool, o'cast, slight breeze
-33.1799720	148.7199900	5/07/2010	bird survey				Common Starling	*Sturnus vulgaris*	*HA1*	AM	O	6	cool, o'cast, slight breeze
-33.1799720	148.7199900	5/07/2010	bird survey				Pied Butcherbird	*Cracticus nigrogularis*	*HA1*	AM	H	1	cool, o'cast, slight breeze
-33.1799720	148.7199900	5/07/2010	opportunistic				Eastern Grey Kangaroo	*Macropus giganteus*	*HA1*	AM	S	.	cool, o'cast, slight breeze
-33.1799720	148.7199900	5/07/2010	opportunistic				Red-rumped Parrot	*Psephotus haematonotus*	*HA1*	AM	O	5	cool, o'cast, slight breeze
-33.1800900	148.7182780	5/07/2010	Call Play Back	1815	1840	25	Common Froglet	*Crinia signifera*	*sth of HA16*	AM	H	5	cool, o'cast (8/8), slight breeze
		5/07/2010	Foot spotlight	1840	1920	40	European Rabbit	*Oryctolagus cuniculus*	*HA1*	AM	O	2	cool, o'cast (8/8), slight breeze
-33.1799900	148.7207700	6/07/2010	Camera trap				Red Fox	*Vulpes vulpes*	*HA1*	AM	O	1	cool, o'cast (8/8), slight breeze
-33.1791140	148.7038630	6/07/2010	bird survey	820	850	40	Australian Magpie	*Gymnorhina tibicen*	*HA1*	AM	O	4	cool, o'cast clearing, slight breeze
-33.1791140	148.7038630	6/07/2010	bird survey				Noisy Miner	*Manorina melanocephala*	*HA1*	AM	O	2	cool, o'cast clearing, slight breeze
-33.1791140	148.7038630	6/07/2010	bird survey				Galah	*Cacatua roseicapilla*	*HA1*	AM	O	2	cool, o'cast clearing, slight breeze
-33.1791140	148.7038630	6/07/2010	bird survey				Eastern Rosella	*Platycercus eximius*	*HA1*	AM	O	2	cool, o'cast clearing, slight breeze
-33.1791140	148.7038630	6/07/2010	bird survey				Common Starling	*Sturnus vulgaris*	*HA1*	AM	O	3	cool, o'cast clearing, slight breeze
-33.1791140	148.7038630	6/07/2010	bird survey				Magpie-lark	*Grallina cyanoleuca*	*HA1*	AM	H		cool, o'cast clearing, slight breeze
-33.1791140	148.7038630	6/07/2010	bird survey				Willie Wagtail	*Rhipidura leucophrys*	*HA1*	AM	O	1	cool, o'cast clearing, slight breeze
-33.1791140	148.7038630	6/07/2010	bird survey				Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*	*HA1*	AM	O	6	cool, o'cast clearing, slight breeze
-33.1791140	148.7038630	6/07/2010	bird survey				Little Corella	*Cacatua sanguinea*	*HA1*	AM	O	2	cool, o'cast clearing, slight breeze
-33.1791140	148.7038630	6/07/2010	bird survey				Crested Pigeon	*Ocyphaps lophotes*	*HA1*	AM	O	1	cool, o'cast clearing, slight breeze
-33.1791140	148.7038630	6/07/2010	bird survey				Australian Raven	*Corvus coronoides*	*HA1*	AM	H		cool, o'cast clearing, slight breeze
-33.1791140	148.7038630	6/07/2010	bird survey				White-winged Chough	*Corcorax melanorhamphos*	*HA1*	AM	O	6	cool, o'cast clearing, slight breeze
-33.1791140	148.7038630	6/07/2010	opportunistic				Superb Parrot	*Polytelis swainsonii*	*HA1*	AM	O	2	cool, o'cast clearing, slight breeze
-33.1791140	148.7038630	6/07/2010	opportunistic				Nankeen Kestrel	*Falco cenchroides*	*HA1*	AM	O		cool, o'cast clearing, slight breeze
-33.1819900	148.7165700	5/07/2010	herp search	850	905	15	Boulenger's Skink	*Morethia boulengeri*	*HA16*	AM	O	1	cool, o'cast clearing, slight breeze
-33.1791140	148.7038630	6/07/2010	bird survey	1030	1050	20	White-plumed Honeyeater	*Lichenostomus penicillatus*	*HA7*	AM	O	3	cool, o'cast clearing, slight breeze
-33.1791140	148.7038630	6/07/2010	bird survey				Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*	*HA7*	AM	O	5	cool, o'cast clearing, slight breeze
-33.1791140	148.7038630	6/07/2010	bird survey				White-winged Chough	*Corcorax melanorhamphos*	*HA7*	AM	H		cool, o'cast clearing, slight breeze

Latitude	Longitude	Date	Activity	Start Time 24 hr	Finish Time 24 hr	TOTAL MINUTES	Common Name	*Scientific Name*	Location	Staff	Observations	No.	conditions
-33.1791140	148.7038630	6/07/2010	bird survey				Australian Magpie	*Gymnorhina tibicen*	*HA7*	AM	O	3	cool, o'cast clearing, slight breeze
-33.1791140	148.7038630	6/07/2010	bird survey				Laughing Kookaburra	*Dacelo novaeguineae*	*HA7*	AM	H		cool, o'cast clearing, slight breeze
-33.1791140	148.7038630	6/07/2010	bird survey				Red-rumped Parrot	*Psephotus haematonotus*	*HA7*	AM	O	4	cool, o'cast clearing, slight breeze
-33.1791140	148.7038630	6/07/2010	bird survey				Sulphur-crested Cockatoo	*Cacatua galerita*	*HA7*	AM	H		cool, o'cast clearing, slight breeze
-33.1707800	148.7060400	6/07/2010	herp search	1055	1115		Large Striped Skink	*Ctenotus robustus*	*HA8*	AM	O	2	cool, o'cast clearing, slight breeze
-33.1707800	148.7060400	6/07/2010	herp search				Cunningham's Skink	*Egernia cunninghami*	*HA8*	AM	S		cool, o'cast clearing, slight breeze
-33.1710560	148.7063070	6/07/2010	bird survey	1115	1135	20	Australian Raven	*Corvus coronoides*	*HA8*	AM	H		cool, o'cast clearing, slight breeze
-33.1710560	148.7063070	6/07/2010	bird survey				Little Raven	*Corvus mellori*	*HA8*	AM	O	5	cool, o'cast clearing, slight breeze
-33.1710560	148.7063070	6/07/2010	bird survey				Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*	*HA8*	AM	O	7	cool, o'cast clearing, slight breeze
-33.17114066	148.7065583	6/07/2010	bird survey				Superb Parrot	*Polytelis swainsonii*	*HA8*	AM	O	2	cool, o'cast clearing, slight breeze
-33.1710560	148.7063070	6/07/2010	bird survey				White-plumed Honeyeater	*Lichenostomus penicillatus*	*HA8*	AM	O	2	cool, o'cast clearing, slight breeze
-33.1710560	148.7063070	6/07/2010	bird survey				Crested Pigeon	*Ocyphaps lophotes*	*HA8*	AM	O	3	cool, o'cast clearing, slight breeze
-33.1710560	148.7063070	6/07/2010	bird survey				Australian Magpie	*Gymnorhina tibicen*	*HA8*	AM	O	2	cool, o'cast clearing, slight breeze
-33.1710560	148.7063070	6/07/2010	bird survey				Red-rumped Parrot	*Psephotus haematonotus*	*HA8*	AM	O	3	cool, o'cast clearing, slight breeze
-33.1710560	148.7063070	6/07/2010	bird survey				Black-faced Cuckoo-shrike	*Coracina novaehollandiae*	*HA8*	AM	O	2	cool, o'cast clearing, slight breeze
-33.1710560	148.7063070	6/07/2010	bird survey				Nankeen Kestrel	*Falco cenchroides*	*HA8*	AM	O	1	cool, o'cast clearing, slight breeze
-33.1710560	148.7063070	6/07/2010	bird survey				Galah	*Cacatua roseicapilla*	*HA8*	AM	O	2	cool, o'cast clearing, slight breeze
-33.1710560	148.7063070	6/07/2010	bird survey				Common Starling	*Sturnus vulgaris*	*HA8*	AM	O	1	cool, o'cast clearing, slight breeze
-33.1710560	148.7063070	6/07/2010	bird survey				Willie Wagtail	*Rhipidura leucophrys*	*HA8*	AM	O	1	cool, o'cast clearing, slight breeze
-33.1747100	148.7058330	6/07/2010	bird survey	1135	1155	20	Black-faced Cuckoo-shrike	*Coracina novaehollandiae*	*HA10*	AM	O	2	cool, o'cast clearing, slight breeze
-33.1747100	148.7058330	6/07/2010	bird survey				Red-rumped Parrot	*Psephotus haematonotus*	*HA10*	AM	O	4	cool, o'cast clearing, slight breeze
-33.1747100	148.7058330	6/07/2010	bird survey				Rufous Songlark	*Cincloramphus mathewsi*	*HA10*	AM	O	1	cool, o'cast clearing, slight breeze
-33.1747100	148.7058330	6/07/2010	bird survey				Crested Pigeon	*Ocyphaps lophotes*	*HA10*	AM	O	4	cool, o'cast clearing, slight breeze
-33.1747100	148.7058330	6/07/2010	bird survey				Willie Wagtail	*Rhipidura leucophrys*	*HA10*	AM	O	1	cool, o'cast clearing, slight breeze
-33.1747100	148.7058330	6/07/2010	bird survey				Common Starling	*Sturnus vulgaris*	*HA10*	AM	O	3	cool, o'cast clearing, slight breeze
-33.1747100	148.7058330	6/07/2010	bird survey				Flame Robin	*Petroica phoenicea*	*HA10*	AM	O	7	cool, o'cast clearing, slight breeze
-33.1747100	148.7058330	6/07/2010	bird survey				Brown Falcon	*Falco berigora*	*HA10*	AM	O	2	cool, o'cast clearing, slight breeze
-33.1747100	148.7058330	6/07/2010	bird survey				Richard's Pipit	*Anthus novaeseelandiae*	*HA10*	AM	O	3	cool, o'cast clearing, slight breeze
-33.1708140	148.7062020	6/07/2010	opportunistic				House Mouse	*Mus musculus*	*HA15*	AM	S		cool, o'cast clearing, slight breeze