



## SUNTOP SOLAR FARM

# BIODIVERSITY DEVELOPMENT ASSESSMENT REPORT

**Prepared for Pitt & Sherry Pty. Ltd.**

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**LIST OF ATTACHMENTS**

Attachment 1. Fauna Survey and Assessment Report

Attachment 2. BAM Credit Summary Report

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## EXECUTIVE SUMMARY

FloraSearch was commissioned by Pitt and Sherry Pty. Ltd. on behalf of Suntop Solar Farm to conduct biodiversity surveys and an ecological assessment on the site of a proposed solar farm at Suntop, approximately 10 kilometres (km) south west of Wellington town centre in the central west of New South Wales. The Project is a State Significant Development for which approval is being sought under Part 4 of the NSW *Environmental Planning and Assessment Act, 1979* (EP&A Act). The survey and assessment were conducted using the Biodiversity Assessment Method (BAM) (OEH, 2017a) under the NSW *Biodiversity Conservation Act 2016* (BC Act). Owing to the small areas of native vegetation to be impacted on the Site, the assessment uses the *Streamlined Assessment Module* of the BAM (OEH, 2017a).

Suntop Solar Farm propose to construct and operate a 200 megawatt (MW) solar farm (the Proposal) using photovoltaic (PV) technology at a 517 hectare site (the Study area) in Suntop, NSW (Figure 1). The Proposal would be located adjacent to Suntop Road and contained within Lots 1, 2 and 3 DP506925, Lot 122 DP753238 and Lot 90 DP657805 (the Subject Land) within the Dubbo Regional Council Local Government Area (LGA). The solar farm would occupy 472 hectares (the Site) of the 517 hectares (approximately 91.3% of the Study area).

The survey comprised three days of field survey (29 November 2017, 15 January 2018 and 8 May 2018), searches of relevant State and Commonwealth databases and a literature review to determine which threatened biodiversity has potential to occur on the investigation area.

The key findings of the survey were:

### **Flora**

- No patches of remnant vegetation occur within the solar farm footprint, which is confined to cleared agricultural land entirely made up of cultivation paddocks for wheat and lucerne production.
- All that remains of the pre-European native vegetation within the solar farm footprint are 25 scattered remnant old growth paddock trees, 10 of which have hollows suitable for wildlife denning and nesting.
- The Site also has five linear plantings and two small block plantings of native trees totalling 477 individuals, some endemic to the local area and some native to other regions.
- Three introduced species regarded as High Threat Exotic weeds under the BAM (OEH, 2018a) were recorded on the Site, Khaki Weed, Bathurst Burr and Saffron Thistle. None are listed as Priority Weeds under the NSW *Biosecurity Act 2015* or as Weeds of National Significance by the Australian Weeds Committee.
- The original dominant vegetation community on the study area is considered to be Plant Community Type (PCT) 267; *White Box - White Cypress Pine - Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion*.
- Upgrade of the intersection of Suntop Road and Renshaw-McGirr Way would disturb remnants of PCT277; *Blakelys Red Gum – Yellow Box grassy tall woodland in the NSW South Western Slopes Bioregion*.

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### **Threatened Biodiversity**

- No threatened flora species, populations or critical habitat listed under the BC Act or the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) were identified on the investigation area by the survey, or by a survey of fauna by Biosphere Environmental Consultants Pty. Ltd (Attachment 1).
- No suitable habitat was considered to be present on the Site for any of the threatened flora species returned by the BAM Credit Calculator as having potential to occur.
- Five ecosystem credit fauna species were considered to have a low potential to use the limited resources on the Site; the Little Lorikeet, Swift Parrot, Regent Honeyeater, Scarlet Robin and Flame Robin.
- No species credit fauna species were considered to have potential to utilise the Site owing to a lack of breeding resources.
- One threatened ecological community (TEC) listed under the BC Act and the EPBC Act is considered to once have occupied the Site, but has been reduced by clearing for agriculture to a few scattered paddock trees;

*White Box Yellow Box Blakely's Red Gum Woodland Endangered Ecological Community* (BC Act), and  
*White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland Critically Endangered Ecological Community* (EPBC Act).

- Remnant woodland of the above EEC/CEEC, commonly known as Box-Gum Woodland, occupies the disturbance area at the intersection of Suntop Road and Renshaw – McGirr Way.

### **Impact Avoidance and Mitigation**

Impact avoidance measures that would be implemented for the Project include;

- Protection measures to avoid damage to discontinuous patches of mature native perimeter trees on all boundaries of the Site.
- Avoidance and protection of the block of planted native eucalypts in Paddock 12.
- Retention and avoidance of a clump of three Fuzzy Box trees within the northern boundary of Paddock 1.

Mitigation measures include:

- Supervised removal of trees with hollows.
- A Vegetation Management Plan to protect old growth trees on the margins of the Site.
- Vegetation enhancement through strategic replanting.
- Development of a weed management strategy.
- Monitoring for feral animals and control as necessary.
- Prohibition of domestic pets on site.
- A site closure and rehabilitation plan.

**Project Impacts**

Direct impacts of the Proposal on biodiversity include;

- Loss of 1.25 ha of eucalypt plantings and six isolated planted eucalypts.
- Loss of 0.04 ha of Box-Gum Woodland at the junction of Suntop Road and Renshaw – McGirr Way.
- Loss of 25 remnant paddock trees and up to 10 isolated roadside trees.

**Cumulative Impacts**

The cumulative impacts of the project on remnant native vegetation loss are negligible whether remnant woodland or plantings of native windbreak trees are considered.

**Biodiversity Credit Report**

The biodiversity credit report of the BAMC indicated that the plantings, which were assumed to represent PCT267 in order to run the calculator, are valued at 20 credits.

Paddock trees for removal were assessed according to Appendix 1 of the BAM (2017a), which valued them at 27.75 credits.

The total credit liability for the Project is 47.75 credits.

**Offset**

Suntop Solar Farm propose to acquit the liability of 47.75 credits by making a lump sum payment of equivalent value to the Biodiversity Conservation Trust Fund.

**Commonwealth Environment Protection and Biodiversity Conservation Act (EPBC Act)**

Two threatened species considered to have potential habitat on the investigation area are listed under the EPBC Act; the Swift Parrot and the Regent Honeyeater. Neither species would be dependent on the site for breeding and foraging visits would occur rarely, if at all. The small loss of potential habitat on the site is highly unlikely to have an adverse impact on either species and referral of the Project to the Department of Energy and the Environment is not required.

**SEPP 44**

Three of the remnant eucalypt species on and around the Subject Land are recognised as secondary Koala food trees (OEH, 2018e), viz. Inland Grey Box, Fuzzy Box and White Box. The last of these is listed as a Koala feed tree in Schedule 2 of SEPP 44. However, the Site does not have an extant Koala population (Attachment 1) and therefore is not 'core' Koala habitat so that a SEPP 44 plan of management is not required.

# 1 INTRODUCTION

FloraSearch was commissioned by Pitt and Sherry Pty. Ltd. on behalf of Suntop Solar Farm to conduct biodiversity surveys and an ecological assessment of the site of a proposed solar farm at Suntop, approximately 10 kilometres (km) south west of Wellington town centre in the central west of New South Wales (Figure 1). The Project is a State Significant Development for which approval is being sought under Part 4 of the NSW *Environmental Planning and Assessment Act, 1979* (EP&A Act). The survey and assessment were conducted using the Biodiversity Assessment Method (BAM) (OEH, 2017a) under the NSW *Biodiversity Conservation Act 2016* (BC Act).

## 1.1 PROJECT OVERVIEW

Suntop Solar Farm propose to construct and operate a 200 megawatt (MW) solar farm (the Proposal) using photovoltaic (PV) technology at a 517 hectare site (the Study area) in Suntop, NSW (Figure 1). The Proposal would be located adjacent to Suntop Road and contained within Lots 1, 2 and 3 DP506925, Lot 122 DP753238 and Lot 90 DP657805 (the Subject Land) within the Dubbo Regional Council Local Government Area (LGA). The solar farm would occupy 472 hectares (the Site) of the 517 hectares (approximately 91.3% of the Study area) (Figure 2).

An estimated up to 550,000 PV panels would be installed on a single axis tracker system across the Site. The single axis tracker system would consist of groups of east-west facing PV modules tilted at +/- 60° angle (each approximately 2m x 1m in area) on mounting structures approximately 2 m in height. The mounting structure would be piled steel posts that would extend 1.6 to 4 m below soil surface depending on substrate conditions. The maximum height of the panels during tracking movement would be 4 m.

The following works and infrastructure would be required to support the construction and operation of the solar farm:

- Construction of an access road for all access and egress for the Site and substation.
- Installation of Electrical infrastructure including:
  - A 132kV Substation including two transformers and associated 132kV switchgear.
  - Inverters to collect and convert DC to AC.
  - Cabling and other electrical infrastructure (e.g. security systems).
- A maintenance compound and buildings.
- Fencing, landscaping and environmental works.
- Upgrade of the intersection of Suntop Road and Renshaw-McGirr Way (Figure 3).

Power generated by the facility will be transmitted via existing 132kV transmission lines, in an easement owned by TransGrid that traverses the Site and extends through to the Wellington substation approximately 15 kilometres to the north. A tee off connection will be used to connect the new substation on Site to the existing TransGrid 132kV transmission line via a short section of transmission line.

The operational life of the solar farm is expected to be approximately 30 years at which point the panels are either replaced and operations continue or removed and the site decommissioned and rehabilitated as required.

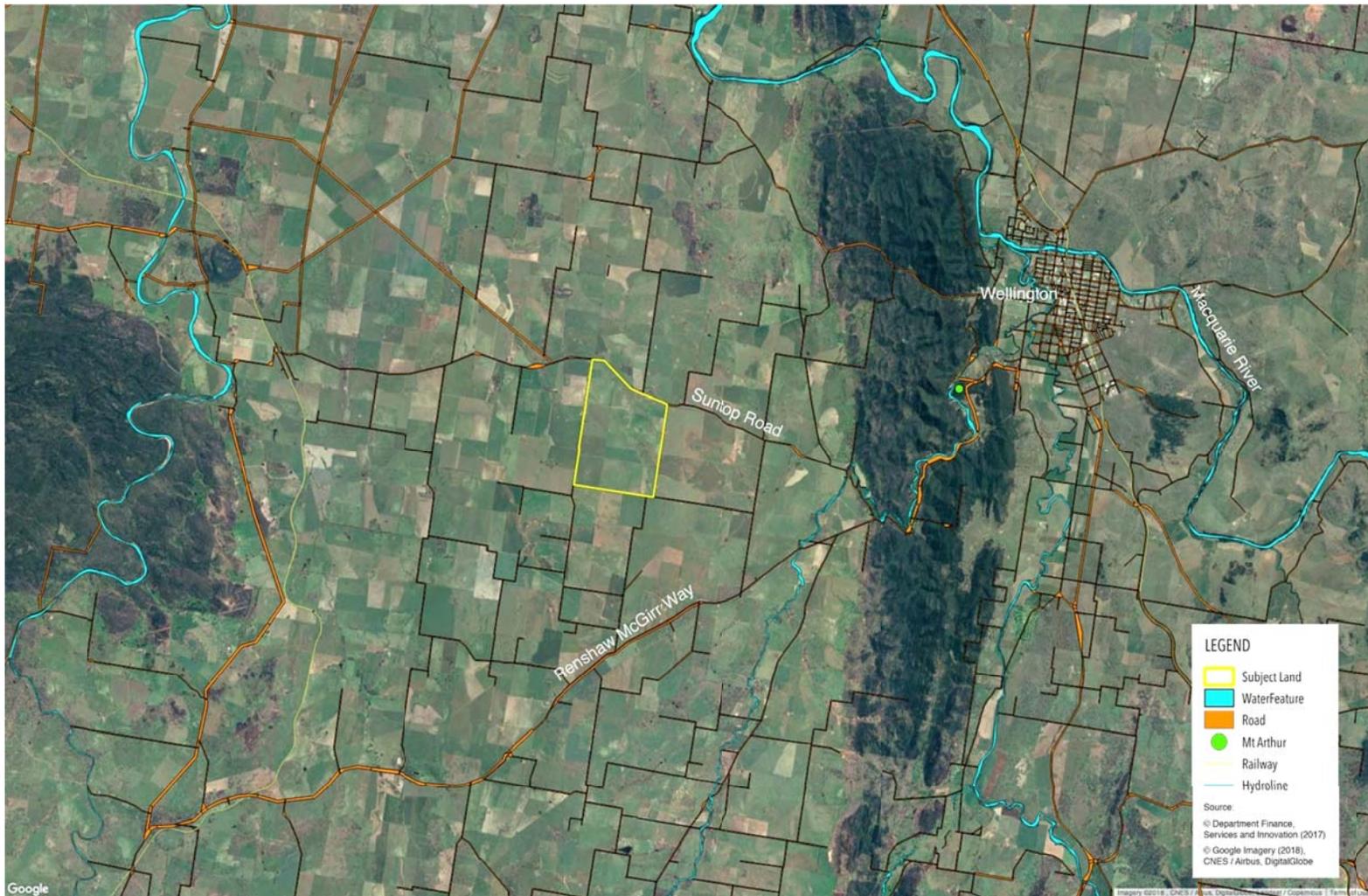


Figure 1. Regional Location of the Project Site.

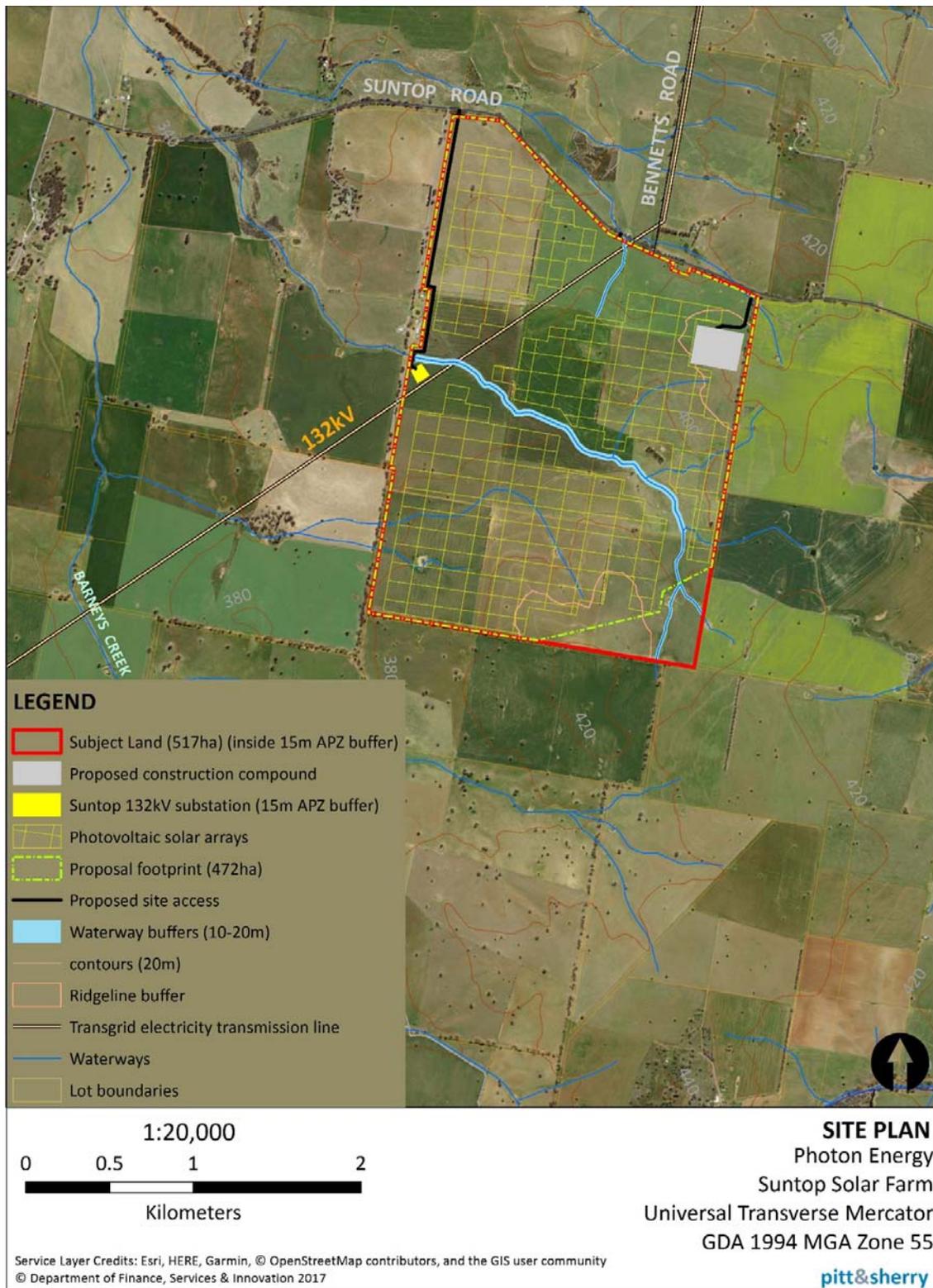


Figure 2. Site Layout.



Figure 3. Proposed Widening of Renshaw - McGirr Way at the Suntop Road Intersection.

## 1.2 BIODIVERSITY ASSESSMENT METHOD

The Environmental Assessment Requirements issued on behalf of the Secretary of the NSW Department of Planning and Environment to Suntop Solar Farm require that the assessment of impacts from this Project on biodiversity should be conducted in accordance with the Biodiversity Assessment Method (BAM) (OEH, 2017a) established under the *Biodiversity Conservation Act 2016* (BC Act). The BAM outlines the methodology that underpins the NSW Biodiversity Offsets Scheme established under Part 6 of the BC Act.

The BAM (OEH, 2017a) requires the use of an online program (calculator) to assess biodiversity impacts and determine the biodiversity offset requirements for those impacts. The *Biodiversity Assessment Method Calculator* (BAMC or the Credit Calculator) was used for this assessment.

As specified by the BAM (OEH, 2017a), three stages of assessment are outlined in this report:

- Stage 1 summarises the biodiversity values of the BDAR Footprint that are entered into the Credit Calculator (e.g. landscape features, native vegetation and threatened species) (Section 2);
- Stage 2 assesses potential impacts on biodiversity, describes impact avoidance and mitigation measures and determines offset requirements (Section 3); and
- Stage 3 describes the Biodiversity Offset Strategy (Section 4).

This Biodiversity Development Assessment Report (BDAR) has been prepared by Dr Colin Bower (FloraSearch), who is an accredited assessor under section 6.10 of the BC Act (assessor accreditation number BAAS18048).

## 1.3 GENERAL DESCRIPTION OF THE DEVELOPMENT SITE

The Biodiversity Development Assessment Report Site Footprint (BDAR Footprint) (Figure 2) is the development Site construction and operational area comprising approximately 472 hectares (ha). An existing TransGrid easement runs in a north-easterly direction across the Site from the western boundary of Lot 3 DP 506925, through Lot 122 DP 753238, and exiting near the north-eastern corner of Lot 122 (Figure 2). This easement contains existing TransGrid 132kV powerlines on wooden pole structures connecting to the Wellington substation approximately 15km to the north-east of the Site.

The land is divided into 15 fenced paddocks currently used for agriculture, including cropping (e.g. wheat and lucerne) and grazing (Figure 4). It is proposed that grazing activities would continue on the land occupied by the solar farm. The Site has been almost entirely cleared of its original vegetation except for a few scattered paddock trees. Various plantings of eucalypts have been made on the property including a woodlot in the centre east, which will remain within the solar farm, and five narrow linear plantings two tree rows wide along fence lines, which are proposed to be removed (Figures 2 and 4). In addition, some of the scattered paddock trees have been planted historically. The remnant paddock trees and plantings comprise the only native vegetation on the Site.

Plates 1 to 18 illustrate the current condition of the vegetation across the Site according to the paddock numbering in Figure 4. The photos demonstrate that the whole property including two access laneways has been regularly cultivated, cropped and heavily grazed, and lacks remnants of native ground cover.



**Figure 4. Paddock Arrangement on the Development Site.**  
[Note the access laneways between paddocks 2/3 and 5/7 in the north and paddocks 9/11 and 13/14 in the south]



**Plate 1. Lucerne crop in Paddock 1.**



**Plate 2. Paddock 2 recently cultivated.**



**Plate 3. Lucerne crop in Paddock 3 and tree planting between Paddocks 2 and 3.**



**Plate 4. Lucerne crop in Paddock 4.**



**Plate 5. Fallow after wheat crop in Paddock 5.**



**Plate 6. Fallow after wheat crop in Paddock 6.**



**Plate 7. Lucerne crop in Paddock 7.**



**Plate 8. Lucerne crop in Paddock 8.**



**Plate 9. Stubble after wheat crop in Paddock 9.**



**Plate 10. Mature lucerne crop in Paddock 10.**



**Plate 11. Lucerne in Paddock 11.**



**Plate 12. Fallow after cropping in Paddock 12.**



**Plate 13. Drought affected wheat crop in Paddock 13.**



**Plate 14. Weed dominated lucerne in Paddock 14.**



**Plate 15. Weedy lucerne in Paddock 15.**



**Plate 16. Weed dominated ground cover in northern laneway.**



**Plate 17. Weed dominated ground cover in southern laneway.**



**Plate 18. Eucalypt planting between Paddocks 12 and 13.**

## 2 STAGE 1 – BIODIVERSITY ASSESSMENT

Stage 1 of the biodiversity assessment summarises the biodiversity values of the BDAR Footprint that are inputs into the Credit Calculator.

### 2.1 LANDSCAPE FEATURES

Landscape features relevant to the Project are described in this section and illustrated on Figures 5 (Site Map) and 6 (Location Map).

This Site is assessed using the site-based assessment module within BAMC. Accordingly, a 1.5 km buffer zone was used to assess the landscape around the development Site (Figure 6).

#### 2.1.1 Regional Setting

The Project is located approximately 10.5 km west south west of Wellington town centre in central western NSW (Figure 1), entirely within the following regions:

- the New South Wales South Western Slopes Bioregion and Upper Slopes Sub-region of the Interim Biogeographic Regionalisation for Australia (IBRA) (Thackway and Cresswell, 1995); and
- the Dubbo Regional LGA.

#### 2.1.2 Mitchell Landscapes

Details of the Mitchell Landscapes within the solar farm footprint are provided in Table 1 and shown on Figure 6. The footprint is predominantly within the Nangar Ranges Mitchell Landscape (OEH, 2018a) (Table 1).

**Table 1. Mitchell Landscapes in the BDAR Footprint**

Landscape Name	Percentage Cleared Estimate <sup>1</sup>	Area (ha)	Percent (%) of BDAR Footprint Covered by Landscape
Nangar Ranges	84	408.3	94.3
Macquarie Alluvial Plains	78	24.7	5.7

<sup>1</sup> Sourced from the 'Over-cleared Landscapes Database' within the BioNet Vegetation Classification Database (OEH, 2018b).

#### 2.1.3 Native Vegetation Extent

The Project is located in a highly cleared agricultural region. The 1.5 km buffer zone around the Project area encompasses 1,696.4 ha, of which only 50.3 ha (3.0%) is remnant native woodland (Figure 6). Within the development Site the only patches of native vegetation are the five linear plantings and two other small plantings which total 1.1 ha in area, or 0.23 percent of the Site area.

#### 2.1.4 Connectivity

No vegetation corridors exist within the Project area or immediate surrounds (Figure 6).



Figure 5. BAM Site Map of Subject Land.



Figure 6. BAM Location Map of Subject Land.

## 2.2 NATIVE VEGETATION

Native vegetation on the BDAR Footprint is described in this section based on site visits undertaken by FloraSearch on 29 November 2017 and 15 January 2018 (solar farm), and 8 May 2018 (intersection of Suntop Road and Renshaw – McGirr Way).

### 2.2.1 Plant Community Types

All that remains of the original pre-European tree cover on the solar farm Site are 28 remnant scattered paddock trees and remnant perimeter trees on the eastern boundary (Figure 7). From these it is possible to determine what were the likely original Plant Community Types (PCT) (BioNet, 2018a). The remnant paddock trees comprise;

- Fuzzy Box (*Eucalyptus conica*) – a clump of 3 trees in Paddock 1 (not to be removed).
- White Box (*Eucalyptus albens*) – 8 scattered trees on the higher parts of the Site.
- Kurrajong (*Brachychiton populneus*) – 2 trees.
- White Cypress Pine (*Callitris glaucophylla*) – 15 scattered trees in the south west corner of the Site in Paddocks 6, 9 and 13.

In addition, it was observed that the native trees remaining along the main access corridor just outside the western boundary of the Site and along Suntop Road are mainly Inland Grey Box (*Eucalyptus microcarpa*) with some White Box and Fuzzy Box. The above observations suggest that three PCTs are likely to have occurred on the Site prior to its clearance (Table 2) (BioNet, 2018a). All of these PCTs represent Threatened Ecological Communities (Table 2). However, no structurally or floristically representative remnants of these PCTs remain on the Site. Accordingly, it was not possible to conduct flora quadrat sampling to provide data for input to the BAMC.

The native vegetation in the proposed disturbance area at the intersection of Suntop Road and Renshaw – McGirr Way is a roadside remnant of the Box-Gum Woodland Endangered Ecological Community, dominated by Yellow Box (*Eucalyptus melliodora*) (Figure 8, Table 2). This vegetation was in moderate to good condition, was sampled with a single BAM flora quadrat and treated as a separate vegetation zone for input of data to the BAMC.

### 2.2.2 Streamlined Assessment Module

This section provides justification for using the streamlined assessment module of the BAM for this Project. The native vegetation on the Site comprises scattered remnant paddock trees and five linear plantings (1.18 ha) of native trees along fence lines, two small patches (0.07 ha) of plantings and a small area (0.04 ha) of Box-Gum Woodland at the intersection of Suntop Road and Renshaw – McGirr Way (Figures 7 and 8). The total area of the plantings is 1.29 ha, which is above the minimum threshold (1.0 ha) for application of the Biodiversity Offsets Scheme and below the 5 ha maximum area limit for application of the streamlined assessment module (BAM, Appendix 2 [OEH, 2017a]) on a site with a minimum Lot size of 40 ha. Accordingly, this report follows the requirements of the BAM streamlined assessment module (OEH, 2017a), which is applied in two parts;

- The streamlined assessment module for the on-site plantings and the Box-Gum Woodland (Suntop Road intersection), and
- the paddock tree module for;
  - 25 paddock trees that would be removed from the Site, and
  - up to 10 additional roadside trees that would be removed on Renshaw – McGirr Way to improve line of sight for motorists and to facilitate road and culvert widening (Figure 8).

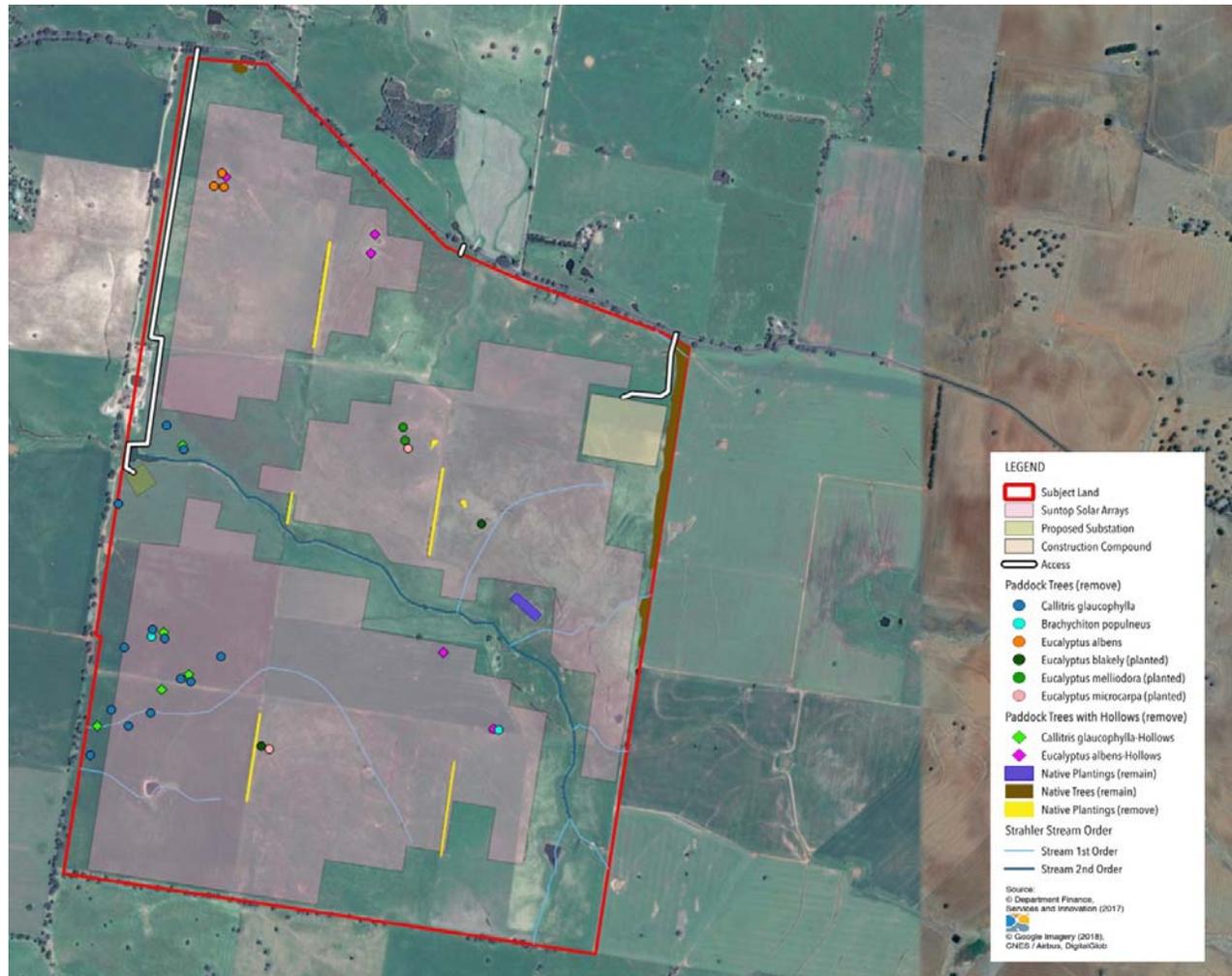


Figure 7. Native Vegetation on the Subject Land.



Figure 8. Flora Quadrat Site, Box-Gum Woodland EEC and Locations of Trees for Removal.

Table 2. Likely Pre-European Plant Community Types on the Development Site (BioNet, 2018a).

Vegetation Formation	Vegetation Class	PCT		Dominant tree species	Justification	Threatened Ecological Communities
		No.	Name			
Grassy Woodlands	Western Slopes Grassy Woodlands	201	Fuzzy Box Woodland on alluvial brown loam soils mainly in the NSW South Western Slopes Bioregion.	<i>Eucalyptus conica</i> , <i>E. microcarpa</i> <i>E. melliodora</i>	The north-western tip of the Site is mapped as part of the Macquarie Alluvial Plains Mitchell Landscape (OEH, 2018a), which is habitat for PCT201.	<i>Fuzzy Box Woodland on alluvial Soils of the South Western Slopes, Darling Riverine Plains and Brigalow Belt South Bioregions Endangered Ecological Community</i> (BC Act)
		267	White Box - White Cypress Pine - Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion.	<i>E. albens</i> <i>E. microcarpa</i> <i>Callitris glaucophylla</i>	The dominant three species of PCT 267 are the dominant trees remaining on and close to the Site, making PCT 267 a good fit for the lower parts of the site, excluding the north west corner.	<i>White Box Yellow Box Blakely's Red Gum Woodland Endangered Ecological Community</i> (BC Act)  and
		266	White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion.	<i>E. albens</i> <i>Brachychiton populneus</i> <i>E. blakelyi</i>	The higher parts of the Site appear to have been dominated originally by White Box with some Kurrajong.	<i>White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland Critically Endangered Ecological Community</i> (Environment Protection and Biodiversity Conservation Act 1999 [EPBC Act]).
		277	Blakelys Red Gum – Yellow Box grassy tall woodland in the NSW South Western Slopes Bioregion.	<i>E. melliodora</i> <i>E. blakelyi</i> <i>E. bridgesiana</i>	The native vegetation beside watercourses and on lower slopes at the intersection of Suntop Road and Renshaw – McGirr Way is dominated by <i>E. melliodora</i> with occasional <i>E. blakelyi</i> , best matching PCT277.	[This community is commonly known as Box-Gum Woodland.]

### 2.2.3 Plantings

The plantings comprise a total of 477 surviving trees within an area of 1.25 ha. Tree stem diameter at breast height was measured on 167 (35%) of these trees to determine the size distribution of trees across plantings (Table 3). Measurements were spread evenly across all plantings and tree species within them. The data in Table 3 were used to estimate the number of trees in each size class within a representative 1000m<sup>2</sup> for input to the BAMC (Table 3).

Other parameters for input to the BAMC were estimated qualitatively as per paragraph 5.3 of Appendix 2 of the BAM (OEH, 2017a) (Table 4). Owing to the small area of the plantings (1.25 ha), an overall estimate of the condition of the plantings was required for the equivalent of one set of quadrat data (Table 4). The estimates were based on field observations across all plantings.

**Table 3. Size Distribution of Planted Native Trees.**

Planting	Diameter at Breast Height (DBH)						
	< 5 cm	5 - 9 cm	10 – 19 cm	20 – 29 cm	30 – 49 cm	50 – 79 cm	80 + cm
1	0	1	6	5	6	1	1
2	0	1	11	4	3	4	2
3	0	2	11	16	1	1	0
4	0	2	11	15	3	0	0
5	0	1	12	19	7	1	0
<b>Total</b>	0	7	51	59	20	7	3
<b>Estimate / 1000m<sup>2</sup></b>	<b>0</b>	<b>2</b>	<b>15</b>	<b>17</b>	<b>6</b>	<b>2</b>	<b>1</b>

**Table 4. Estimates of Inputs to BAMC for Farm Plantings.**

BAM attribute (400m <sup>2</sup> )	No. of species	Foliage cover (%)
<i>Trees</i>	3	30
<i>Shrubs</i>	0	0
<i>Grasses / grass-like</i>	2	2
<i>Forbs</i>	2	0.2
<i>Ferns</i>	0	0
<i>Other</i>	0	0
<i>High Threat Weeds</i>	2	1
<i>Litter cover (1000m<sup>2</sup>)</i>	-	10
<i>Length of logs</i>	-	0 m

For the purposes of inputting the plantings data to the BAMC, it was assumed the plantings represent the likely original dominant PCT on the Site, i.e. PCT267, *White Box - White Cypress Pine - Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion*, which they were intended to replace. The resulting vegetation integrity statistics from the BAMC are given in Table 5.

**Table 5. Vegetation Integrity Statistics for Plantings (PCT267).**

Statistic	Score
Composition	22.4
Structure	33.1
Function	36.7
Vegetation Integrity	30.1

#### 2.2.4 Roadside Woodland on Renshaw – McGirr Way

One BAM flora quadrat was conducted in remnant Box-Gum Woodland in the disturbance area for road widening on Renshaw – McGirr Way (Tables 6 and 7).

**Table 6. Inputs to BAMC for Roadside Woodland.**

BAM attribute (400m <sup>2</sup> )	No. of species	Foliage cover (%)
<i>Trees</i>	1	40
<i>Shrubs</i>	2	0.3
<i>Grasses / grass-like</i>	4	20.6
<i>Forbs</i>	9	1.1
<i>Ferns</i>	1	0.1
<i>Other</i>	1	0.1
<i>High Threat Weeds</i>	1	3
<i>Litter cover (1000m<sup>2</sup>)</i>	-	95
<i>Length of logs</i>	-	4 m

**Table 7. Tree Size Distribution in Roadside Woodland.**

	Diameter at Breast Height (DBH) (cm)						
	< 5	5 - 9	10 – 19	20 – 29	30 – 49	50 – 79	80 +
<b>No. of trees</b>	8	2	8	2	3	0	1
<b>No. with hollows</b>	0	0	0	0	0	0	0

Because this BDAR utilises the streamlined assessment module of the BAM, the credit calculator is configured for only one PCT, the dominant PCT on the Site. For the purposes of inputting the roadside woodland data to the BAMC, it was assumed the woodland belonged to PCT267 instead of PCT277. This is justified on the grounds that the two PCTs belong to the same EEC; Box-Gum Woodland. The planting and woodland data were entered as two separate zones in the calculator. The vegetation integrity statistics for the roadside vegetation are given in Table 8.

**Table 8. Vegetation Integrity Statistics for the Roadside Box-Gum Woodland.**

Statistic	Score
Composition	72.5
Structure	81.0
Function	65.9
Vegetation Integrity	72.9

### 2.2.5 Paddock and Roadside Trees

The scattered remnant trees on the Site are treated as paddock trees for this assessment (Figure 7). Their diameters at breast height (DBH) and the presence of any hollows suitable for wildlife were recorded for input to the Paddock Tree module of the Streamlined Assessment (Appendix 1, BAM [OEH, 2017a]) (Table 9). Some very large remnant trees, probably dating to pre-European times, occur across the Site (Table 9) and around its perimeter. All but one of the remnant paddock trees exceed the lower limit (50 cm) for classification as large trees in PCT267.

In addition to native remnant trees, six isolated planted paddock trees were also recorded (Figure 7, Table 9). The origins of these trees were evident from the remains of tree guards and stakes left over from planting.

Up to ten trees would be removed from the south side of Renshaw – McGirr Way to improve line of sight for motorists to the Suntop Road intersection and as part of the road widening and upgrading works (Figure 8). Eight trees that lie within the road widening disturbance area of 0.04 ha are not considered here. The impact of the project on these trees is accounted for in the BAMC for vegetation clearance.

**Table 9. Paddock and Roadside Tree Sizes and Presence of Hollows.**

Species	Tree Diameter at Breast Height (cm) (number of trees)					
	≤ 20	21 – 50	51 - 90	91 - 130	131 - 170	Total
<b>Remnant native trees</b>						
<i>Brachychiton populneus</i>	-	-	1	-	1	2
<i>Callitris glaucophylla</i>	-	-	14	1	-	15
<i>Eucalyptus albens</i>	-	-	3	4	1	8
<b>Total</b>	<b>0</b>	<b>0</b>	<b>18</b>	<b>5</b>	<b>2</b>	<b>25</b>
No. with hollows	0	0	4	5	1	10
<b>Isolated planted trees</b>						
<i>Eucalyptus blakelyi</i>	2	1	1	-	-	4
<i>Eucalyptus melliodora</i>	-	1	-	-	-	1
<i>Eucalyptus microcarpa</i>	-	1	-	-	-	1
<b>Total</b>	<b>2</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>6</b>
No. with hollows	0	0	0	0	0	0
<b>Roadside trees</b>						
<i>Eucalyptus melliodora</i>	4	-	3	2	-	9
<i>Brachychiton populneus</i>	1	-	-	-	-	1
<b>Total</b>	<b>5</b>	<b>0</b>	<b>3</b>	<b>2</b>	<b>0</b>	<b>10</b>
No. with hollows	0	0	1	1	0	2
<b>TOTAL TREES</b>	<b>7</b>	<b>3</b>	<b>22</b>	<b>7</b>	<b>2</b>	<b>41</b>
<b>TOTAL with hollows</b>	<b>0</b>	<b>0</b>	<b>5</b>	<b>6</b>	<b>1</b>	<b>12</b>

### 2.2.6 High Threat, Priority and Nationally Significant Weeds

Three introduced flora species are considered to be High Threat Exotic weeds by OEH (2018g), Khaki Weed, Bathurst Burr and Saffron Thistle. No weeds listed as Priority Weeds for the Dubbo Regional LGA under the NSW *Biosecurity Act 2015* were identified by the survey (DPI, 2018). Similarly, no weeds listed as Weeds of National Significance by the Australian Weeds Committee of the Commonwealth Government ([www.weeds.org.au](http://www.weeds.org.au)) were identified.

## 2.3 THREATENED SPECIES

Threatened species relevant to the Project are identified in this section. The BAM recognises two categories of threatened species:

- ecosystem credit species (i.e. species predicted to be present based on the PCTs present on the Site); and/or
- species credit species (i.e. species that cannot be reliably predicted by PCTs) (OEH, 2017a).

Threatened species that are ecosystem credit species and/or species credit species are pre-determined in the Credit Calculator and *BioNet Threatened Species Profile Database* (OEH, 2018c).

### 2.3.1 Data Sources

Three data sources were used to compile lists of threatened flora and fauna that may potentially occur on the Site (Tables 10 and 11):

- BAM online calculator – Lists of ecosystem credit species and species credit species generated by the BAMC from the BioNet databases using inputs on IBRA subregion, Site location and vegetation integrity (OEH, 2018d).
- BioNet website – Searches of the NSW Atlas of Wildlife, NSW State Forests, Australian Museum and Royal Botanic Gardens Sydney databases (BioNet, 2018b). The search area comprised a 20 × 20 km square centred on the study area. This search returned a list of threatened species records from within the search area and shown on Figure 9.
- Commonwealth Department of the Environment and Energy (DoEE) website – Protected Matters Search Tool (PMST) (DoEE, 2018a). The search area comprised the same 20 × 20 km square as for the BioNet search. The PMST uses actual records and habitat modelling to return a list of 'protected matters' that are known or predicted to occur in the search area, including threatened species, migratory species, ecological communities, wetlands of international significance, and national and world heritage properties.

BAMC returned 16 ecosystem credit species, all fauna; and 14 species credit species, four flora and 10 fauna species (Tables 10 and 11). Four fauna species are dual ecosystem and credit species. All species returned by the BAMC require assessment within the calculator of the suitability of the habitat on the Site for them.

The BioNet database search returned records of one flora species, the Sandhill Spider Orchid (*Caladenia arenaria*) and one fauna species, the Glossy Black Cockatoo (*Calyptorhynchus lathamii*), close to the Site that were not identified by BAMC (Figure 9). The potential for habitat of these species to occur on the Site is also assessed in Tables 10 and 11.



Figure 9. Locations of Threatened Species within 10 km of the Subject Land.

Table 10. Threatened Flora Species Returned by Database Searches of the Surrounding Region.

Scientific Name	Common Name	Data Source			Conservation Status		Ecosystem OR Credit Species <sup>5</sup>	Likelihood to be on Study Area	Assessment of Likelihood
		BAMC <sup>2</sup>	BioNet <sup>3</sup>	PMST <sup>4</sup>	BC Act	EPBC Act			
<i>Acacia ausfeldii</i>	Ausfeld's Wattle	✓	-	-	V	-	Sp <sup>1</sup>	Nil	Generally confined to an area between Dubbo, Ulan and Mudgee, where it occurs on sandy soils in dry shrubby forests (OEH, 2018e). It is unlikely to have once occurred on the Site.
<i>Austrostipa wakoolica</i>	-	-	-	✓	E	E	Sp	Nil	Confined to the floodplains of the Lachlan, Murrumbidgee and Murray Rivers in central-western and south-western NSW (OEH, 2018e). It typically occurs on floodplain alluvial and stagnant alluvial soils, which do not occur on the Site.
<i>Caladenia arenaria</i>	Sandhill Spider Orchid		✓	-	E	E	Sp	Nil	Occurs in woodland with sandy soil, especially that dominated by White Cypress Pine ( <i>Callitris glaucophylla</i> ). There is a record of this species 5.7 km east of the Site in undisturbed Cypress Pine habitat in the Mt Arthur Reserve (Althofer and Harden, 1980, where recorded as <i>C. patersonii</i> ). Suitable habitat is absent from the Site.
<i>Commersonia procumbens</i> [syn. <i>Androcalva procumbens</i> ]	-	-	-	✓		V	Sp	Nil	Grows in sandy sites in <i>Eucalyptus dealbata</i> and <i>Eucalyptus sideroxylon</i> communities, <i>Melaleuca uncinata</i> scrub, under mallee eucalypts with a <i>Calytrix tetragona</i> understorey (OEH, 2018e). Also occurs in <i>Eucalyptus fibrosa</i> subsp. <i>nubila</i> , <i>Eucalyptus dealbata</i> , <i>Eucalyptus albens</i> and <i>Callitris glaucophylla</i> woodlands north of Dubbo. Habitats absent from Suntop.
<i>Diuris tricolor</i>	Pine Donkey Orchid	✓	-	-	V	-	Sp	Nil	The Pine Donkey Orchid grows in sclerophyll forest among grass, often with native Cypress Pine ( <i>Callitris</i> spp.). It is generally found in sandy soils, either on flats or small rises. The nearest record is at Geurie (BioNet, 2018b) at lower altitudes than the Site. It is unlikely to have occurred around Wellington on the upper slopes.

Scientific Name	Common Name	Data Source			Conservation Status		Ecosystem OR Credit Species <sup>5</sup>	Likelihood to be on Study Area	Assessment of Likelihood
		BAMC <sup>2</sup>	BioNet <sup>3</sup>	PMST <sup>4</sup>	BC Act	EPBC Act			
<i>Euphrasia arguta</i>	-	✓	-	✓	CE	CE	Sp	Nil	<i>Euphrasia arguta</i> has been recorded from grassy areas near rivers at elevations up to 700 m above sea level in central western NSW, and grassy forests or regrowth vegetation on the Northern Tablelands (DoEE, 2018b). Suitable habitat is lacking on the Site.
<i>Philothea ericifolia</i>	-	-	-	✓	-	V	Sp	Nil	<i>Philothea ericifolia</i> grows chiefly in dry sclerophyll forest and heath on damp sandy flats and in gullies. The species has been collected from open woodland, heathland, dry sandy creek beds and rocky ridge and cliff tops. Preferred soils have a sandy, gravelly or rocky component (DoEE, 2018b). The Site lacks suitable habitat for this species.
<i>Prasophyllum petilum</i>	-	-	-	✓	E	E	Sp	Nil	Grows in open sites in natural temperate grassland, grassy woodland and in grassy Box-Gum Woodland. Highly susceptible to grazing, being retained only at little-grazed travelling stock reserves and in cemeteries (OEH, 2018e). Habitat occurs on the Site is too disturbed for this species.
<i>Prasophyllum</i> sp. Wybong (Phelps ORG 5269)	-	-	-	✓	-	CE	-	Nil	<i>Prasophyllum</i> sp. Wybong (C. Phelps ORG 5269) is known from open eucalypt woodland and grassland in northern NSW, exclusively Box-Gum Woodlands (DoEE, 2018b). Suitable habitat is absent from the Site.
<i>Swainsona recta</i>	Small Purple-pea	✓	✓	✓	E	E	Sp	Nil	Before European settlement Small Purple-pea occurred in the grassy understorey of Box-Gum Woodlands and open-forests dominated by <i>Eucalyptus blakelyi</i> , <i>E. melliodora</i> , <i>E. rubida</i> and <i>E. goniocalyx</i> (OEH, 2018e). Populations remain in the Mt. Arthur Reserve, only 6 km north east of the Site, in colluvial and alluvial soils in the lower parts of the reserve. It is not known from cleared and heavily grazed habitats such as those on the Site.

Scientific Name	Common Name	Data Source			Conservation Status		Ecosystem OR Credit Species <sup>5</sup>	Likelihood to be on Study Area	Assessment of Likelihood
		BAMC <sup>2</sup>	BioNet <sup>3</sup>	PMST <sup>4</sup>	BC Act	EPBC Act			
<i>Swainsona sericea</i>	Silky Swainson-pea	✓	-	-	V	-	Sp	Nil	The Silky Swainson-pea was formerly a widespread, common species in Box-Gum Woodlands and is likely to have been common in the Wellington district (OEH, 2018e). However, the high degree of disturbance to the Site means it is highly unlikely to occur there now.
<i>Tylophora linearis</i>	-	-	-	✓	V	E	Sp	Nil	Grows in dry scrub and open forest. Recorded from low-altitude sedimentary flats in dry woodlands of <i>Eucalyptus fibrosa</i> , <i>Eucalyptus sideroxylon</i> , <i>Eucalyptus albens</i> , <i>Callitris endlicheri</i> , <i>Callitris glaucophylla</i> and <i>Allocasuarina lehmannii</i> (OEH, 2018e). On coarse-grained sediments. Distributed to the north of the study area from east of Boggabri, Pilliga Scrub, Peak Hill and Dubbo. Suitable habitat is absent from the Site.

<sup>1</sup> Sp=Species Credit Species

<sup>2</sup> Biodiversity Assessment Method Credit Calculator (OEH, 2018d)

<sup>3</sup> NSW Atlas of Wildlife (BioNet, 2018b)

<sup>4</sup> Protected Matters Search Tool (DoEE, 2018a)

<sup>5</sup> BioNet Threatened Species Profile Database (OEH, 2018c)

E Endangered.

CE Critically Endangered

V Vulnerable.

Table 11. Threatened Fauna Species Returned by Database Searches of the Surrounding Region.

Scientific Name	Common Name	Data Source			Conservation Status		Ecosystem and/or Credit Species <sup>5</sup>	Likelihood to be on Study Area	Assessment of Likelihood
		BAMC <sup>2</sup>	BioNet <sup>3</sup>	PMST <sup>4</sup>	BC Act	EPBC Act			
<i>Galaxias rostratus</i>	Flathead Galaxia	-	-	✓	CE <sup>6</sup>	CE	-	Nil	These fish species were all identified by the PMST and are covered by the <i>Fisheries Management Act 1994</i> in NSW. They occur in large permanent rivers with deep waterholes (DoEE, 2018b). No suitable permanent watercourses occur on or near the Site.
<i>Maccullochella macquariensis</i>	Trout Cod	-	-	✓	E <sup>6</sup>	E	-	Nil	
<i>Maccullochella peelii</i>	Murray Cod	-	-	✓	-	V	-	Nil	
<i>Macquaria australasica</i>	Macquarie Perch	-	-	✓	E <sup>6</sup>	E	-	Nil	
<i>Aprasia parapulchella</i>	Pink-tailed Worm-lizard	✓	-	✓	V	V	Sp <sup>1</sup>	Nil	The Pink-tailed Worm-lizard inhabits sloping, open woodland areas with predominantly native grassy ground layers, particularly those dominated by Kangaroo Grass ( <i>Themeda australis</i> ). Sites are typically well-drained, with rocky outcrops or scattered, partially-buried rocks (OEH, 2018e). Suitable habitat does not occur on the Site.
<i>Delma impar</i>	Striped Legless Lizard	-	-	✓	V	V	Sp	Nil	Found mainly on the Southern Tablelands and South West Slopes in Natural Temperate Grassland but may also occur in grasslands with a high exotic component. Occasionally found in open Box-Gum Woodland. Shelters beneath logs and/or rocks in winter (OEH, 2018e). Predicted as potentially occurring on the Site by PMST (DoEE, 2018b), but is not known north of Goulburn. Suitable habitat is lacking on the Site.
<i>Leipoa ocellata</i>	Mallee Fowl	-	-	✓	E	V	Ec <sup>1</sup>	Nil	The Mallee Fowl was predicted to potentially occur on the study area by the PMST. Mallee Fowl are found in semi-arid to arid shrublands and low woodlands, especially those dominated by mallee and/or acacias. A sandy substrate and abundance of leaf litter are required for breeding (Benshemesh, 2007). Suitable habitat is absent from the Site and surrounding regions.

Scientific Name	Common Name	Data Source			Conservation Status		Ecosystem and/or Credit Species <sup>5</sup>	Likelihood to be on Study Area	Assessment of Likelihood
		BAMC <sup>2</sup>	BioNet <sup>3</sup>	PMST <sup>4</sup>	BC Act	EPBC Act			
<i>Haliaeetus leucogaster</i>	White-bellied Sea Eagle	✓	-	-	V	-	Sp	Nil	Habitats are characterised by the presence of large areas of open water including larger rivers, swamps, lakes, and the sea. Breeding habitat consists of mature tall open forest, open forest, tall woodland, and swamp sclerophyll forest close to foraging habitat. Prime foraging habitat is lacking close to the site, as are potential nest trees.
<i>Botaurus poiciloptilus</i>	Australasian Bittern	-	-	✓	E	E	Ec	Nil	Favours permanent freshwater wetlands with tall, dense vegetation, particularly <i>Typha</i> spp. and <i>Eleocharis</i> spp. (OEH, 2018e). Suitable habitat is absent from the Site.
<i>Rostratula australis</i>	Australian Painted Snipe	-	-	✓	E	V	Ec	Nil	Australian Painted Snipe inhabits freshwater swamps and marshes (Blakers <i>et al.</i> , 1984). Suitable habitat is absent from the study area.
<i>Calidris ferruginea</i>	Curlew Sandpiper	-	-	✓	E	CE	Ec/Sp	Nil	Forages mainly on coastal estuarine mudflats, but also in inland lakes and lagoons with extensive shallows (OEH, 2018e). Suitable habitat is absent from the Study Area.
<i>Numenius madagascariensis</i>	Eastern Curlew	-	-	✓	-	CE	Ec/Sp	Nil	The Eastern Curlew has a primarily coastal distribution on mudflats in estuaries. The species is found in all states, particularly the north, east, and south-east regions including Tasmania (DoEE, 2017b). Eastern curlews are rarely recorded in inland wetlands, which in any event are absent from the Study Area.
<i>Calyptorhynchus lathamii</i>	Glossy Black Cockatoo	-	✓	-	V	-	Ec/Sp	Nil	Feeds almost exclusively on the seeds of several species of she-oak ( <i>Casuarina</i> and <i>Allocasuarina</i> species), shredding the cones with the massive bill (OEH, 2018e). Casuarinaceae are absent from the Site.
<i>Glossopsitta pusilla</i>	Little Lorikeet	✓	-	-	V	-	Ec	Low	The Little Lorikeet is widespread on the coast, tablelands and western slopes of NSW, where it is usually encountered in larger bushland remnants (BioNet, 2018b). It is a nomadic species that may occasionally occur on the Site when woodland eucalypts are in flower.

Scientific Name	Common Name	Data Source			Conservation Status		Ecosystem and/or Credit Species <sup>5</sup>	Likelihood to be on Study Area	Assessment of Likelihood
		BAMC <sup>2</sup>	BioNet <sup>3</sup>	PMST <sup>4</sup>	BC Act	EPBC Act			
<i>Lathamus discolor</i>	Swift Parrot	✓	-	✓	E	CE	Ec/Sp	Low	The Swift Parrot is a migratory species that breeds in Tasmania and winters on the mainland, where it feeds on flowering eucalypts (OEH, 2018e). On the western slopes Swift Parrots utilise Mugga Ironbark and White Box trees as nectar sources and Grey Box for lerp and scale insects (Saunders and Tzaros, 2011). Favoured winter flowering eucalypts occur on and near the Site.
<i>Polytelis swainsonii</i>	Superb Parrot	✓	✓	✓	V	V	Sp	Nil	The Superb Parrot occurs in tall grassy Box-Gum Woodlands and forests on and west of the Tablelands (Blakers <i>et al.</i> , 1984). There are several records of the species close to Wellington (BioNet, 2018b). Box Woodland and potentially suitable breeding and/or feeding habitat with large old growth trees having hollow limbs is present on the study area. However, the high degree of disturbance of the Site, especially the ground cover, is likely to deter this species.
<i>Climacteris picumnus victoriae</i>	Brown Treecreeper (eastern subspecies)	✓	-	-	V	-	Ec	Nil	The Eastern subspecies of the Brown Treecreeper is widespread through much of NSW avoiding only tall wet forests and alpine regions (BioNet, 2018b) There are multiple records close to Molong (BioNet, 2018b). It favours grassy woodlands with rough-barked trees at close to natural densities, sparse shrub cover and fallen timber on the ground (OEH, 2018e). Habitat in the study areas is considered to be unsuitable.
<i>Pomatostomus temporalis temporalis</i>	Grey-crowned Babbler (eastern subspecies)	✓	-	-	V	-	Ec	Nil	The eastern sub-species of the Grey-crowned Babbler occurs in the Hunter Valley, on the western slopes of the Great Dividing Range, and on the western plains reaching as far as Louth and Balranald. It inhabits open Box Woodlands on the slopes. The study area is at the eastern limits of the known distribution of the species on the upper western slopes (BioNet, 2018e) and the habitat is too disturbed to support it.
<i>Chthonicola sagittata</i>	Speckled Warbler	✓	-	-	V	-	Ec	Nil	A sedentary species of natural relatively undisturbed open woodland on rocky ridges or in gullies. Recorded sparsely but widely in the surrounding region in larger blocks of remnant woodland (OEH, 2018e; BioNet, 2018b). It has been recorded nearby in the Mt. Arthur Reserve but is considered highly unlikely to utilise the Site, which is too highly disturbed.

Scientific Name	Common Name	Data Source			Conservation Status		Ecosystem and/or Credit Species <sup>5</sup>	Likelihood to be on Study Area	Assessment of Likelihood
		BAMC <sup>2</sup>	BioNet <sup>3</sup>	PMST <sup>4</sup>	BC Act	EPBC Act			
<i>Anthochaera phrygia</i>	Regent Honeyeater	✓	-	✓	E	E	Ec/Sp	Low	A nomadic/migratory nectar-dependent species found on flowering eucalypts, which has been recorded rarely in the region around the Site (BioNet, 2018b). It has potential to occasionally visit the study area when Eucalypts are flowering, especially White Box.
<i>Grantiella picta</i>	Painted Honeyeater	-	-	✓	V	V	Ec	Nil	Inhabits Boree/ Weeping Myall ( <i>Acacia pendula</i> ), Brigalow ( <i>A. harpophylla</i> ), Box-Gum Woodlands and Box-Ironbark Forests (OEH, 2018e). A specialist feeder on the fruits of mistletoes growing on woodland eucalypts and acacias. Box Woodland is present, but mistletoes are scarce on the Site. There are very few records on the Central Western Slopes (BioNet, 2018a).
<i>Artamus cyanopterus cyanopterus</i>	Dusky Woodswallow	✓	✓	-	V	-	Ec	Nil	Found in larger blocks of woodland and dry open sclerophyll forests, usually dominated by eucalypts (Scientific Committee, 2017). Also recorded in shrublands, heathlands and regenerating forests. The understorey is typically open with sparse eucalypt saplings, acacias and other shrubs. The habitat on the Site is too highly disturbed for this species.
<i>Melanodryas cucullata cucullata</i>	Hooded Robin (south eastern subspecies)	✓	-	-	V	-	Ec	Nil	The south-eastern subspecies of the Hooded Robin is found throughout much of inland NSW, with the exception of the extreme north-west. It prefers lightly wooded country, usually open eucalypt woodland, acacia scrub and mallee, often in or near clearings or open areas and requires structurally diverse habitats with mature eucalypts, saplings, some small shrubs and a ground layer of moderately tall native grasses. There are a few records in the Wellington area (BioNet, 2018e). Site habitats are too disturbed to support this species.
<i>Petroica boodang</i>	Scarlet Robin	✓	-	-	V	-	Ec	Low	Breeds in high altitude eucalypt forest with an open understorey (Blakers <i>et al.</i> , 1984). Juveniles disperse to more open country in autumn. There are relatively few records on the western slopes and one close to Wellington (BioNet, 2018e). It may occasionally occur on the Site in autumn and winter.

Scientific Name	Common Name	Data Source			Conservation Status		Ecosystem and/or Credit Species <sup>5</sup>	Likelihood to be on Study Area	Assessment of Likelihood
		BAMC <sup>2</sup>	BioNet <sup>3</sup>	PMST <sup>4</sup>	BC Act	EPBC Act			
<i>Petroica phoenicea</i>	Flame Robin	✓	-	-	V	-	Ec	Low	The Flame Robin breeds in high altitude forests and disperses to lower more open habitats in winter. It has been recorded sparingly on the western slopes with few records near Wellington (BioNet, 2018a). It may occasionally occur on the Site.
<i>Stagonopleura guttata</i>	Diamond Firetail	✓	-	-	V	-	Ec	Nil	Widespread in open forest and woodland mostly on the inland side of the Great Dividing Range in eastern NSW (Blakers <i>et al.</i> , 1984). Recorded widely in the region around Wellington (BioNet, 2018b). Favours open grassy woodlands. Habitat on the Site lacks the native grasses required by this species.
<i>Dasyurus maculatus</i>	Spotted-tailed Quoll	✓	✓	✓	V	E	Ec	Nil	Generally confined to areas of native forest and woodland where it nests in rock caves or hollow logs (Edgar, 1983). Hollow logs and caves are absent from the Site.
<i>Phascogale tapoatafa</i>	Brush-tailed Phascogale	✓	-	-	V	-	Sp	Nil	Prefer dry sclerophyll open forest with sparse groundcover of herbs, grasses, shrubs or leaf litter. Agile climber foraging preferentially in rough barked trees of 25 cm DBH or greater. Feeds mostly on arthropods but will also eat other invertebrates, nectar and sometimes small vertebrates (OEH, 2018e). Suitable habitat is lacking on the Site.
<i>Phascolarctos cinereus</i>	Koala	✓	-	✓	V	V	Ec/Sp	Nil	Koalas are widespread in eastern NSW. However, there are only a few records near Wellington with scattered records further east in the timbered country around Burrendong Dam and south west in the Curumbenya Ranges (BioNet, 2018b). There is no known population recorded from the vicinity of the Site.
<i>Petaurus norfolcensis</i>	Squirrel Glider	✓	-	-	V	-	Sp	Nil	Inhabits mature or old growth Box, Box-Ironbark woodlands and River Red Gum forest west of the Great Dividing Range and Blackbutt-Bloodwood forest with heath understorey in coastal areas (OEH, 2018e). Prefers mixed species stands with a shrub or Acacia midstorey. Requires abundant tree hollows for refuge and nest sites. The remnant trees on the Site are too scattered, the ground cover is too disturbed and a suitable mid-storey is lacking for this species.

Scientific Name	Common Name	Data Source			Conservation Status		Ecosystem and/or Credit Species <sup>5</sup>	Likelihood to be on Study Area	Assessment of Likelihood
		BAMC <sup>2</sup>	BioNet <sup>3</sup>	PMST <sup>4</sup>	BC Act	EPBC Act			
<i>Petauroides volans</i>	Greater Glider	-	-	✓	V	V	Sp	Nil	There is one record for the Greater Glider south of Wellington BioNet, 2018b). It is found in highest abundance in taller, montane, moist eucalypt forests with relatively old trees and abundant hollows (DoEE, 2018a). The Greater Glider favours forests with a diversity of eucalypt species. The study area lacks montane forest and abundant hollows and is unsuitable for this species.
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	✓	-	✓	V	V	Ec/Sp	Nil	The Grey-headed Flying Fox mostly occurs on the eastern side of the Great Dividing Range and is rarely recorded on the western slopes (OEH, 2018e). There is one record in BioNet (2018b) of a temporary roost along the Bell River at Wellington in 2012. There is a very low possibility this species would utilise the study area on rare occasions.
<i>Nyctophilus corbeni</i>	Corben's Long-eared Bat	-	-	✓	V	V	Ec	Nil	Corben's Long-eared Bat was predicted to potentially occur on the study area by the PMST. It is predominantly a western species in NSW, the nearest records to the study area being in the Hervey Nangar Ranges and Goonoo SCA (BioNet, 2018b) which are at lower altitudes than the study area. It has not been recorded on the upper slopes and tablelands.
<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	-	-	✓	V	V	Sp	Nil	Large-eared pied Bat is widespread on the Central Coast and Tablelands and reaches its western distributional limit near Wellington (BioNet, 2018b). It roosts in caves, mine tunnels and the abandoned nests of Fairy Martins. The Large-eared Pied Bat forages over areas of continuous forest habitat (Greg Richards and Associates, 2000, 2005). The vegetation on the Site is likely to be too fragmented for this species.

<sup>1</sup> Ec=Ecosystem Credit Species; Sp=Species Credit Species

<sup>2</sup> Biodiversity Assessment Method Credit Calculator (OEH, 2018d)

<sup>3</sup> NSW Atlas of Wildlife (BioNet, 2018b)

<sup>4</sup> Protected Matters Search Tool (DoEE, 2018a)

<sup>5</sup> BioNet Threatened Species Profile Database (OEH, 2018c)

<sup>6</sup> NSW Fisheries Management Act 1994.

E Endangered; CE Critically Endangered; V Vulnerable.

The PMST search returned 8 potentially occurring flora species and 21 fauna species. Assessment of these species is required to determine whether there is any obligation to refer the Project to the Commonwealth Department of the Environment and Energy (DoEE) under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The total numbers of potentially occurring threatened species identified by the searches are 12 flora and 34 fauna species.

### **2.3.2 Likelihood of Threatened Species Occurrence on the Site**

BAMC allows the assessor to include or exclude from further consideration the candidate threatened species selected by the calculator on the basis of the presence or absence of suitable habitat, and other constraints, on the BDAR footprint. The likelihood of occurrence of each candidate species has been assessed in Tables 10 and 11 based on distribution records in the NSW Atlas of Wildlife (BioNet, 2018b), and information in both the *Threatened Biodiversity Profile Database* (OEH, 2018e) and referenced scientific publications. Knowledge of the Site is based on three days of site visits and surveys by the assessor (29 November 2017, 15 January 2018 and 8 May 2018).

### **2.3.3 Habitat Features of the Site**

In assessing the suitability of the habitat on the Site for threatened biodiversity, the following attributes of the Site were considered;

- The native vegetation being assessed comprises very small scattered plantings of native eucalypts, some, but not all, of which are native to the location.
- The choice of PCT267 as a description of the vegetation was made to enable the BAMC to run. The plantings clearly are not remnants of PCT267, which is considered likely to have been the dominant PCT on the Site pre-European settlement.
- The plantings individually cover very small areas from 0.02 ha to 0.4 ha and, as such, are highly unlikely to support a population of a threatened species. Their values for threatened species are most likely as stepping stones for fauna moving through the landscape, or for short term foraging of wide ranging nomadic species.
- The plantings all have very large perimeter to area ratios, being long and narrow, mostly two trees wide.
- All the plantings lack a mid-storey, the ground cover is very sparse or absent and comprises mainly exotic species. The surrounds of the plantings are entirely cultivation paddocks supporting wheat or lucerne crops.

### 2.3.4 Ecosystem Credit Species

No flora species returned by BAMC were ecosystem credit species. Of the 16 ecosystem credit fauna species listed by BAMC, five are considered to have potential foraging habitat on the Site (Table 12).

**Table 12. Ecosystem Credit Fauna Potentially Able to Utilise the Site.**

Common Name	Scientific Name	Likelihood of Occurrence
Little Lorikeet	<i>Glossopsitta pulchella</i>	Low
Swift Parrot	<i>Lathamus discolor</i>	Low
Regent Honeyeater	<i>Anthochaera phrygia</i>	Low
Scarlet Robin	<i>Petroica boodang</i>	Low
Flame Robin	<i>Petroica phoenicea</i>	Low

The species in Table 12 are only likely to utilise the site rarely to occasionally as nomadic foraging visitors.

### 2.3.5 Habitat Features for Species Credit Species

The BAMC identifies specific habitat features essential to particular species credit species and the BAM (OEH, 2017a) requires the assessor to determine if those habitat features occur on the site. The BDAR footprint lacks habitat features identified in the *BioNet Threatened Biodiversity Profile Database* (OEH, 2018c) that are critical for many threatened species, including:

- Burrows
- Caves
- Cliffs
- Claypans
- Dunes
- Epiphytes
- Escarpments
- Rocky areas
- Fallen and standing dead timber
- Swamps
- Termite mounds

Important specific habitat features that are present on the Site are:

- Hollow-bearing trees (totalling 10 scattered paddock trees [Table 9, Figure 7])
- Semi-permanent / ephemeral wet areas (including first and second order streams [Figure 5])
- Waterbodies (including one small farm dam per paddock, varying between 0.2 and 0.5 ha in size)

Given the attributes of the native vegetation (section 2.3.3) and the specific site characteristics (section 2.3.5), very few of the candidate threatened species are likely to utilise the area and those that do would utilise it rarely. This is reflected in the very low number of candidate species in Tables 10 and 11 that are considered likely to utilise the Site.

### 2.3.6 Species Credit Species

The five candidate threatened flora species identified by BAMC are all species credit species and none are considered to have any likelihood of occurring on the Site (Table 10). Accordingly, all have been excluded from further consideration in BAMC.

Only two of the threatened species credit fauna species are considered to have some likelihood of utilising the site, the Little Lorikeet and the Regent Honeyeater (Table 11). However, neither is likely to breed on the Site and are therefore excluded from further consideration as species credit species but remain as ecosystem credit species. Seven other threatened species credit fauna species have also been excluded for further assessment owing to lack of suitable habitat on the Site (Table 11).

### 2.3.7 Targeted Surveys for Threatened Species

The BAM (OEH, 2017a) requires targeted surveys only for threatened species that are species credit species because ecosystem credit species are predicted to occur based solely on habitat.

All candidate threatened flora listed by BAMC are species credit species, therefore, targeted surveys may be required. However, the assessment applied in Table 10 determined that habitat does not exist on the Site for any of these species so that survey and further consideration in the calculator is unnecessary.

Of the candidate threatened species credit fauna species listed by BAMC, two, the Critically Endangered Regent Honeyeater (*Anthochaera phrygia*) and the Vulnerable Little Lorikeet (*Glossopsitta pusilla*), are considered to have a low probability of utilising the Site. Both are nomadic species that may seek out flowering eucalypts to feed on nectar and may occasionally utilise the Site during a high nectar flow event. Neither species would be able to breed on the Site. Accordingly, they are not regarded as species credit species for this assessment and do not require targeted surveys.

### 2.3.8 Threatened Species Listed under the EPBC Act

Two fauna species listed as Critically Endangered under the EPBC Act are considered to have a low probability of utilising the Site; the Swift Parrot and the Regent Honeyeater (Table 10). Both are nomadic species that are only likely to use the Site occasionally, if at all, for foraging when eucalypts are in flower. The Site is unsuitable for breeding by the Regent Honeyeater and the Swift Parrot is a winter migrant to the mainland, breeding only in Tasmania. Potential food resources on the Site are quite limited, being restricted to eight isolated mature White Box trees and plantings of mixed eucalypts. These trees are unlikely to be attractive to either species given their isolation and the preference of both birds for intact woodland and forest habitats. Accordingly, the loss of these trees is highly unlikely to result in a significant adverse impact on either species and referral of the Project to the DoEE is not required.

### 2.3.9 SEPP 44

NSW SEPP 44 aims to protect habitat utilised by the Koala, *Phascolarctos cinereus*, which is known to occur sparsely on the Central West Slopes, mainly in forested habitats (BioNet, 2018b). Three of the remnant eucalypt species on and around the Subject Land are recognised as secondary Koala food trees (OEH, 2018h), viz. Inland Grey Box, Fuzzy Box and White Box. The last of these is listed as a Koala feed tree in Schedule 2 of SEPP 44. Accordingly, there is a requirement under SEPP 44 for consideration of the Site as potential Koala habitat. The Site does not have an extant Koala population (Biosphere Environmental Consultants, 2018). Therefore, it does not include 'core' Koala habitat and a SEPP 44 plan of management is not required.

### **3 STAGE 2 – IMPACT ASSESSMENT**

Stage 2 involves assessing the potential direct and indirect impacts on biodiversity, describing impact avoidance and mitigation measures and determining the offset requirements.

#### **3.1 MEASURES TO AVOID AND MINIMISE IMPACTS**

Measures to avoid and minimise Project impacts on biodiversity are summarised in this section and Table 13.

##### **3.1.1 Impact Avoidance**

Impact avoidance measures that would be implemented for the Project include;

- Protection measures to avoid damage to discontinuous patches of mature native perimeter trees on all boundaries of the Site.
- Avoidance and protection of the block of planted native eucalypts in Paddock 12 (Figure 7).
- Retention and avoidance of a clump of three Fuzzy Box trees within the northern boundary of Paddock 1.

##### **3.1.2 Vegetation Management Plan (VMP)**

A Vegetation Management Plan (VMP) will be prepared to establish measures that will:

- ensure that harm is minimised to wildlife that may be inhabiting hollows in the ten hollow-bearing trees that are proposed for removal. This will include timing of tree removal outside the nesting season of birds and mammals, i.e. autumn/winter, and supervision of the clearance by a qualified animal carer;
- protect the mature eucalypt trees around the perimeter of the site during the construction of the solar farm;
- enhance the habitat values of the perimeter trees through the establishment of vegetation buffer zones; and
- replace removed trees by selective replanting in the buffer zones around the Site.

##### **3.1.3 Weed Management Strategy**

A weed management strategy will be developed to prevent unwanted plants from becoming established in and around the solar farm. Several weed control measures will be employed, including regular site inspections, communication with lessees and authorities and annual control of weeds.

##### **3.1.4 Animal Pest Management and Monitoring**

A number of animal pest management and monitoring procedures would be established, including the following:

- the maintenance of a clean, rubbish-free environment in order to discourage scavenging and reduce the potential for colonisation by non-endemic fauna (e.g. introduced rodents, predators and birds);
- monitoring for feral animals (including pigs, foxes, dogs, rabbits) every two years;
- undertaking pest animal control where necessary;
- domestic pets prohibited in the solar farm; and
- employees and contractors not permitted to encourage fauna through feeding.

### 3.1.5 Rehabilitation

At the completion of the life of the solar farm after 25 years, the site will either be refurbished or be dismantled and rehabilitated to arable agricultural land.

### 3.1.6 Summary of Avoidance and Mitigation Actions

Table 13 summarises avoidance and mitigation actions with expected outcomes, timing and management responsibility.

**Table 13. Avoidance and Minimisation Measures, Responsibility and Timing.**

Action	Outcome	Timing	Responsibility
<b>During Construction</b>			
1. Place barriers to protect remnant perimeter trees, planting in Paddock 12 and Fuzzy Box clump in Paddock 1 2. Inform all employees and contractors during inductions of trees not to be damaged.	No damage to trees earmarked for protection and retention.	Throughout construction phase.	Site manager
Removal of hollow-bearing paddock trees supervised by trained wildlife carer.	Harm to hollow-dwelling wildlife minimised during tree falling. Injured wildlife cared for and recovered. Displaced wildlife released into appropriate habitat nearby.	During paddock clearing operations, which should be conducted in the non-breeding season (autumn and winter).	Environmental manager or site manager.
<b>During Solar Farm Operation</b>			
Preparation of a Vegetation Management Plan.	Long term vegetation management objectives achieved.	Within 12 months of approval.	Environmental manager.
Enhancement plantings	Biodiversity values of protected patches of remnant trees improved.	Within first two years of operation.	Environmental manager
Weed management	Priority Weeds, Weeds of National Significance and High Threat Exotic weeds controlled.	Annual inspections and control as required.	Environmental manager
Pest Animal Management: Monitoring and control, Maintain site cleanliness	Pest animals, especially rodents, foxes, rabbits, wild dogs, feral cats and pigs controlled.	Every two years, or as needed.	Environmental manager / site manager.
Domestic pets prohibited. Staff and contractors informed during inductions.	No harassment of wildlife or livestock.	Ongoing	Site manager.
<b>Site closure</b>			
Preparation of a site rehabilitation plan	All solar farm infrastructure removed. Land left in a suitable state for resumption of farming.	At least two years prior to shut down	Site manager / environmental manager.

## 3.2 SUMMARY OF PROJECT IMPACTS ON BIODIVERSITY

### 3.2.1 Serious and Irreversible Impacts

No threatened ecological communities, populations, flora or fauna species meet the criteria for Serious and Irreversible Impacts as a result of the Project (OEH, 2018f) (sections 2.2 and 2.3).

### 3.2.2 Vegetation Clearance Requiring Offsetting

The following native vegetation on the Site would be impacted adversely by the Project;

- Loss of 1.25 ha of eucalypt plantings which are assumed to represent PCT267 for the purposes of running BAMC.
- Loss of 0.04 ha of Box-Gum Woodland EEC beside Renshaw – McGirr Way.
- Loss of 25 remnant paddock trees, 6 isolated planted native trees and up to 10 roadside trees.

### 3.2.3 Vegetation Clearance Not Requiring Assessment or Offsetting

All other vegetation on the site comprises mainly planted crops and some exotic-dominated ground cover in laneways and on paddock margins and does not require assessment or offsetting.

### 3.2.4 Species Credit Species

No impacts on species credit species are expected.

### 3.2.5 Cumulative Impacts

The cumulative impacts of the project on remnant native vegetation loss are negligible whether remnant woodland or plantings of native windbreak trees are considered (Table 14).

**Table 14. Cumulative Losses of Native Vegetation in Affected Mitchell Landscapes.**

Mitchell Landscape	Area of Landscape (ha)	Percent Cleared	Project Clearance (ha)	Additional Clearance (%)
Nangar Ranges	178,920	84	0	0
Macquarie Alluvial Plains	348,198	78	0.04 (remnant woodland) 1.25 (plantings)	$0.1 \times 10^{-4}$ $0.4 \times 10^{-3}$

## 3.3 BIODIVERSITY CREDIT REPORT

### 3.3.1 BAM Assessment Number

The Assessment Identification Number within the BAM online calculator is 00010097/BAAS180848/18/00010106.

### 3.3.2 Credits for Removal of Plantings

The biodiversity credit report output from the BAMC for clearance of the blocks of planted trees is provided at Attachment 2. The credit report indicates that the total area of native plantings to be removed from the Site and the roadside of Renshaw – McGirr Way is valued at 20 credits.

### 3.3.3 Credits for Paddock Tree Removal

The number of native paddock trees on the Site is summarised by species, size (DBH) and the presence of hollows in Table 6. The locations of the trees are shown on Figures 7 and 8. Table 15 presents this data in the form required for use in the *Streamlined Assessment Module – Clearing of Paddock Trees* in the BAM (Appendix 1, OEH [2017a]), which values the paddock trees at 27.75 credits.

**Table 15. Paddock Trees Assigned to Classes**

	<b>Class 1</b>	<b>Class 2</b>	<b>Class 3</b>
Size range	≤20cm DBH	≥20 cm & ≤50cm DBH	≥50cm DBH
No. of trees without hollows	7	3	19
No. of trees with hollows	0	0	12
No. of ecosystem credits <sup>1</sup>	0	1.5	26.25

<sup>1</sup> Calculated according to Table 12, Appendix 1 of the BAM (OEH, 2017a).

The most likely PCT to which the remnant paddock trees formerly belonged is PCT267; *White Box - White Cypress Pine - Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion* (Table 2). This PCT is also assumed for the farm plantings, the roadside woodland and isolated trees on Renshaw – McGirr Way. Accordingly, the remnant paddock trees, farm plantings, roadside woodland and isolated roadside trees are valued at the same rate per credit.

### 3.3.4 Credit summary

Table 16 summarises the combined credit liability for clearance of the native plantings, roadside woodland, remnant paddock trees and isolated roadside trees.

**Table 16. Combined Biodiversity Credits Summary.**

<b>IBRA sub-region</b>	<b>PCT common name</b>	<b>No. of ecosystem credits</b>
<b>Plantings</b>		
Upper Slopes	<i>White Box - White Cypress Pine - Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion</i>	20
<b>Paddock trees</b>		
Upper Slopes	<i>White Box - White Cypress Pine - Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion</i>	27.75
<b>Total credits</b>		47.75

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ATTACHMENT 1

Fauna Survey and Assessment Report

(Biosphere Environmental Consultants Pty. Ltd.)

## Executive Summary

Suntop Solar Farm propose to construct and operate a 200 megawatt (MW) photovoltaic solar (PV) farm (the "Proposal"). The Proposal would be located at 909 Suntop Road, Suntop, NSW, 2820 and contained within Lot 1-2-3 DP 506925, Lot 122 DP 753238 and Lot 90 DP 657805 (the "Site"). The Site is approximately 517 hectares and is currently used for agriculture, specifically cropping. The solar farm would occupy approximately 472 hectares (the "development footprint") out of the 517 hectares (equivalent to approximately 91%) with the remaining land retaining its existing agricultural use.

The construction of the Proposal is estimated to consist of up to 550,000 PV panels which will be installed on a single axis tracker system across the Site. The single axis tracker system option would consist of groups of east-west facing PV modules tilted at +/- 60° angle (each approximately 2m x 1m in area) on mounting structures approximately 4m in height and in rows approximately 11m apart. The mounting structure would be piled steel posts that would extend between 1.6m to 4m below ground depending on geological conditions. The maximum height of panels during tracking movement is approximately 4m.

Associated infrastructure to support the solar farm will include the upgrading of access roads, the construction of a sub-station and power lines to the main electricity grid.

This report presents the results of a fauna assessment of the proposed site. The study involved a desktop assessment and field surveys of the solar farm site and the remainder of the property. It also includes database searches for records of threatened fauna. The current fauna survey included targeted searches for threatened fauna species that could potentially occur on the site and their habitats.

Two broad fauna habitat types were recorded within the site;

- isolated Grey Box (*Eucalyptus microcarpa*) trees were present around the perimeter of the site. These trees could have once been part of a Grey Box Woodland community but no trace remains of the native shrubs and associated vegetation that is normally associated with this community;
- narrow, linear tree plantations comprising an assortment of eucalypts (local and non-endemic species), and
- cleared land with scattered trees. The majority of the project area has been previously cleared for agricultural purposes.

A search of the NSW Wildlife Atlas (26 July 2017) identified 3 listed threatened ecological communities and 3 listed threatened species within 10 km of the Site. A search of the EPBC Act Protected Matters (10 July 2017) identified 2 listed

threatened ecological communities, 27 listed threatened species and 10 migratory species within 10km of the Site.

The EPBC Protected Matters search also identified 16 listed marine species and 29 invasive species.

A fauna assessment of the site was conducted in November 2017 and none of the listed threatened species were found on site. The tree patches around the boundary of the project area could provide seasonal habitat for some of the flying threatened species, including the Regent Honeyeater, Swift Parrot, Painted Honeyeater, Corben's Long-eared Bat and the Grey-headed Flying Fox. The isolated trees inside the project area were too isolated and in poor condition because of their isolation and offered little habitat to these species. The tree plantations on site contained mixed species but were too young to provide hollows or other roosting features for the threatened fauna.

In addition, the surrounds to Dam 5 may provide seasonal habitat for Curlew Sandpipers and Eastern Curlews.

Several mature Western Grey Box (*Eucalyptus microcarpa*) trees occur around the perimeter of the site. This species are regarded as secondary food trees for koalas (OEH 2017a). No evidence was found of koalas in the trees and it appears that the trees are too remote from other koala habitat areas that koalas would be unable to reach them. In addition, the remnant tree patches are quite small, highly exposed and totally surrounded by cleared paddocks. A linear plantation of Yellow Box *E. melliodora* occurs on the site (between fields 2 and 3) but these trees are still young, lack hollows or cavities that could be used by roosting animals but may occasionally flower. This stand will be lost as part of the development of the solar farm.

The main type of impact on fauna that could occur as a result of the Proposal include damage to threatened waterbird potential habitat near Dam 5 and damage to some of the Western Grey Box as a result of vehicle movements about the site. All of the other land to be used for the solar farm is land that has been cleared for agriculture and is devoid of woodland or native grasslands.

The following mitigation measures will be implemented during the preparation of the land for the solar farm:

- tree protection measures will be put in place to conserve the trees around the perimeter of the site;
- enhancement of buffer zones around the perimeter of the site that includes additional planting of replacement trees for those lost due to the clearing of the paddocks;
- protection of Dam 5 such that it is not altered by siltation or wind-blown dust or by accidental spills;

- weed management; and
- animal pest management and monitoring.

The potential impacts of the Proposal are described herein for the range of threatened fauna identified in accordance with the Draft Guidelines for Threatened Species Assessment (DoE, DPI 2005). The results indicate that no threatened fauna are likely to be affected to the point that a local population would be placed at risk of extinction. Key thresholds were assessed as follows:

- The Proposal includes actions to avoid or mitigate impacts by excluding the only mature tree patches (at various locations around the perimeter of the site) from the solar farm footprint,
  - All of the threatened fauna that could be potentially affected have been recorded in nearby areas and the tree patches that occur on site are likely to be used as roost sites for Corben's Long-eared Bat or as foraging sites when in flower by Grey-headed Flying Foxes, Swift Parrots, Superb Parrots, Painted Honeyeaters and/or Regent Honeyeaters,
- The Proposal will not place any local population of a threatened species at risk of extinction.
- The Proposal does not affect any critical habitat.

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## Introduction

### 1.1 Overview of the Project

Suntop Solar Farm propose to construct and operate a 200-megawatt (MW) solar farm (the “Proposal”) using photovoltaic (PV) technology at a 517-hectare site (the “Subject Land) in Suntop, NSW. The solar farm would occupy 472 hectares (the “Site”) out of the 517 hectares (equivalent to approximately 91% of the Site).

The construction of the Proposal is estimated to consist of up to 550,000 PV panels which will be installed on a single axis tracker system across the Site. The single axis tracker system option would consist of groups of east-west facing PV modules tilted at +/- 60° angle (each approximately 2m x 1m in area) on mounting structures approximately 4m in height and in rows approximately 11m apart. The mounting structure would be piled steel posts that would extend between 1.6m to 4m below ground depending on geological conditions. The maximum height of panels during tracking movement is up to 4.03m. The mounting structures for the panels will be 2m high and when the panels are at maximum tilt, the overall height will be approximately 4m.

The following works and infrastructure would be required to support the construction and operation of the solar farm:

- Construction of an access road for all access and egress for the Site and substation
- Installation of Electrical infrastructure including:
  - A 132kV Substation
  - Inverters to collect and convert DC to AC
  - Cabling and other electrical infrastructure (e.g. security systems).
- A maintenance compound and buildings
- Fencing, landscaping and environmental works.

Power generated by the facility will be transmitted via existing 132kV transmission lines, in an easement owned by TransGrid that traverses the Site and extends through to the Wellington substation approximately 15 kilometres to the north. A tee off connection will be used to connect directly into the existing grid located on Site. A tee connector is an electrical connector that joins three cables together.

The operational life of the solar farm is expected to be approximately 30 years at which point the panels are either replaced and operations continue or removed and the site is decommissioned and rehabilitated as required.

The Proposal would be located adjacent to Suntop Road, Suntop, NSW 2820 and contained within Lot 1-2- 3 DP 506925, Lot 122 DP 753238 and Lot 90 DP 657805 (the “Subject Land”). The Proposal is located within the Dubbo Local Government Area (LGA) and is approximately 10km south-west from the Wellington town centre.

The Subject Land is currently used for agriculture including cropping (e.g. wheat and lucerne) and grazing. It is proposed that grazing activities would also continue on the land occupied by the solar farm.

A full description of the Proposal can be found in the Suntop Solar Farm Environmental Impact Statement (EIS).

## **1.2 Scope and objectives**

The primary aim of this assessment is to assess potential impacts on terrestrial fauna, in particular, fauna of conservation significance. Potential impacts of the Proposal on fauna were assessed in accordance with the Guidelines for Threatened Species Assessment (Department of Environment and Conservation and Department of Primary Industries (DEC and DPI, 2005).

Fauna of conservation significance are defined in this report as threatened species or populations listed on the Schedules of the NSW Threatened Species Conservation Act 1995 (TSC Act) and/or are listed as matters of national environmental significance by the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act).

- The specific objectives of this impact assessment are to consider the terrestrial fauna known or likely to occur in the area that would be affected by the Proposal, including fauna of conservation significance;
- potential impacts of the Proposal on those fauna;
- proposed impact avoidance and mitigation measures.

This scope of this study includes:

- a desktop assessment of the fauna likely to occur in the vicinity;
- fauna surveys and field assessments;

Threatened fauna listed under the NSW Fisheries Management Act 1994 are not discussed further as no habitat exists for threatened fish species on the site.

## **1.3 Location**

The Site is located at 909 Suntop Road, Suntop, NSW, 2820, approximately 10km from Wellington town centre in the Wellington Local Government Area (LGA) and approximately 9km west of the Mitchell Highway (A32). The Site is not located in close proximity to urban or dense residential areas. The Proposal would be contained within Lot 1-2-3 DP 506925, Lot 122 DP 753238 and Lot 90 DP 657805 (Figure 1).

## 1.4 Site Description

The Site comprises a series of large fenced paddocks containing irrigated crops accessible via Suntop Road to the north. The paddocks have been levelled and largely cleared for agricultural purposes (specifically cropping) and currently contain several built structures including agricultural sheds and one residential dwelling. There is scattered rows and clusters of vegetation across the site as described in Table 1 below.

**Table 1**  
**Vegetation Clusters**

Isolated trees along boundary	Lot 90 DP 657805
Rows of Mature Trees	Western boundary of Lot 2 and 3 DP 506925  Southern boundary of Lot 1 and 2 DP 506925  Western and eastern boundaries of Lot 122 DP 753238  Eastern border of Lot 90 DP657805
LEP 'Biodiversity Region'	Edge of Suntop Road, located at the northern boundary of Lot 3 DP 506935, Lot 122 DP 753238 and Lot 90 DP 657805.

There are 8 dams within the Site ranging in size from 0.2 ha to 0.5 ha. The two largest dams are contained in the middle of Lot 2 DP 506925, and the south-west corner of Lot 3 DP 506925. Surface hydrology, landform and soils have been heavily modified by the paddock development and It is understood that the development footprint will avoid the existing surface water bodies on the site where possible including a buffer of 20m between infrastructure and any waterway.

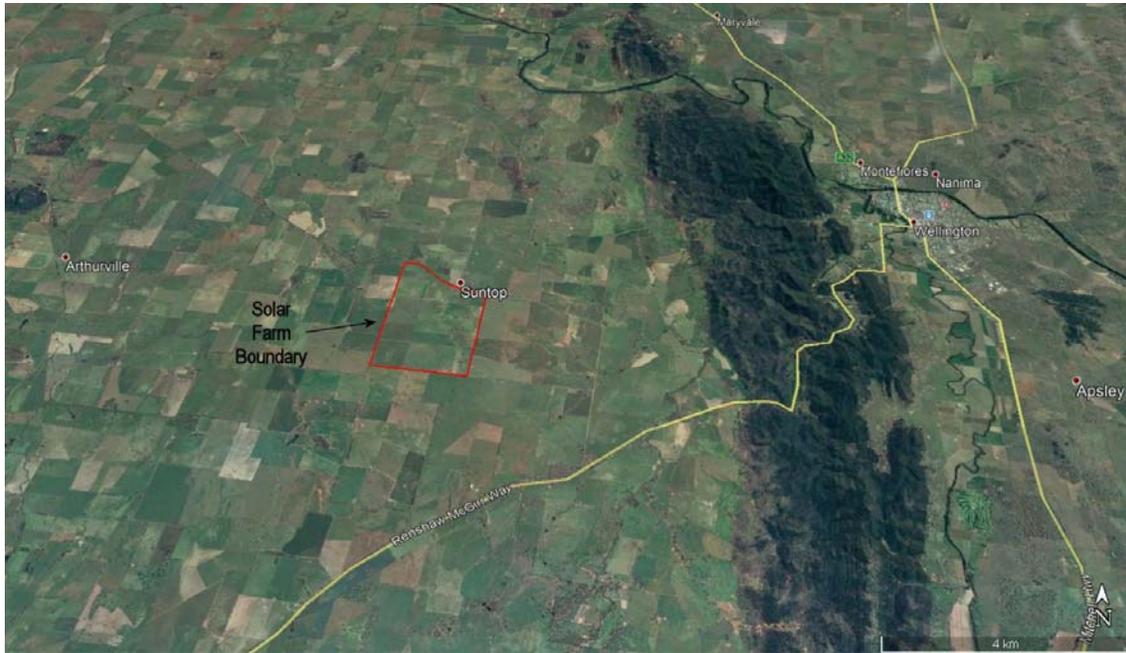
Local topography is generally flat with a gentle slope towards the north-west of the site boundary. Highpoints within 10km of the site; Mount Duke (540m), Mount Arthur (525m) and Bushrangers Hill (406m). Mount Arthur is part of the Mount Arthur Reserve, located 5km east of the Site occupying an area of 2,123ha with dense native vegetation.

The closest major water course is the Macquarie River, which is located approximately 7.7km north of the Site. The creek (unnamed) running through the Site flows into Barney's Creek, approximately 2.5km north of the Site. This creek (unnamed) is classified a first order stream, as it is located at the top of a catchment

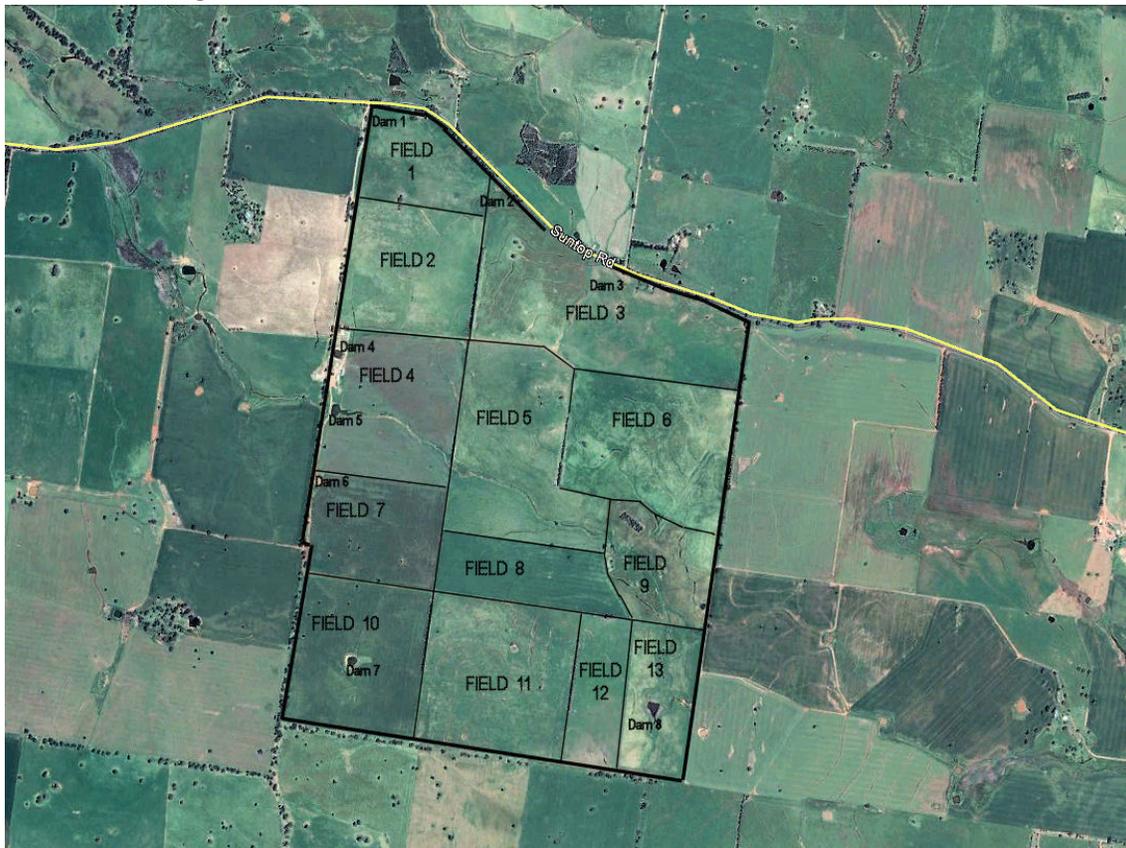
as a headwater' flow. Barney's creek, flows into Little River which is a major tributary of the Macquarie River. The head waters of Little River have been historically very saline, although the water quality of the creek running through the site may be slightly higher, due to potential flow granite groundwater flow system. There are also several man-made agricultural dams in neighbouring plots.

The environment around the Site is predominantly cleared agricultural land (Figure 3). The dominant land use for Suntop comprises of grazing (55%) and cropping (21%). A region within the neighbouring eastern lots, of approximately 350ha has been identified as Karst landscape. A Karst landscape is characterised by the presence of underground cavern networks created from the dissolution of bedrock by surface water or groundwater.

**Figure 1: Location of Solar Farm and Project Area**



**Figure 2: Location of fields and dams on the Suntop site.**



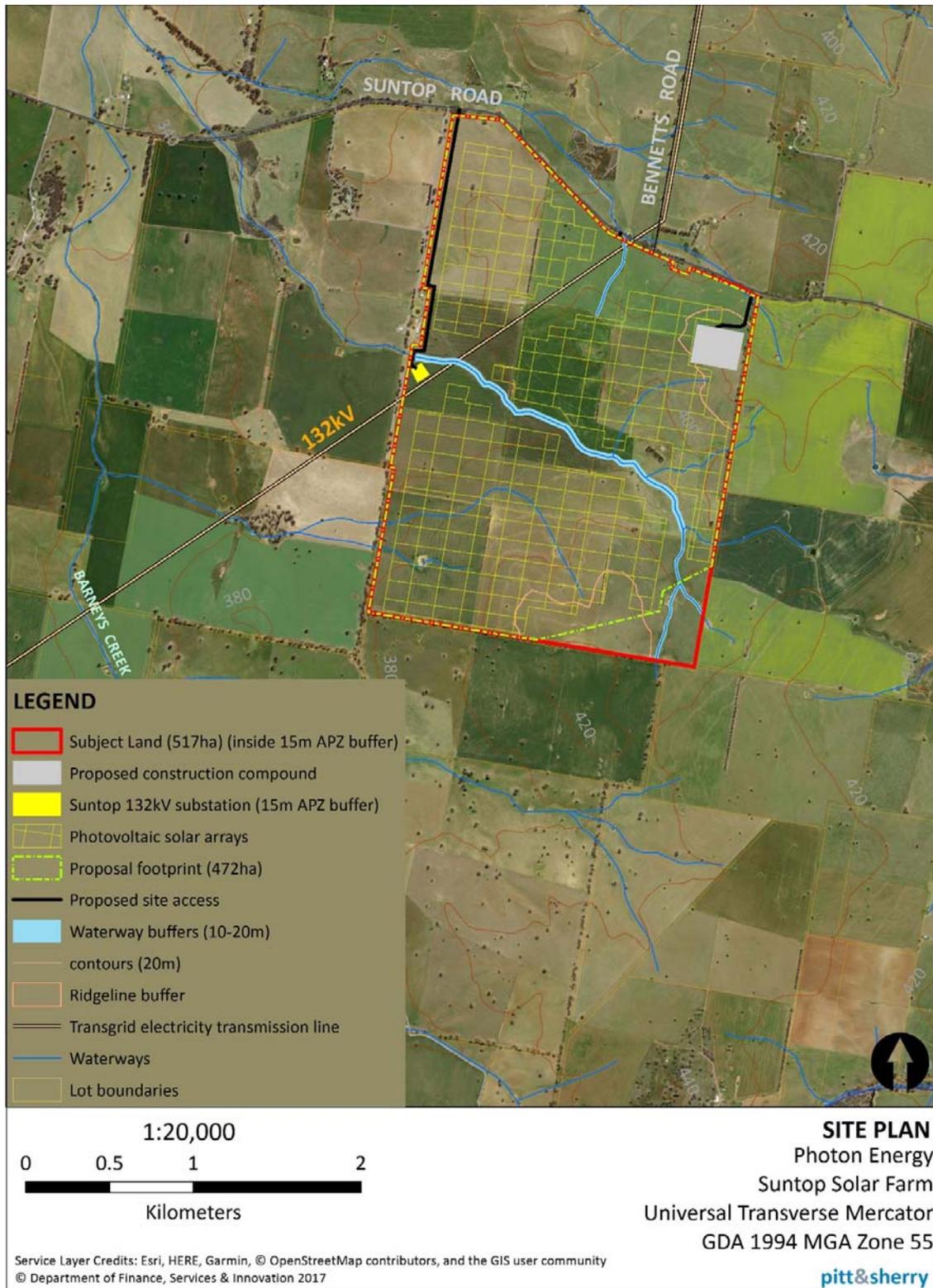
**Figure 3: Field 6 looking north**



**Figure 4: Dam 5**



**Figure 5: Solar Farm Footprint and Proposed Buffer Zones**



There are eight dams on site, many are small and were dry at the time of the site visit in November 2017. Dam 5 is the largest and contains potential habitat for threatened

water birds, Figure 4). Surface hydrology, landform and soils have been heavily modified by the paddock development and irrigation works. Land use within the local area is dominated by rural activities and population density is low.

### **1.5 Authorship and acknowledgements**

This fauna assessment was prepared by Dr. Arthur White of Biosphere Environmental Consultants Pty Ltd. for KMH Environmental.

## **2 Methodology**

### **2.1 Desktop assessment**

A desktop investigation was carried out to identify terrestrial fauna species and habitat that may be affected by the Proposal. This included:

- a search of the Office of Environment and Heritage (OEH) Threatened Species Profiles database (OEH 2017a) for species known or predicted to occur within the Wellington region;
- a search of the OEH Atlas of NSW Wildlife database (OEH 2017b) for records of threatened fauna within the locality;
- a search of the Commonwealth Department of the Environment (DotE) Protected Matters database (DotE 2017) for matters of national environmental significance within the locality (sourced 7 May 2014);
- a search of the Birdlife Australia database for records of threatened birds within the locality (sourced 14 October 2017);

### **2.2 Previous fauna surveys**

No fauna studies have been previously conducted on the site.

### **2.3 Fauna Assessment**

A fauna assessment was carried out on the entire site on the 22<sup>nd</sup> of November 2017 by Biosphere Environmental Consultants Pty. Ltd. The assessment commenced with a site familiarisation tour in which all of the roads and tracks on the site were traversed by vehicle. Following this, the site was re-traversed so that areas of potential habitat for threatened species could be mapped. As most of the site consisted of cleared paddocks, there were relatively few areas left that could provide potential habitat for native fauna. Each area was then revisited and traversed on foot.

The assessment included non-threatened species as well as threatened species. No trapping or netting of animals was carried out. All animal species encountered were identified and recorded on map of the site. The assessment components consisted of:

- Arboreal mammals: a search was made of the trees on site and evidence of the presence of arboreal mammals was searched for: these include scratch marks on trees, the presence of used hollows or drays, faecal droppings and chew marks. A particular emphasis was made to search for evidence of koalas on the site and all Yellow Box, Western Grey Box and Blakely's Red Gums were fully checked for signs of koala scratches or faecal pellets.
- Terrestrial Mammals: evidence of terrestrial animals was searched for across the site. This included searching for animal tracks, burrows, digging sites and scats.
- Bats: potential food trees for flying foxes were noted. These included trees that either produce edible fruit that flying foxes could eat or produce flowers with edible nectar. For the smaller insectivorous bats, small hollows or loose bark refuge sites on the trees were sought and investigated to see if there were any signs of current or previous occupation by microbats.
- Diurnal Birds: A constant watch was kept for birds using field binoculars. Birds were identified and their location noted on the field map.
- Nocturnal Birds: No night survey work was conducted. Owl, nightjar and frogmouth roosts were searched for during daylight hours and any potential site found was recorded on the site map.
- Reptiles: a hand search for reptiles was carried out in areas where there was ground cover such as fallen bark, branches, logs or scrap timber or metal that could be used as shelter areas by reptiles. Reptiles were not caught unless this was necessary for positive identification. Other reptiles were encountered opportunistically and their location was also recorded on the site map.
- Frogs: A search of the channels and water collection points on site was examined to see if any evidence of frogs could be found. Standing water was netted using a long-handled net and if tadpoles were caught they were identified using Anstis (2002). In clay areas near water points, evidence of frog burrows was also searched for and when found recorded on the site map.
- Fish: Fish sampling was carried out in the larger farm dams using long-handled nets.

## **2.4 Assessment of Impacts**

Potential impacts of the Proposal on fauna were assessed in accordance with the Guidelines for Threatened Species Assessment (DEC and DPI, 2005). Given the paucity of potential habitat areas for native species on site, the fauna assessment survey methodology undertaken by Biosphere Environmental Consultants Pty. Ltd. was considered to be sufficient to identify the habitat of threatened species on site.

## **2.5 Limitations**

The surveys undertaken by Biosphere Environmental Consultants Pty. Ltd. were short in duration and only conducted during one season (spring). The techniques used were observation-based rather than trapping. Accordingly, it is likely the surveys would not have recorded the full range of fauna on site, particularly those species which may only occur seasonally or occasionally.

## **3 Results**

### **3.1 Threatened fauna previously recorded or predicted to occur**

Appendix A provides a summary of the threatened fauna species that are known or considered to have potential to occur within the locality and/or region. The table indicates which of those species have been recorded previously within the local area between 1996 and 2017. The table also provides an assessment of the likelihood of each species occurring within the Project area or immediate surrounds. Only those species with the potential to occur within the project area were assessed further.

### **3.2 Habitat types, condition and features**

Two broad fauna habitat types were recorded within the Project area or immediate surrounds:

- Tree patches containing Western Grey Box (*E. microcarpa*) occur along the western and southern boundary of the site. These trees are mature and contain hollows.
- Tree patches containing River Red Gum (*E. camaldulensis*) and other eucalypts (probably planted) are present just outside the northern boundary of the site. These are also mature trees with hollows.
- Cleared Land devoid of native vegetation dominates the Project Area. In a few places highly isolated trees may occur but these are in poor condition due to their isolation and exposure.

There are very few rocks on site and no rocky exposures.

### **3.3 Fauna recorded during the surveys**

A total of 26 species of vertebrate fauna were recorded during the current (2017) surveys and are listed in Appendix B. This included 21 species of bird (1 of which was non-native), 2 exotic species of mammal, three species of reptile but no species of frog or fish. No threatened fauna species were recorded within the study area or nearby.

### **3.4 Migratory species**

No migratory species listed under the EPBC Act was recorded nearby the study area during the current surveys. A summary of migratory species recorded within 10 kilometres of the study area and/or locality is provided within Appendix C.

### **3.5 Endangered populations**

There are no endangered populations listed under the TSC Act that are known to occur within the old Wellington Shire boundary, as defined within the NSW OEH Threatened Species Profiles database (OEH 2017a).

### **3.6 Exotic fauna**

Three exotic vertebrate species (excluding livestock animals) were recorded within the Project area. These including the European Red Fox (*Vulpes vulpes*), European Starling (*Sturnus vulgaris*) and House Mouse (*Mus musculus*).

## **4 Potential impacts**

In general, the range of potential impacts associated with the Proposal are either associated with the construction or operation of the solar farm. These impacts may arise from direct and indirect impacts on the fauna.

### **4.1 Direct impacts**

#### **4.1.1 Loss of habitat**

Most of the project area is already devoid of native vegetation and the solar farm has been located so that maximal use of previously cleared land is utilised. The Proposal would require the removal of a small few scattered and isolated paddock isolated trees but also the removal of a linear stand of planted Yellow Box (located between fields 2 and 3; Figure 2). The paddock trees are in poor condition, presumably due to their exposure. The Yellow Box trees in the linear plantation are all young trees that lack hollows.

The Yellow Box although young, may provide seasonal habitat for native fauna such as birds and bats when they flower.

#### **Loss of hollow-bearing trees**

No mature trees bearing hollows will be removed.

#### **Removal of dead wood and dead trees**

The Proposal would result in the removal of two dead standing trees and dead wood on the ground as a part of the clearing of habitat. Dead wood and fallen branches is not common on the site.

#### **4.1.2 Loss of individual animals**

The Proposal has the potential to cause mortality of some animals during the removal of fauna habitat. Nocturnal species, species with low mobility, territorial species and some ground-dwelling species (such as lizards and snakes) are particularly susceptible to injury or death during construction and clearing. However, given that the paddock trees to be removed are so depauperate and that there is little fallen timber, this impact should be minimal. Some flying species that use these trees from time to time will lose habitat.

It is considered unlikely that wildlife mortality on roads would substantially increase as a result of the Proposal, given there are existing roads currently in operation with low vehicle speed limits, and no new roads would be created.

#### **4.1.3 Animal Injury**

In 2016, Harrison *et al.* reviewed the literature for the impact of solar farms on birds and bats in the United Kingdom. They concluded that the studies were not complete but indicated that reflected polarised light from solar panels can cause injury to some birds (particularly water birds). The reflected polarised light appears to be occasionally misinterpreted by water birds as light being reflected from a standing body of water and the birds may attempt to land on the solar panels. Although this is an uncommon occurrence, the potential for birds to be injured exists. Methods to reduce bird impacts were not discussed but it is likely that the establishment of tree buffer zones around the solar farms will discourage water birds from attempting to land there.

Harrison *et al.* (2016) also noted that certain insects are attracted to the reflected polarised light during daylight hours and this may entice some insectivorous birds towards the solar farms. They did not have evidence of injury to insectivorous birds as a result of the concentration of insects around the solar farms.

### **4.2 Indirect impacts**

#### **4.2.1 Loss of habitat connectivity**

Habitat corridors provide essential pathways for the movement of native fauna and play an important role in ensuring the long-term genetic viability of species. The Project is surrounded by occasional mature trees, either inside the property boundary or in road easements along the boundary. These trees provide the only wildlife corridors around the site and no corridors exist across the site because of the removal of so much native vegetation.

Vegetation connectivity in the surrounds of the project area is also highly variable. To the east of the project area is the Mount Arthur Range (Figure 1). These low ranges are fully vegetated and have a continuous tree cover. But there is no vegetated

corridors leading to the Mount Arthur Ranges and so the Suntop site remains quite isolated.

The removal of some paddock trees from the Project area will not interfere with habitat connectivity as these trees are few in number and are widely spaced. The removal of the linear Yellow Box plantation between fields 2 and 3 may impact some flying species as a potential feeding sources will be lost, however the mature tree around the perimeter of the site offer larger (and safer) feeding stations for dispersing birds and bats.

Mobile terrestrial animals such as Eastern Grey Kangaroos (*Macropus giganteus*) would be capable of crossing the agricultural land but would not remain on site because of the lack of cover.

#### **4.2.2 Predation by feral animals**

The European Red Fox (*Vulpes vulpes*) was recorded within the project area and throughout the locality. Foxes are a key threatening process under the TSC Act, Predation by the European red fox and Predation by feral cats. The proposed changes to the site are unlikely to result in an increase the impacts of these feral species on native fauna. Few terrestrial species occur in the Project area and the establishment of solar panels there will not assist native species or foxes.

#### **4.2.3 Edge effects**

Most of the habitats within the project area are already impacted by edge effects (light, noise, dust, etc.). The removal of the paddock trees will not result in increase in dust, noise or light. The emplacement of the solar panels will provide greater ground coverage than currently exists and this may facilitate weed growth in the paddock. The issue of weed management will be incorporated into a Land Management Plan which will be developed to address this and other land management issues across the Site.

#### **4.2.4 Noise and Air Quality**

There will be some increase in noise and air quality impacts during the construction of the solar farm. However, once the construction is completed, both noise and dust levels will be reduced. The main source of noise during the operation of the solar farm will occur near the sub-station to be established on site. Noise and air quality will not be a factor that will negatively impact on native fauna.

#### **4.2.5 Artificial lighting**

It is not proposed to undertake works during night time hours therefore, there should be no requirement for night lighting, except for maintenance activities if needed. Artificial lighting during the operation of the solar farm will be negligible and mainly associated with sensor security lighting and ancillary lighting.

#### **4.2.6 Changes to hydrology**

Some minor land re-surfacing will occur during the establishment of the solar farm. In general, most of the earth works proposed will be minor and will consist of levelling out minor undulations in the ground surface. These changes will not alter the general hydrology of the project area.

#### **4.3 Cumulative impacts**

Cumulative impacts are the successive, incremental and combined impacts (both positive and negative) of an activity on society, the economy and the environment (Franks *et al.*, 2010). They can arise from the compounding activities of a single operation given the interaction of that operation with past, current and future activities that may or may not be related to the existing development. Cumulative impacts may also arise through the interaction of one development with other types of activities and industries, such as grazing and broad scale agriculture. In relation to the Proposal, the cumulative impacts are considered to be the total impact on the environment that would result from incremental impacts (including both direct and indirect impacts) of the Proposal, added to other existing impacts. The main cumulative impact associated with the Proposal will occur during the construction of the solar farm when machinery and vehicle movements will be high. However, the establishment of the vegetation buffers around the perimeter of the site should offset most of this disturbance.

The proposed impact avoidance, mitigation and offset measures described in Sections 5 and 6 of this report are likely to assist with the maintenance of regional fauna biodiversity in the short-term and to potentially enhance it in the medium to long-term once rehabilitation and revegetation programmes become more established.

#### **4.4 Significance of impacts on threatened fauna listed under the TSC Act**

A total of 19 species of threatened fauna were considered to have potential to occur within the project area or immediate surrounds (Appendix A). For these species assessments were undertaken to determine the significance of potential impacts. Assessment Approach In accordance with the Draft Guidelines for Threatened Species Assessment (DEC and DPI, 2005) six questions require consideration and assessment in relation to each threatened species that could be impacted by the Proposal:

1. How is the proposal likely to affect the lifecycle of a threatened species and/or population?
2. How is the proposal likely to affect habitat for a threatened species, population or ecological community?

3. Does the proposal affect any threatened species or populations that area at the limit of its known distribution?
4. How is the proposal likely to affect current disturbance regimes?
5. How is the proposal likely to affect habitat connectivity?
6. How is the proposal likely to affect critical habitat?

The potential impacts for each species of threatened fauna is provided in Appendix D. For species where the ecology or habitat requirements are similar, they have been grouped and assessed together.

In relation to 6, the Proposal would not impact on any area of critical habitat. No area of critical fauna habitat occurs near the study area as designated by the Register of Critical Habitat held by the Commonwealth Minister of the DotE (DotE, 2009), Register of Critical Habitat held by the Director-General of the OEH (OEH 2017), or the Register of Critical Habitat held by the Director-General of the DPI-Fisheries (DPI-Fisheries, 2014).

### **Summary**

In summary, the conclusions of the assessment were that the modification would be unlikely to significantly impact any threatened species given;

- the relatively small area of potential habitat that would be impacted (isolated paddock trees);
- this habitat area is not used by many native species, with the exception of flying animals. There are few old growth features observed in the trees and there is scant ground cover available. This area is also highly isolated from other treed areas.
- habitat fragmentation within the locality would be insignificant as a result of the removal of these trees,
- to assist those species that do occur in the local area a vegetation buffer zone will be established around the site, and a buffer zone will be established around the central watercourse that leads to Dam 5.
- impact avoidance and mitigation measures would be implemented.

#### **4.5 Significance of impacts on threatened fauna listed under the EPBC Act**

This report identifies potential impacts from the Proposal on threatened fauna listed under the EPBC Act and assessed whether the identified impacts would likely result in a significant impact on any Matters of National Environmental Significance. The conclusion of this assessment is that the proposed Modification is not likely to have a significant impact on any threatened fauna (see Appendix D).

#### **4.6 State Environmental Planning Policy No. 44 – Koala Habitat Protection**

There are two important definitions that apply when considering Koala habitat under SEPP 44:

- "core koala habitat" means an area of land with a resident population of koalas, evidenced by attributes such as breeding females (that is, females with young) and recent sightings and historical records of a population; and
- "potential koala habitat" means areas of native vegetation where the trees of the types listed in Schedule 2 constitute at least 15% of the total number of trees in the upper or lower strata of the tree component.

Three Schedule 2 Koala feed trees occur in the Suntop area, namely River Red Gum *Eucalyptus camaldulensis*, Yellow Box *Eucalyptus melliodora* and Western Grey Box *Eucalyptus microcarpa*. The Project site contains a few Western Grey Box *E. microcarpa* near the southern and western boundary of the site. These trees will be conserved and included in the vegetation buffer zone.

There are no historic or current observations of koalas within the Project Site. The isolation of the few tree areas that remain makes it extremely difficult for koalas to reach them and their poor condition and exposure means that if koalas were able to reach these trees they could not remain there for long.

#### **4.7 Migratory species**

Twelve migratory bird species listed under the EPBC Act have been recorded within the locality or predicted to occur in the Protected Matters database (Appendix C). There are no records of any of these species being recorded in the project area. The current survey did not detect any of these species but the limited nature of the survey does not preclude their presence from time to time. The Proposal is not likely to significantly impact any listed migratory species under the EPBC Act, on the basis of the following:

- no 'important habitat' exists within the Proposal area for any listed migratory species;
- the Proposal would not result in an invasive species that is harmful to any migratory species becoming established in an area of important habitat; and

- the Proposal would not disrupt the life cycle of an ecologically significant proportion of any population of any migratory species.

## **5 Mitigation measures**

A number of impact avoidance and mitigation measures are proposed to alleviate any potential impacts on native species that occur in or over the project area.

### **5.1 Land Management plan**

A Land Management Plan (LMP) will be prepared to include measures that will:

- protect the mature eucalypts trees around the perimeter of the site during the construction of the solar farm;
- enhance the habitat values of these trees through the establishment of the vegetation buffer zones; and  
replace the trees lost from field B1 by selective replanting in the buffer zones around the site.
- prevent unwanted plants from becoming established in and around the solar farm.
- schedule regular site inspections and communication with lessees and authorities;
- undertake annual control of weeds

### **5.2 Animal pest management and monitoring**

A variety of animal pest management and monitoring procedures, including the following:

- the maintenance of a clean, rubbish-free environment in order to discourage scavenging and reduce the potential for colonisation of these areas by non-endemic fauna (e.g. introduced rodents, predators and birds);
- monitoring of feral animals (including pigs, foxes, dogs, rabbits and newly established exotics species);
- undertaking pest animal control where necessary; and
- employees and contractors are not permitted to encourage fauna through feeding.

### 5.3 Rehabilitation

At the completion of the life of the solar farm, the site will be rehabilitated to either arable agricultural land with/without replanted tree habitat areas.

### 5.4 Other fauna protection and management measures

Other fauna protection and management initiatives include the following:

- setting speed limits (20 km per hour on roads and tracks);
- installing warning signs on roads and tracks in the vicinity of the solar farm to reduce potential vehicle strikes;
- the maintenance of a clean, rubbish-free area; and
- preparation of procedures which detail how to care for animals found at risk of harm or injured at the solar farm site.

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**Appendix A: Likelihood of occurrence of threatened fauna**

Scientific Name	Common Name	Conservation Status		Known or predicted occurrence in region		Records from the locality		Survey Records	Potential occurrence in the Modification area or immediate surrounds
		TSC Act	EPBC Act	NSW OEH Database	Protected Matters	Wildlife Atlas NSW	Birdlife Aust.		
<i>Anthrochaera phrygia</i>	Regent Honeyeater	CE	CE	Yes	-	No	No	No	Opportunistic habitat available to Regent Honeyeaters when mature eucalypts around perimeter of site are in flower.
<i>Lathamus discolor</i>	Swift Parrot	E	CE	Yes	-	No	No	No	Mature eucalypts around perimeter of site possible stopping points for Swift Parrots during migration.
<i>Polytelis swainsonii</i>	Superb Parrot	V	V	Yes	-	No	No	No	Opportunistic habitat available to Superb Parrots when mature eucalypts around perimeter of site are in flower.
<i>Calidris ferruginea</i>	Curlew Sandpiper	E	CE	Yes	-	No	No	No	Dam 5 could provide ephemeral habitat.
<i>Numenius madagascarensis</i>	Eastern Curlew	CE	CE	Yes	-	No	No	No	Dam 5 could provide ephemeral habitat.
<i>Grantiella picta</i>	Painted Honeyeater	V	V	Yes	-	No	No	No	Opportunistic habitat available to Painted Honeyeaters when mature eucalypts around perimeter of site are in flower.
<i>Rostratula australis</i>	Australian Painted Snipe	E	E	Yes	-	No	No	No	No habitat available.
<i>Botaurus poiciloptilus</i>	Australasian Bittern	E	E	Yes	-	No	No	No	No habitat available. Insufficient tree cover.
<i>Leipoa ocellata</i>	Malleefowl	V	V	Yes	-	No	No	No	No habitat available.
<i>Maccullochella peelii</i>	Murray Cod	V	V	Yes	-	No	No	No	No habitat available.
<i>Maccullochella macquarensis</i>	Trout Cod	V	V	Yes	-	No	No	No	No habitat available.

<i>Galaxia rostratus</i>	Flathead galaxia	V	V	Yes	-	No	No	No	No habitat available.
<i>Macquaria australasica</i>	Macquarie Perch	V	V	Yes	-	No	No	No	No habitat available.
<i>Petauroides volans</i>	Greater Glider	V	V	Yes	-	No	No	No	No habitat available. Insufficient tree cover.
<i>Phascolarctos cinereus</i>	Koala	V	V	Yes	-	No	No	No	Habitat inaccessible to koalas. Larger tree stands contains secondary food trees, but trees are inaccessible to koalas.
<i>Chalinolobus dwyeri</i>	Large Pied Bat	V	V	Yes	-	No	No	No	No habitat available. Insufficient tree cover.
<i>Dasyurus maculatus maculatus</i>	Spotted-tail Quoll	V	-	Yes	-	No	No	No	No habitat available. Insufficient tree cover or ground cover available.
<i>Nyctophilus corbeni</i>	Corben's Long-eared Bat	V	V	Yes	-	No	No	No	Mature eucalypts around perimeter of site may provide habitat for these bats.
<i>Petrogale penicillata</i>	Brush-tailed Rock-wallaby	V	V	Yes	-	No	No	No	No habitat available.
<i>Pteropus poliocephalus</i>	Grey-headed Flying Fox	V	V	Yes	-	No	No	No	Opportunistic habitat available to Grey-headed Flying when mature eucalypts around perimeter of site are in flower.
<i>Aprasia parapulchella</i>	Pink-tailed Worm-lizard	V	V	Yes	-	No	No	No	No habitat available. Little surface rock available; no exfoliations.
<i>Delma impar</i>	Striped Legless Lizard	V	V	Yes	-	No	No	No	No habitat available.

CE = Critically Endangered

E = Endangered

V = Vulnerable

**Appendix B Fauna Detected On Site**

Class	Common Name	Scientific Name	TSC Act	EPBC Act
Mammalia	House Mouse	<i>Mus musculus</i>	I	-
	Red Fox	<i>Vulpes vulpes</i>	I	-
Aves				
	Pacific Black Duck	<i>Anas superciliosa</i>	P	
	Australasian Grebe	<i>Tachybaptus novaehollandiae</i>	P	
	Australian Maned Duck	<i>Chenonetta jubata</i>	P	
	Black-shouldered Kite	<i>Elanus axillaris</i>	P	
	Crested Pigeon	<i>Ocyphaps lophotes</i>	P	
	Eastern Rosella	<i>Platycercus eximius</i>	P	
	Red-rumped Parrot	<i>Psephotus haematonotus</i>	P	
	Galah	<i>Eolophus rosiecapilla</i>	P	
	Yellow-rumped Thornbill	<i>Acanthiza chrysorrhea</i>	P	
	Superb Fairy Wren	<i>Malurus cyaneus</i>	P	
	Noisy Miner	<i>Manorina melanocephala</i>	P	
	Blue-faced Honeyeater	<i>Entomyzon cyanotus</i>	P	
	White-plumed Honeyeater	<i>Lichenostomus penicillatus</i>	P	
	Magpie-lark	<i>Grallina cyanoleuca</i>	P	
	Welcome Swallow	<i>Hirundo neoxena</i>	P	
	Australian Reed-warbler	<i>Acrocephalus australis</i>	P	
	Common Starling	<i>Sturnus vulgaris</i>	I	
	Australasian Pipit	<i>Anthus novaeseelandiae</i>	P	
	Grey Butcherbird	<i>Cracticus torquatus</i>	P	
	Australian Magpie	<i>Cracticus tibicens</i>	P	
	Australian Raven	<i>Corvus coronoides</i>	P	
Reptiles	Eastern Brown Snake	<i>Pseudonaja textilis</i>	P	
	Inland Snake-eyed Skink	<i>Cryptoblepharus pannosus</i>	P	
	Grass Skink	<i>Lampropholis guichenoti</i>	P	
Frogs	Spotted Grass Frog	<i>Limnodynastes tasmaniensis</i>	P	
Fish	Nil			

Note: P = protected, V = vulnerable, I = introduced, M = migratory.

**Appendix C: Migratory Species known or potential occurrence within the study area and/or locality.**

Scientific Name	Common Name	Conservation Status		Known or predicted occurrence in region	Records from the Locality		Current Survey
		TSC Act	EPBC Act		Wildlife Atlas	Birdlife Australia	
<i>Apus pacificus</i>	Forked-tailed Swift	-	M	✓	-	-	-
<i>Hirundapus caudacutus</i>	White-throated Needletail	-	M	✓	-	-	-
<i>Actitis hypoleucos</i>	Common Sandpiper	-	M	✓	-	-	-
<i>Calidris acuminata</i>	Sharp-tailed Sandpiper	-	M	✓	-	-	-
<i>Monarcha melanopsis</i>	Black-faced Monarch	-	M	✓	-	-	-
<i>Motacilla flava</i>	Yellow Wagtail	-	M	✓	-	-	-
<i>Myiagra cyanoleuca</i>	Satin Flycatcher	-	M	✓	-	-	-
<i>Pandion haliaetus</i>	Osprey	-	M	✓	-	-	-
<i>Rhipidura rufifrons</i>	Rufous Flycatcher	-	M	✓	-	-	-
<i>Rostratula benghalensis</i>	Painted Snipe	E	M	✓	-	-	-

Note: E = endangered, M = migratory.

## Appendix D: Assessments of Significance

### Birds

Three of the threatened species that have been recorded within 10 kilometres of the project area have been excluded from this assessment as there is no habitat available for these birds in the project area. Those species were the Australasian Bittern, Mallee Fowl and Australian Painted Snipe.

### **Wetland-associated Birds**

Two threatened wetland bird species have the potential to occur in the Study Area:

- Eastern Curlew *Numenius madagascarensis*
- Curlew Sandpiper *Calidris ferruginea*

Habitat for both of these birds is extremely limited and confined to the area around Dam 5 (Figure 2).

#### **1. How is the proposal likely to affect the lifecycle of a threatened species and/or population?**

Both of the threatened birds listed above are known or predicted to occur in the region (Appendix A) but neither were detected during the fauna assessment in November 2017. Habitat for both species is limited to the area around Dam 5. Dam 5 will be excluded from the development footprint. In addition, silt fences will be erected to prevent dust or silt from being transported into the dam and catchment. The proposed establishment of the solar farm is unlikely to affect the lifecycle of these threatened species.

#### **2. How is the proposal likely to affect the habitat of a threatened species, population or ecological community?**

No water bodies would be directly impacted by the proposal.

#### **3. Does the proposal affect any threatened species or populations that are at the limit of its known distribution?**

Neither of the threatened waterbird species listed above are at the limit of their known distribution (OEH 2017a).

#### **4. How is the proposal likely to affect current disturbance regimes?**

As indicated in 4.2 the construction and operation of the solar farm would not result in a significant change to existing disturbance regimes, given impacts would be limited already cleared agricultural land and the loss of trees that will occur will occur in areas not frequented and out of reach of these birds.

#### **5. How is the proposal likely to affect habitat connectivity?**

As indicated in 4.2 the construction and operation of the solar farm would not result in an adverse impact on habitat connectivity for these birds. The only dam that provides potential habitat for them will be conserved and protected during the construction and operation of the solar farm.

#### **6. How is the proposal likely to affect critical habitat?**

No area of critical fauna habitat occurs near the study area as designated by the Register of Critical Habitat held by the Commonwealth Minister of the DoE (DoE, 2014), Register of Critical Habitat held by the Director-General of the OEH (OEH 2017), or the Register of Critical Habitat held by the Director-General of the DPI-Fisheries (DPI-Fisheries, 2017).

## Woodland Birds

Two threatened woodland birds have the potential to occur within the Study Area:

- Painted Honeyeater *Grantiella picta*
- Superb Parrot *Polytelis swainsonii*

### **1. How is the proposal likely to affect the lifecycle of a threatened species and/or population?**

Both woodland species listed above have been recorded or are predicted to occur in the region (Appendix A) but neither were detected on site during the fauna assessment carried out in November 2017. Habitat for these birds is restricted to the few remaining mature eucalypts around the margins of the site and these trees will be retained and conserved. The small tree plantation areas on site are too young to provide habitat for these birds. The proposed establishment of the solar farm is unlikely to affect the lifecycle of these threatened species.

### **2. How is the proposal likely to affect the habitat of a threatened species, population or ecological community?**

The mature trees around the perimeter of the site will be retained and included in a vegetation buffer zone. The management of the buffer zone will improve the habitat value of these trees. The proposal will not adversely affect the habitat of these species.

### **3. Does the proposal affect any threatened species or populations that are at the limit of its known distribution?**

Both of these species have wide distributions in NSW and none are at the limit of their known distribution (OEH 2017a).

### **4. How is the proposal likely to affect current disturbance regimes?**

As indicated in 4.2 the construction and operation of the solar farm would not result in a significant change to existing disturbance regimes, given impacts would be limited to already cleared agricultural land and the loss of trees that will occur will occur in areas not frequented and out of reach of these birds. The trees that may provide habitat are located around the margins of the site and will be conserved.

### **5. How is the proposal likely to affect habitat connectivity?**

As indicated in 4.2 the construction and operation of the solar farm would not result in an adverse impact on habitat connectivity for these birds. The mature eucalypts around the perimeter of the project area will remain and be conserved and potential movement corridors will be retained. All potential habitat for these birds will be conserved and protected during the construction and operation of the solar farm.

### **6. How is the proposal likely to affect critical habitat?**

No area of critical fauna habitat occurs near the study area as designated by the Register of Critical Habitat held by the Commonwealth Minister of the Environment (DotE, 2014), Register of Critical Habitat held by the Director-General of the OEH (OEH 2017), or the Register of Critical Habitat held by the Director-General of the DPI-Fisheries (DPI-Fisheries, 2017).

## **Regent Honeyeater and Swift Parrot**

The following birds are considered to have the potential to occur within the Study Area:

- Swift Parrot *Lathamus discolor*
- Regent Honeyeater *Anthochaera phrygia*

### **1. How is the proposal likely to affect the lifecycle of a threatened species and/or population?**

The Swift Parrot is a non-breeding autumn-winter migrant to mainland Australia (breeds in Tasmania), where they forage primarily on nectar from winter flowering plants (OEH 2017a). Similarly, within NSW the Regent Honeyeater is known to breed in the Capertee Valley and the Bundarra-Barraba regions during spring and summer but can move large distances during the non-breeding season to forage on winter nectar resources (OEH 2017a). Both species would forage lerp and/or insects when nectar resources are scarce.

Suitable vegetation for these species within the project area is limited to the few remaining mature eucalypts that occur around the perimeter of the site. These trees will be retained and conserved. The small tree plantation areas on site are too young to provide habitat for these birds. The proposed establishment of the solar farm is unlikely to affect the lifecycle of these threatened species.

### **2. How is the proposal likely to affect the habitat of a threatened species, population or ecological community?**

The mature trees around the perimeter of the site will be retained and included in a vegetation buffer zone. The management of the buffer zone will improve the habitat value of these trees. The proposal will not adversely affect the habitat of these species.

### **3. Does the proposal affect any threatened species or populations that are at the limit of its known distribution?**

Within the Study Area, neither of these species are at the limits of their known distribution (OEH 2017a).

### **4. How is the proposal likely to affect current disturbance regimes?**

As indicated in 4.2 the construction and operation of the solar farm would not result in a significant change to existing disturbance regimes, given impacts would be limited already cleared agricultural land and the loss of the few paddock trees that will occur will occur in areas not frequented by these birds. The trees that may provide habitat for Swift Parrots and Regent Honeyeaters are located around the margins of the site and will be conserved.

### **5. How is the proposal likely to affect habitat connectivity?**

As indicated in 4.2 the construction and operation of the solar farm would not result in an adverse impact on habitat connectivity for these birds. The trees that may provide habitat for Swift Parrots and Regent Honeyeaters are located around the margins of the site and will be conserved. The creation of vegetation buffer zones should enhance potential movement corridors for these birds.

### **6. How is the proposal likely to affect critical habitat?**

No area of critical fauna habitat occurs near the study area as designated by the Register of Critical Habitat held by the Commonwealth Minister of the DotE (DotE, 2014), Register of Critical Habitat held by the Director-General of the OEH (OEH 2017), or the Register of Critical Habitat held by the Director-General of the DPI-Fisheries (DPI-Fisheries, 2017).

## **Mammals**

Four of the threatened species that have been recorded within 10 kilometres of the project area have been excluded from this assessment as there is no habitat available for these birds in the project area. Those species were the Spotted-tail Quoll, Large-eared Pied Bat, Koala and Greater Glider.

Two threatened mammal species have the potential to occur in the Study Area:

- Corben's Long-eared Bat *Nyctophilus corbeni*
- Grey-headed Flying Fox *Pteropus poliocephalus*

### **Grey-headed Flying-fox**

The Grey-headed Flying-fox (*Pteropus poliocephalus*) has the potential to occur within the project area.

#### **1. How is the proposal likely to affect the lifecycle of a threatened species and/or population?**

The Grey-headed Flying-fox is known to occur in the region and records exist for the locality. The species was not recorded during the fauna assessment conducted in November 2017. Grey-headed Flying-foxes feed on nectar and pollen of native trees as well as fruits and occur in a wide range of habitats (OEH 2017a). During the day individuals aggregate in camps, which are important for mating, giving birth and rearing young. Camps are generally located within 20 km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy (OEH 2017a). The Grey-headed Flying-fox can travel large distances (up to 50 km) from their camp to forage (OEH 2017a). No camps were observed within or near the study area.

The only habitat trees available to the flying foxes are the mature eucalypts that occur around the perimeter of the site. They could provide nectar when in flower. These trees will be retained and conserved. The small tree plantation areas on site are too young to provide much food for these bats. The proposed establishment of the solar farm is unlikely to affect the lifecycle of these threatened species.

#### **2. How is the proposal likely to affect the habitat of a threatened species, population or ecological community?**

The mature trees around the perimeter of the site will be retained and included in a vegetation buffer zone. The management of the buffer zone will improve the habitat value of these trees. The proposal will not adversely affect the habitat of these species.

#### **3. Does the proposal affect any threatened species or populations that are at the limit of its known distribution?**

The Grey-headed Flying-fox occurs in a 200 km broad band along the east coast of Australia from Bundaberg, QLD to Melbourne, VIC (OEH 2017a). Thus, the species is not at the limits of its known distribution.

#### **4. How is the proposal likely to affect current disturbance regimes?**

As indicated in 4.2 the construction and operation of the solar farm would not result in a significant change to existing disturbance regimes, given impacts would be limited to already cleared agricultural land and the loss of the few paddock trees that will occur will occur in areas not frequented by these bats. The trees that may provide habitat for flying foxes are located around the margins of the site and will be conserved.

#### **5. How is the proposal likely to affect habitat connectivity?**

As indicated in 4.2 the construction and operation of the solar farm would not result in an adverse impact on habitat connectivity for these bats. The trees that may provide habitat for Grey-headed Flying Foxes are located around the margins of the site and will be conserved. The creation of vegetation buffer zones should enhance potential movement corridors for these bats.

## **6. How is the proposal likely to affect critical habitat?**

No area of critical fauna habitat occurs near the study area as designated by the Register of Critical Habitat held by the Commonwealth Minister of the DotE (DotE, 2014), Register of Critical Habitat held by the Director-General of the OEH (OEH 2017), or the Register of Critical Habitat held by the Director-General of the DPI-Fisheries (DPI-Fisheries, 2017).

### **Corben's Long-eared Bat**

Corben's Long-eared Bat (*Nyctophilus corbeni*) has the potential to occur within the project area.

#### **1. How is the proposal likely to affect the lifecycle of a threatened species and/or population?**

Corben's Long-eared Bat has not been recorded in the immediate vicinity of Suntop. These bats will often seek shelter in small terminal or mid-branch hollows. The only trees on the project area that have such hollows are the few mature eucalypts that are present around the margins of the site. These trees will be retained and conserved. The small tree plantation areas on site are too young to provide hollows for these bats. The proposed establishment of the solar farm is unlikely to affect the lifecycle of these threatened species.

#### **2. How is the proposal likely to affect the habitat of a threatened species, population or ecological community?**

The mature trees around the perimeter of the site will be retained and included in a vegetation buffer zone. The management of the buffer zone will improve the habitat value of these trees. The proposal will not adversely affect the habitat of these species.

#### **3. Does the proposal affect any threatened species or populations that are at the limit of its known distribution?**

Corben's Long-eared Bat is widely distributed around the western slopes and semi-arid of New South Wales; its distribution coincides approximately with the Murray Darling Basin with the Pilliga Scrub region being the distinct stronghold for this species (OEH 2017a). Thus, the species is not at the limits of its known distribution.

#### **4. How is the proposal likely to affect current disturbance regimes?**

As indicated in 4.2 the construction and operation of the solar farm would not result in a significant change to existing disturbance regimes, given impacts would be limited to already cleared agricultural land and the loss of the few paddock trees that will occur will occur in areas not frequented by these bats. The trees that may provide habitat for Corben's Long-eared Bat are located around the margins of the site and will be conserved.

#### **5. How is the proposal likely to affect habitat connectivity?**

As indicated in 4.2 the construction and operation of the solar farm would not result in an adverse impact on habitat connectivity for these flying foxes. The trees that may provide habitat for them are located around the margins of the site and will be conserved. The creation of vegetation buffer zones should enhance potential movement corridors for these bats.

#### **6. How is the proposal likely to affect critical habitat?**

No area of critical fauna habitat occurs near the study area as designated by the Register of Critical Habitat held by the Commonwealth Minister of the DotE (DotE, 2014), Register of Critical Habitat held by the Director-General of the OEH (OEH 2017), or the Register of Critical Habitat held by the Director-General of the DPI-Fisheries (DPI-Fisheries, 2017).

### **Reptiles**

Two threatened species of legless lizard have the potential to occur in the project area:

- Pink-tailed Worm Lizard *Aprasia parapulchella*
- Striped Legless Lizard *Delma impar*

Habitat does not exist for either species on the project site and so neither species is further assessed for potential impacts.

### **Fish**

Four threatened species of fish have the potential to occur in the project area:

- Flathead Galaxia *Galaxia rostratus*
- Trout Cod *Maccullochella macquarensis*
- Murray Cod *Maccullochella peelii*
- Macquarie Perch *Macquaria australasica*

As no habitat is present on the project site for any of these fish species, they are not considered any further in this assessment.

ATTACHMENT 2

BAM Credit Summary Report



# BAM Calculator

App last updated: 26/04/2018 (Version: 1.2.3.00)  
 BAM data last updated \*: 24/02/2018 (Version: 3) \* **Disclaimer**

00010097/BAAS18048/18/00010106 / 0

1. Assessment details
2. Site context
3. Vegetation
4. Habitat suitability
5. Habitat survey
6. Credits
7. Credit classes
8. Price

Ecosystem credits for plant communities types (PCT), ecological communities & threatened species habitat

Zone	Vegetation zone name	Vegetation integrity loss	Area	Species sensitivity to gain class (for BRW)	Biodiversity risk weighting	Candidate SAIL	Ecosystem credits
White Box - White Cypress Pine - Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion							
1	267_Plantings	30.1	1.3 hectares	High Sensitivity to Potential Gain	2	TRUE	19
2	267_Woodland	72.9	0 hectares	High Sensitivity to Potential Gain	2	TRUE	1
							Subtotal: 20
							<b>Total: 20</b>

Species credits for threatened species

Vegetation zone name	Habitat condition (vegetation integrity) loss	Area / Count	Biodiversity risk weighting	Candidate SAIL	Species credits
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