Premise

TERRAIN SOLAR

Marulan Solar Farm

BIODIVERSITY DEVELOPMENT ASSESSMENT REPORT

Report No: 221106_BDAR
Rev: 001D
17 August 2022

BAM CERTIFICATION AND DECLARATION
This report was prepared using Version 54 of BAM Credit Calculator 2022 and adhering to the requirements of the Biodiversity Assessment Method 2020.
This BDAR comprises BAM-C analyses; vegetation clearance covered by BAM-C case number 00028758/BAS18048/21/00028759 (Revision 5), finalised on 17/08/2022 and, case number 00028758/BAAS18048/22/00034363 (Revision 1), finalised on 17/08/2022.
I certify that this report has been prepared based on the requirements of, and information provided under, the Biodiversity Assessment Method and clause 6.15 of the Biodiversity Conservation Act 2016 (BC Act).
Signed:  Sally Kirby (Assessor No: BAAS21027)
Date: 17/08/2022

DOCUMENT AUTHORISATION					
Revision	**Revision Date**	**Report Details**			
A	18/03/22	Draft Biodiversity Development Assessment Report			
B	1/06/22	Updated draft for DPE review			
C	8/07/22	Final			
D	17/08/2022	Calculator finalisation			
Prepared By		**Reviewed By**		**Authorised By**	
Isobel Colson		David Walker		Sally Kirby	

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EXECUTIVE SUMMARY

Marulan Solar Farm

The proposed site of the Marulan Solar farm is located approximately 14 kilometres (km) east of Goulburn in the Southern Tablelands of New South Wales (NSW). Terrain Solar is the proponent of the Marulan Solar Farm.

The Marulan Solar Farm is being assessed as State Significant Development under the NSW *Environmental Planning and Assessment Act 1979*, which requires assessment under the Biodiversity Offset Scheme (BOS). The biodiversity assessment has been undertaken by Biodiversity Assessment Method (BAM) accredited personnel according to the protocol outlined in the NSW Biodiversity Conservation Act 2016 (BC Act).

The main elements proposed for the development include the following:

- 375.5 hectare solar farm, including approximately 330 hectares of solar infrastructure and approximately 35.5 hectares of exclusion areas, comprising approximately 360,000 modules (solar panels) mounted on single axis-tracker units or fixed mounting frames;
- Between 24 and 55 inverter stations, each containing an inverter between 2.2 and 4.92MW capacity and a 400V/ 33kV transformer;
- Cabling, electrical connections and switch-gear, attached to the mounting frame structures, to interconnect modules;
- Underground cabling connecting arrays and inverter stations;
- A 132kV switching station in one of two possible locations;
- Overhead 132kV power line connecting the solar farm to the existing 132kV transmission line;
- A 132/33kV substation location on the northern side of the existing gas pipeline, and central to the solar farm;
- A Battery Energy Storage System (BESS) located either adjacent to the substation in its own compound or, distributed across the solar farm with individual battery containers located adjacent to the solar inverter stations;
- Temporary construction compound south of the solar farm including material laydown areas, site offices, car and bus parking and amenities;
- Construction of an internal road from a new crossover at the site's Munro Road boundary;
- Minor widening of Munro Road in one location;
- Chain-link/barbed-wire security fence up to three metres in height; and
- Specific native vegetation screening from identified visual impact locations.

Premise Australia Pty Ltd (Premise) have prepared this Biodiversity Development Assessment Report (BDAR) to assess the impact of the Marulan Solar Farm on biodiversity values, threatened species, threatened ecological communities and their habitats under the Biodiversity Conservation Act 2016 (BC Act) and the Commonwealth Environmental Protection and Biodiversity Conservation Act 2000 (EPBC Act).

This BDAR has been prepared using Version 50 of the Biodiversity Assessment Method (BAM) 2020 under the BC Act 2016.

Subject Land

The Subject Land is located in the Goulburn Mulwaree Local Government Area, 14 km east of Goulburn within the Southern Tablelands of NSW . The development footprint (Subject Land) is approximately 406.3

hectares (ha), of which 375.5 ha is to be occupied by the proposed solar farm. The Subject Land is the subject of this BDAR and is formed of a single lot: Lot 55 DP 1141136.

The Subject Land is dominated by exotic pasture with smaller areas of remanent woodland, native derived grassland, exotic plantings and ten farm dams.

The Subject Land is located within the Bungonia Subregion of the NSW South Eastern Highlands IBRA Bioregion.

Methods

The BAM outlines the methodology that underpins the NSW Biodiversity Offset Scheme established under Part 6 of the BC Act. The BAM requires the use of an online program (the BAM Credit Calculator) to assess the biodiversity impacts and determine the biodiversity offset requirements for those impacts. Stage 1 summarises the biodiversity values of the Subject Land, and Stage 2 assesses potential impacts on biodiversity, describes impact avoidance and mitigation measures and determines offset requirements.

Vegetation surveys were carried out 19th to 24th November 2019, 5th to 8th October 2021 and 18th February 2022. Vegetation sampling included:

- Initial field mapping of vegetation communities conducted in 2019 and revised in October 2021.
- Thirty BAM-compliant Vegetation Integrity (VI) plots, of which 18 were sampled in 2019 and 13 were sampled between the 5th and 8th October 2021, with the addition of one plot in February 2022.
- Scattered tree assessment progressively on all visits.
- Targeted threatened species flora searches in October 2021 and February 2022.

Native Vegetation

Vegetation on the proposed solar farm area consists of cleared modified pastures, low-lying wetland areas with native grasses and sedges, patches of semi-cleared and remnant native woodland, and one native planting.

Sampling by Premise has identified three PCTs on the Subject Land:

- PCT 351 - Brittle Gum - Broad-leaved Peppermint - Red Stringybark open forest in the north-western part (Yass to Orange) of the South Eastern Highlands Bioregion
- PCT 1110 - River Tussock - Tall Sedge - Kangaroo Grass moist grasslands of the South Eastern Highlands Bioregion (in a number of separated and disconnected patches)
- PCT 1330 - Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion

Native vegetation for removal has been classified into nine vegetation zones. A description of each is included in Table 6 and includes the following vegetation condition zones on the Subject Land:

- Brittle Gum – Broad-leaved Peppermint – Red Stringybark Open Forest in dense condition (PCT 351) – one patch (0.19 ha)
- Brittle Gum – Broad-leaved Peppermint – Red Stringybark Open Forest in derived condition (PCT 351) – one patch (1.14 ha)
- Blakely's Red Gum – Yellow Box Woodland in moderate condition (PCT 1330) – four patches (2.46 ha)
- Blakely's Red Gum – Yellow Box Woodland in mod-poor condition (PCT 1330) – three patches (1.2 ha)
- Derived Native Grassland in poor condition (PCT 1330) – two patches (20.43 ha)

- Regeneration (PCT 1330) – one patch (0.45 ha)
- Plantings (PCT 1330) – one patch (1.52 ha)
- Exotic Grassland (PCT 1330) – one patch (302.4 ha)
- River Tussock – Tall Sedge – Kangaroo Grass Moist Grasslands in moderate condition – two patches (0.94 ha)

A total of 16 scattered trees were recorded on the Subject Land. Tree species, Diameter at Breast Height (DBH) and hollow size are listed in **Table 7**. Scattered Trees were classified under Category B of the BAM (2020) that is: *have a DBH of greater than or equal to 5 cm and are located more than 50 m away from any living tree that is greater than or equal to 5 cm DBH, and the land between the scattered trees is comprised of vegetation that are all ground cover species on the widely cultivated native species list, or exotic species or human-made surfaces or bare ground.*

Two additional lone trees were mapped but these contain hollows which BMS (2022) considers potential habitat for the Glossy Black Cockatoo and threatened owls. To account for threatened species habitat the canopy of these two trees was mapped and included in the area of PCT 1330 Mod-Poor in the BAM calculator.

Scattered Trees on the Subject Land are located greater than 50 metres from one another, in a matrix of exotic-dominated pasture with a VI score of less than the minimum threshold for offsetting (<15).

Weeds

Eleven High Threat Exotic Weed species were identified on the Subject Land, three Priority Weed for the Goulburn-Mulwaree Shire and three Weeds of National Significance.

Fauna

Fauna surveys were undertaken by Biodiversity Monitoring Services (BMS) using a combination of desktop searches and targeted surveys. Targeted fauna surveys were conducted between 13-15 December 2021, 10-14th January 10th February and 22-24th February 2022 according to State and Commonwealth Guidelines (i.e. timing and duration of surveys, methods to locate species and potential habitat).

During the 2021-2022 fauna surveys, 160 invertebrate fauna species were recorded, including 106 bird (plus 4 exotic), 23 mammal (plus 10 exotic), 8 amphibian and 13 reptiles.

Threatened Species

The BAM Credit Calculator considers two categories of threatened species:

- Ecosystem Credit Species (predicted to be present based on the PCTs present).
- Species Credit Species (cannot be reliably predicted based on PCT owing to specific habitat requirements).

A total of 25 of the ecosystem credit species identified in association with PCT 351, 1110 and 1330 were retained in the BAM Credit Calculator. A further two species were added based on PMST results. Of the 33 species credit species identified in association with PCT 351, 1110 and 1330, 28 species were eliminated through habitat assessment and targeted flora and fauna surveys; and six species were assumed present, as due to seasonal timing constraints, targeted surveys could not be conducted.

Threatened fauna species assessed in the BAM Credit Calculator are Pink-tailed Legless Lizard, Striped Legless Lizard, Glossy Black Cockatoo, Masked, Powerful and Barking Owls.

PCT 1330 constitutes part of the *White Box - Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland* Critically Endangered Ecological Community (CEEC), commonly known as Box-Gum Woodland, that is listed under both the BC Act and the EPBC Act.

PCT 1110 is associated with the Natural Temperate Grasslands of the South Eastern Highlands CEEC that is listed under the EPBC Act. The areas of PCT 1110 impacted by the project consist of four non-contiguous patches.

Serious and Irreversible Impacts

As a critically endangered entity, Box-Gum Woodland is considered at risk of Serious And Irreversible Impacts (SAII). Required information is provided to assist the decision-maker to determine whether the Solar Farm would constitute an SAII. The proposed activity will require the permanent removal of 5.62 hectares of Box-Gum Woodland CEEC. It is considered that the proposed activity would not contribute significantly to the risk of the CEEC becoming locally or regionally extinct and it is concluded that serious and irreversible impacts on the CEEC would not occur.

Matters of National Environmental Significance (MNES)

Four fauna species, the Pink-tailed Legless Lizard, Striped Legless Lizard, Greater Glider and Koala listed as Vulnerable and Endangered (Koala) under the EPBC Act were assessed for potential impact and while the Greater Glider is considered to have a low probability of being significantly impacted by the Solar Farm, the other three species may be impacted and therefore require referral. Remnants on the Subject Land of the Commonwealth listed Box-Gum Woodland CEEC do not meet the criteria for protection under the EPBC Act. The Natural Temperate Grasslands CEEC does meet the criteria for protection under the EPBC Act. Referral to the DAWE was carried out and the resulting decision was that the activity is not a controlled action – refer **Appendix G**.

Koalas

The Subject Land is zoned RU1 within Goulburn-Mulwaree Shire Local Government Area so that Koala management is regulated by Chapter 4 of the *State Environmental Planning Policy (Biodiversity and Conservation) 2021*. One Koala feed tree listed in the KHP SEPP occurs on the Subject Land, Forest Red Gum (*Eucalyptus tereticornis*) and the area must be considered potential Koala habitat. Koala survey by BMS did not locate any Koalas or Koala signs. The site is therefore not considered Core Koala Habitat. No Koala Management Plan is necessary for the Solar Farm.

Measures to Avoid and Minimise Impacts

Opportunities to avoid and minimise impacts were considered during the planning stage of the Solar Farm. The Subject Land has been designed to disturb the minimum area possible, while providing some flexibility for future engineering specifications/changes in design. This included designation of large exclusion areas along creeks and movement of the southern boundary of the Subject Land north to avoid most of the remnant woodland which occurs along the southern extent of the agricultural property.

Prescribed Biodiversity Impacts

Four prescribed biodiversity impacts relevant to the Subject Land are the presence of rocky outcrops that are potentially habitat for the Pink-tailed Legless Lizard and the Striped Legless Lizard, the presence of exotic grasslands that area potential habitat for the Striped Legless Lizard, the presence of waterbodies which may be impacted by runoff during construction and potential for vehicle strikes along the proposed access road.

Assessments of significance of impacts on rock outcrops and exotic grassland concluded that habitat loss for the threatened lizard species is likely.

Vehicle Strikes and water-quality impacts are a possibility posed by the Solar Farm but it is considered that management of these via minimisation and mitigation measures will reduce the impact to a negligible level.

There will be no impact of wind turbines.

Direct Impacts

The direct impacts of the Solar Farm would be the removal of 7.89 ha of native vegetation and the removal of 16 isolated scattered trees.

The loss of 0.17 hectares of rock outcrop and 3.6 ha of exotic grassland that is potential habitat for threatened species is a prescribed biodiversity impact that cannot be avoided through planning.

Indirect Impacts

Indirect impacts of the Solar Farm would include the temporary disruption to adjacent habitat during construction associated with noise, dust and light, however management measures will be put in place to mitigate this disturbance. There is also a risk of increased pressure on food and shelter resources in adjacent habitat areas as wildlife are displaced when vegetation is removed from the Subject Land. Logs and felled trees from the Subject Land will be relocated to adjacent woodland areas as supplement habitat to minimise this indirect impact.

Offset Obligation

Terrain will satisfy the biodiversity credit requirements using offset mechanisms allowed by the NSW Biodiversity Offsets Scheme (i.e. contribution to the Biodiversity Trust Fund administered by the NSW Biodiversity Conservation Trust, purchase of existing credits on the market, funding of a biodiversity conservation action, retirement of biodiversity credits and/or mine site ecological rehabilitation).

Shortened Forms

BAM	Biodiversity Assessment Method
BAM-C	Biodiversity Assessment Method Calculator
BC Act	*Biodiversity Conservation Act 2016* (NSW)
BC Regulation	Biodiversity Conservation Regulation 2017 (NSW)
BDAR	Biodiversity Development Assessment Report
BOAMS	Biodiversity Offsets and Agreement Management System
BOS	Biodiversity Offsets Scheme
CEEC	critically endangered ecological community
DBH	diameter at breast height over bark
EC	ecological community listed under the EPBC Act
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Cwlth)
EP&A Act	*Environmental Planning and Assessment Act 1979* (NSW)
EEC	endangered ecological community
HTW	high threat weed
IBRA	Interim Biogeographic Regionalisation for Australia
LLS Act	*Local Land Services Act 2013* (NSW)
MNES	matters of national environmental significance
NSW	New South Wales
PCT	plant community type
SAII	serious and irreversible impact
SEARs	Secretary's Environmental Assessment Requirements
TBDC	Threatened Biodiversity Data Collection
TEC	threatened ecological community

Conflict of interest

I declare that I have considered the circumstances and there is no actual, perceived or potential conflict of interest

This declaration has been made in the interests of full disclosure to the decision-maker. Full disclosure has also been provided to the client.

Signature: 

Date: 17/08/2022

BAM Assessor Accreditation no: BAAS21027

Project Personnel

The BDAR was prepared by appropriately qualified and experienced professionals (**Table 1**).

Table 1. Premise Project Team

Name	Position	CV details	Role in this ecology report and experience
Dr Colin Bower BSc, PhD, Accredited BAM assessor	Principal Ecologist	40 years' experience in biodiversity survey and assessment. BAM accredited, recognised expert in native flora identification, published numerous scientific papers and contributed to development of NSW Vegetation Classification System.	**Role:** Peer review.
Sally Kirby BSc M. Env Studies Accredited BAM assessor	Senior Ecologist	20 years' experience in natural resource management, BAM accredited, impact assessment and community engagement. Skills in terrestrial and aquatic habitat survey and assessment.	**Role:** Oversee BAM project inputs, BAM Calculations, project manager, vegetation surveys, reporting.
Isobel Colson BSc MSc	Senior Ecologist	7 years' experience in natural resource management, ecological monitoring, and project management. Skills in GIS, botany and habitat survey and assessment.	**Role:** Vegetation surveys, data input. reporting.
Michelle Lindsay BSc Biodiversity and Conservation	Graduate Ecologist	Graduate ecologist with one year of experience with Premise collecting and collating data, database searches, report preparation.	**Role:** Data management, input, collation, database searches, reporting.
Adam Davis	Spatial Analyst	Civil engineer with 14 years' experience consulting in multidisciplinary organisations. Skills in spatial data management, Geographic Information Systems, mapping, constraints analysis.	**Role:** Spatial data management, produce figures, calculations for the BDAR.

Report Structure

This Biodiversity Development Assessment Report (BDAR) has been prepared in accordance with BAM 2020 and comprises two stages:

Stage 1 – assessment of the biodiversity values of the Subject Land; and

Stage 2 – impact assessment (biodiversity and prescribed impact)s.

The Structure of the report is summarised in **Table 2**.

Table 2. Report Structure

Section Reference	Section heading / BAM Requirement	Description
1	Introduction – Chapters 2 and 3	Project overview
2.1	Landscape Context- Sections 3.1 and 3.2, Appendix E	Regional Setting and Landscape Context
2.2	Native Vegetation – Chapter 4, Appendix A and Appendix H	Review of existing information, survey methods, description of vegetation communities on Subject Land
2.3	Threatened Species – Chapter 5	Fauna survey methods
2.4		Data sources, Likelihood of Threatened Species Occurrence, Derivation of Species Credits, Ecosystem Credit Species Species Credit Species, Threatened Species listed under the EPBC act, Koala Protection SEPP 2020
2.5	Prescribed Impacts – Chapter 6	Identification of Prescribed Impacts relevant to the proposed activity and Subject Land
3.1	Avoid and Minimise Impacts – Chapter 7	Description of measures to avoid and minimise impacts during the planning process and proposed activity
3.2	Assessment of Impacts - Chapter 8, Sections 8.1 and 8.2	Direct and indirect impacts, prescribed impacts, cumulative impacts
3.3	Mitigation of Impacts - Chapter 8, Sections 8.4 and 8.5	Mitigation measures for direct, indirect and prescribed impacts
3.4	Impact Summary – Chapter 9	Serious and Irreversible Impacts
3.5	Impact Summary – Chapter 10	Ecosystem and Species Credits for offsetting
3.6	Conclusions and Recommendations	Conclusions and Recommendations

1. INTRODUCTION

In August 2021, Premise Australia (Premise) were engaged by Terrain Solar to assess the potential environmental impact associated with the development of a 150 megawatt (MW) solar farm at 740 Carrick Road, Carrick, NSW. The development, referred to herein as the Marulan Solar Farm, will be located 14 km east of Goulburn and will include a solar farm footprint within an area of (377.60 ha), grid connection footprint including a switching station and substation (28.69 ha). Terrain Solar is the project proponent.

The Marulan Solar Farm is being assessed as State Significant Development under the NSW *Environmental Planning and Assessment Act 1979*, which requires assessment under the Biodiversity Offset Scheme (BOS). The biodiversity assessment has been undertaken by Biodiversity Assessment Method (BAM) accredited personnel according to the protocol outlined in the NSW Biodiversity Conservation Act 2016 (BC Act).

Premise Australia Pty Ltd (Premise) have prepared this Biodiversity Development Assessment Report (BDAR) to assess the impact of the Marulan Solar Farm on biodiversity values, threatened species, threatened ecological communities and their habitats under the Biodiversity Conservation Act 2016 (BC Act) and the Commonwealth Environmental Protection and Biodiversity Conservation Act 2000 (EPBC Act).

The survey and assessment reported here were conducted using Version 45 of the Biodiversity Assessment Method (BAM) (DPIE, 2020a) under the BC Act.

1.1 Project Overview

The main elements proposed for the development include the following:

- 375.5 hectare solar farm, including approximately 330 hectares of solar infrastructure and approximately 35.5 hectares of exclusion areas, comprising approximately 360,000 modules (solar panels) mounted on single axis-tracker units or fixed mounting frames;
- Between 24 and 55 inverter stations, each containing an inverter between 2.2 and 4.92MW capacity and a 400V/ 33kV transformer;
- Cabling, electrical connections and switch-gear, attached to the mounting frame structures, to interconnect modules;
- Underground cabling connecting arrays and inverter stations;
- A 132kV switching station in one of two possible locations;
- Overhead 132kV power line connecting the solar farm to the existing 132kV transmission line;
- A 132/33kV substation location on the northern side of the existing gas pipeline, and central to the solar farm;
- A Battery Energy Storage System (BESS) located either adjacent to the substation in its own compound or, distributed across the solar farm with individual battery containers located adjacent to the solar inverter stations;
- Temporary construction compound south of the solar farm including material laydown areas, site offices, car and bus parking and amenities;
- Construction of an internal road from a new crossover at the site's Munro Road boundary;
- Minor widening of Munro Road in one location;
- Chain-link/barbed-wire security fence up to three metres in height; and
- Specific native vegetation screening from identified visual impact locations.

1.2 The Subject Land

The Subject Land is located on part of 'Lockyersleigh' on the Carrick Road, Marulan in the Goulburn Mulwaree Local Government Area, 14 km east of Goulburn within the Southern Tablelands of NSW (**Figure 1**). The development footprint (Subject Land) is approximately 406.3 hectares (ha), of which 375.5 ha is to be occupied by the proposed solar farm as shown in **Figure 2**. The Subject Land is the subject of this BDAR and is formed of a single allotment: Lot 55 DP 1141136 (**Figure 3**).

The Subject Land is dominated by exotic pasture with smaller areas of remnant woodland, native derived grassland, exotic plantings and 14 farm dams.

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Figure 1. Regional Location

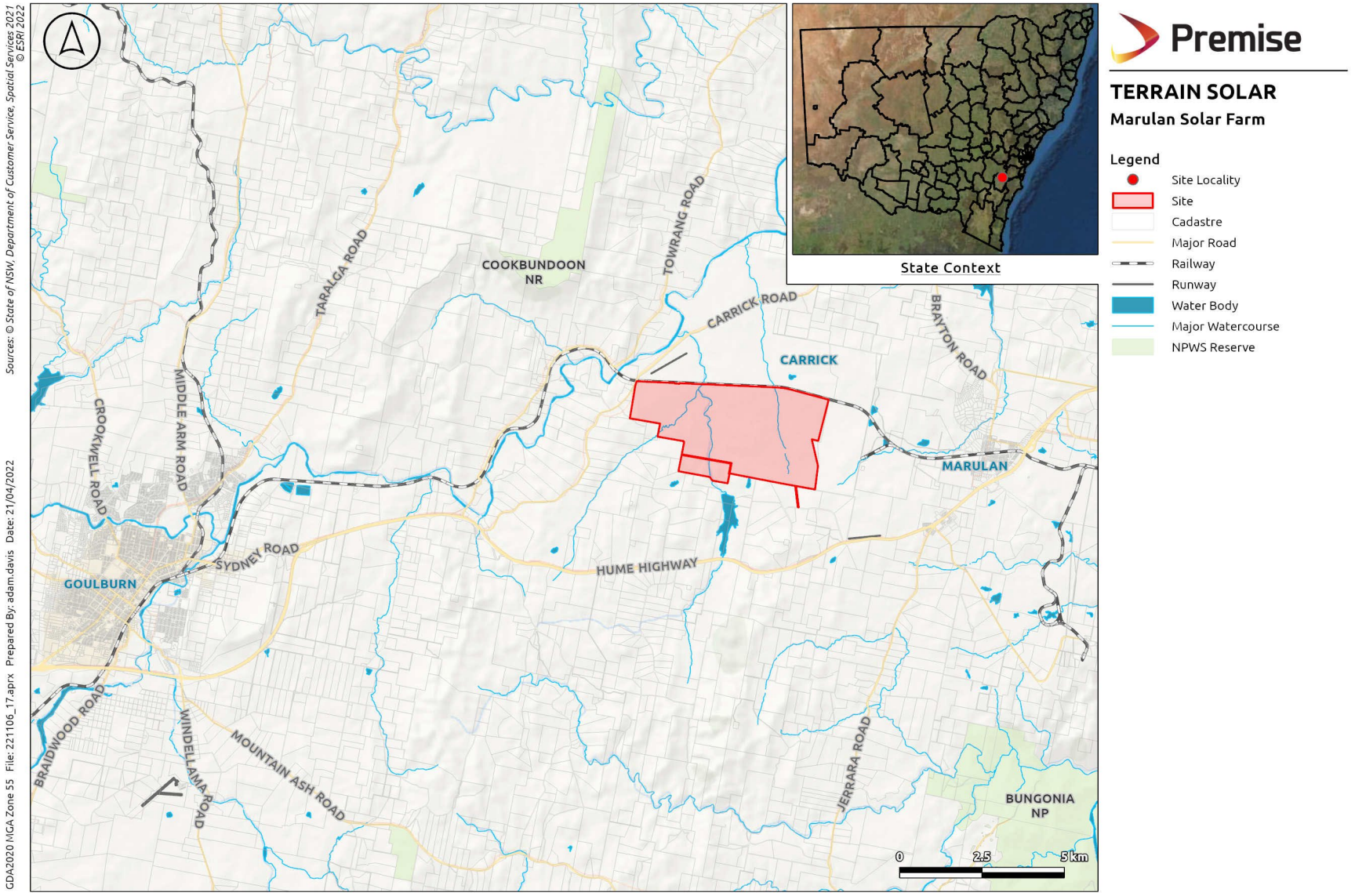

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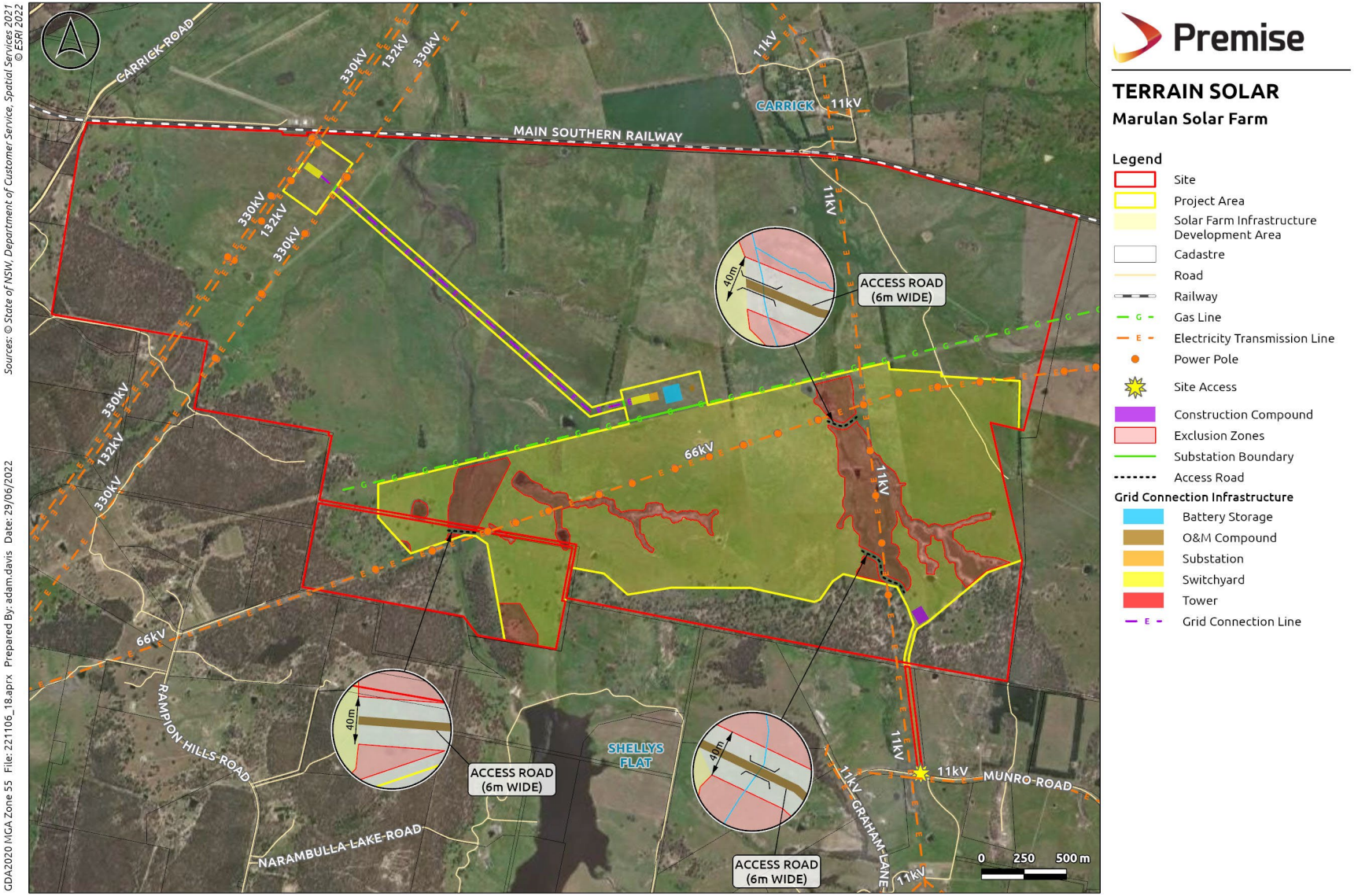
Figure 2. Solar Farm General Arrangement



1.3 The Biodiversity Assessment Method

The assessment of impacts on biodiversity is conducted in accordance with the BAM (DPIE, 2020a) established under the BC Act. The BAM outlines the methods that underpin the NSW Biodiversity Offset Scheme (BOS) established under Part 6 of the BC Act.

The BAM (DPIE, 2020a) requires the use of an online program (calculator) to assess biodiversity impacts and determine the biodiversity offset requirements for those impacts. Version 1.4.0.00 BAM data last updated 16/06/2022 (version 54) of the Biodiversity Assessment Method Calculator (BAM-C or the Credit Calculator) was used for this assessment.

As specified by the BAM, two stages of assessment are outlined in this report:

- Stage 1 summarises the biodiversity values of the development footprint that are entered into the Credit Calculator (e.g. landscape features, native vegetation and threatened species) (Section 2); and
- Stage 2 assesses potential impacts on biodiversity, describe impact avoidance and mitigation measures and determine offset requirements (Section 3).
  - Matters of National Environmental Significance (MNES)

A referral to the Federal Government was made for potential impacts on the Pink-tailed Legless Lizard, Striped Legless Lizard, the Koala and the Natural Temperate Grasslands CEEC, via the DAWE Business Portal. The Referral Reference number is EPBC 2022/09218. Detailed assessment of the need for referral is provided in **Sections 2.4.6.1-2.4.6.2**. A draft version of this BDAR was submitted, along with Appendix D and Appendix E as part of the Referral. The outcome of the EPBC Referral was that the proposed actions do not constitute a controlled action (Appendix F).

1.4 Sources of Information used in Assessment

Datasets used to prepare this BDAR are referenced in **Table 3** and **Table 4**.

1.4.1 SPATIAL DATASETS AND WEBSITES

Table 3. Spatial Data used in this report

GIS Layer name	**Reference**
Title	**Web Address**
IBRA bioregions and Subregions	https://www.seed.nsw.gov.au/
NSW landscape regions	https://www.seed.nsw.gov.au/
Rivers and streams	https://www.industry.nsw.gov.au/water/licensing-trade/hydroline-spatial-data
Wetlands	https://pmst.awe.gov.au/
Waterways	https://www.dpi.nsw.gov.au/about-us/research-development/spatial-data-portal
Key Fish Habitat	https://maps.six.nsw.gov.au/
Connectivity of different areas of habitat	https://www.seed.nsw.gov.au/
Native Vegetation Extent	https://www.seed.nsw.gov.au/

Table 4. Web sites and links to documents used in this report

Biodiversity	
Biodiversity Assessment Methodology (DPIE, 2020a)	https://www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Animals-and-plants/Biodiversity/biodiversity-assessment-method-2020-200438.pdf
BAM Credit Calculator (DPIE, 2021e)	https://www.lmbc.nsw.gov.au/bamcalc
Threatened Biodiversity Survey and Assessment Guidelines for Developments and Activities – Working Draft (DEC 2004)	https://www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Animals-and-plants/Threatened-species/draft-threatened-biodiversity-survey-guide.pdf
Surveying threatened plants and their habitats NSW Survey Guide for the BAM (DPIE, 2020b)	https://www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Animals-and-plants/Biodiversity/surveying-threatened-plants-and-habitats-nsw-survey-guide-biodiversity-assessment-method-200146.pdf
Threatened Biodiversity profile search (DPIE)	https://www.environment.nsw.gov.au/threatenedspeciesapp/
NSW BioNet Atlas	https://www.environment.nsw.gov.au/atlaspublicapp/UI_Modules/ATLAS_/AtlasSearch.aspx
Vegetation Classification System (requires login)	https://www.environment.nsw.gov.au/NSWVCA20PRapp/LoginPR.aspx
Threatened Biodiversity Profile Data Collection (requires login)	https://www.environment.nsw.gov.au/AtlasApp/UI_Modules/TSM_/Default.aspx?a=1
PlantNET	https://plantnet.rbgsyd.nsw.gov.au/floraonline.htm
Threatened Species Test of Significance Guidelines (OEH, 2018)	https://www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Animals-and-plants/Threatened-species/threatened-species-test-significance-guidelines-170634.pdf
Significant Impact Guidelines 1.1 – Matters of National Environmental Significance (Australian Government, 2013).	https://www.environment.gov.au/system/files/resources/42f84df4-720b-4dcf-b262-48679a3aba58/files/nes-guidelines_1.pdf
Guidance to assist a decision maker to determine a serious and irreversible impact (DPIE, 2019b)	https://www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Animals-and-plants/Biodiversity/guidance-decision-makers-determine-serious-irreversible-impact-190511.pdf

2. STAGE 1 – BIODIVERSITY ASSESSMENT

Stage 1 of the biodiversity assessment summarises the biodiversity values of the Subject Land that are inputs into the BAM Credit Calculator.

2.1.1 REGIONAL SETTING

The Subject Land is located approximately 14 km east of Goulburn in Southern Highlands NSW (**Figure 1**), within the following regions:

- the Goulburn Mulwaree Local Government Area (LGA);
- Oberon-Kialla Granites, Towrang Ranges and Wollondilly-Bindook Tablelands and Gorges BioNet NSW Landscapes (**Table 5** and **Figure 4**); and
- South Eastern Highlands (Bungonia sub-region) of the Interim Biogeographic Regionalisation for Australia (IBRA) (Thackway and Cresswell, 1995) (**Figure 4**).

Table 5. BioNet NSW Landscapes Located within the Subject Land

Landscape Name	Percentage Cleared Estimate[1]	Area (ha)	Percentage (%) of Subject Land Covered by Landscape
Oberon-Kialla Granites	89	359.84	95.2
Towrang Ranges	59	16.17	4.3
Wollondilly-Bindook Tablelands and Gorges	38	1.58	0.4

[1] Sourced from the 'Over-cleared Landscapes Database' within the BioNet Vegetation Classification Database (DPIE, 2019a).

Figure 3. Site Map (Lots and Plans)

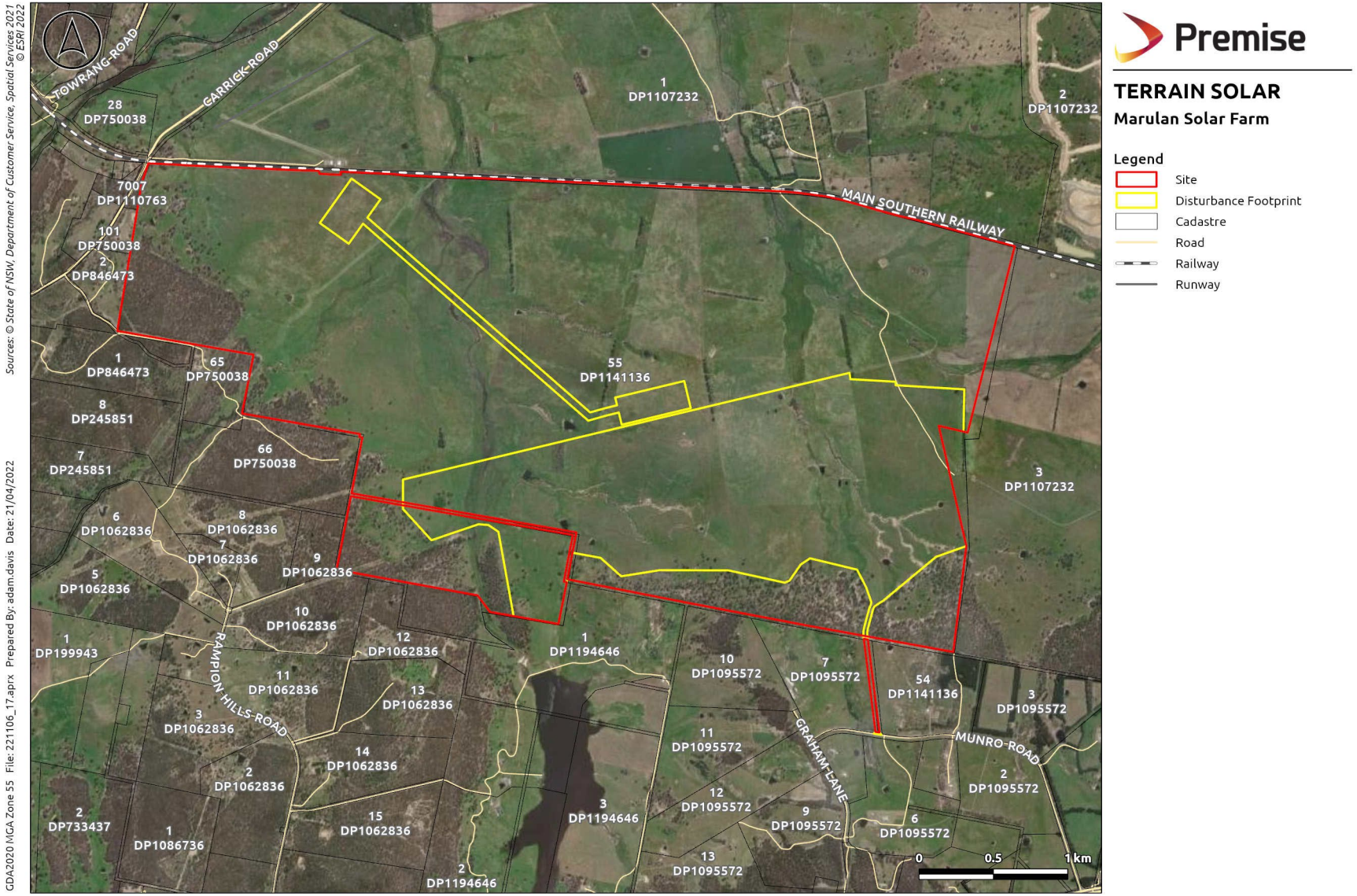


Figure 4. Site Map 2 (BioNet NSW Landscapes, NSW Biodiversity Values)

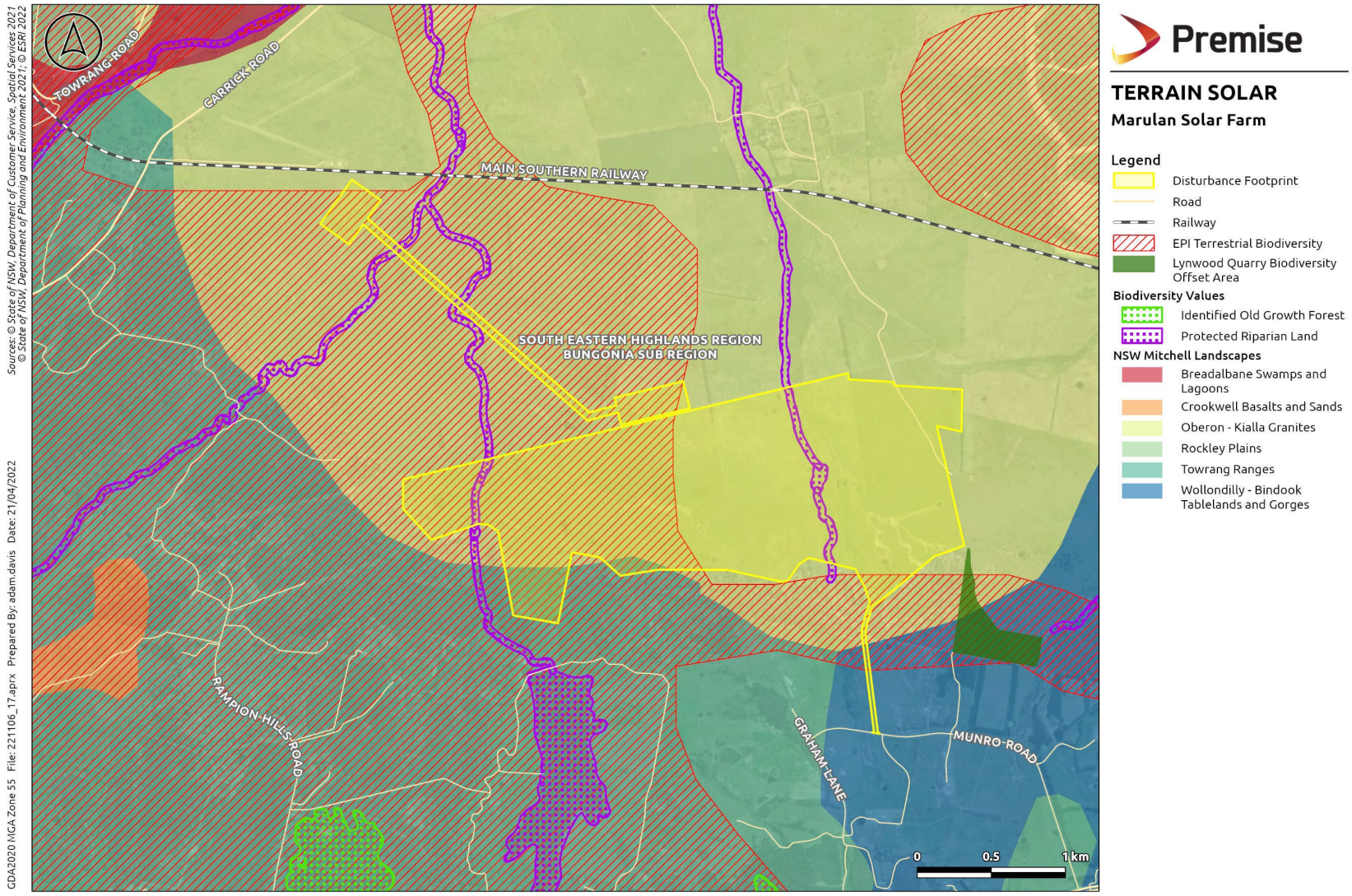


Figure 5. Site Map 3 (Native Vegetation Regulatory Map)

2.1.2 LANDSCAPE CONTEXT

2.1.2.1 Geology and Soils

The Subject Land predominantly sits within the Garland Soil Landscape with the western extent of the site (west of the Narambulla Creek) and part of the proposed access route sits within the Blakney Creek Soil Landscape (Hird, 1991). Soils in the Garland Soil Landscape have formed in-situ from granitic parent rock and form alluvial-colluvial deposits. This Landscape occurs on gently undulating rises and low hills between 600-900 m elevation and is associated with permanent erosional stream channels. Light sandy duplex soils (Yellow Podzolic Soils) occur on the upper slopes, yellow duplex soils with sandy textured topsoils occur on mid and lower slopes, Sandy Red and Yellow Earths occur on sideslopes and Deep Siliceous Sands occur in drainage lines. Yellow Podzolic Soils have moderately erodible topsoil, moderate fertility, pH of 5.5 and have imperfect drainage. This is similar to Yellow Solodic Soils, however, these soils have moderate drainage. In contrast Siliceous Sands are a minor component of this landscape, are acidic, moderately well-drained with moderately fertility and erodibility. The Blakney Creek Soil Landscape soils have also formed in-situ on alluvial-colluvial materials derived from sandstone, greywacke, phyllite, shale, slate and quartzite. This landscape also occurs between 600-900 m elevation in proximity to widely spaced permanent erosional stream channels. Red Podzolic Soils occur on crests and upper sides of hills and are hardsetting with moderate drainage, high topsoil erodibility and low fertility, with a pH of 5.0. Similarly, Yellow Podzolic Soils in this landscape are also hardsetting but occur on sideslopes and footslopes. These soils have moderate drainage, high topsoil erodibility and low fertility with a pH of 6.5.

2.1.2.2 Climate and Elevation

The Subject Land ranges from 620 metres (m) Australian Height Datum (AHD) in the west to 667 m in the central southern extent of the site.

The closest Bureau of Meteorology (BOM) station with long-term climate data is the Goulburn TAFE weather station (070263) with data since 1971 (BOM 2021). It should be noted that the elevation of the Goulburn TAFE weather station is 670 m, slightly higher than the Subject Land. Average annual rainfall is moderately high by Australian standards at 622.7 millimetres (mm). Mean monthly rainfall is mostly consistent throughout the year with peaks in spring and summer. Temperatures are generally mild with cold winters ranging between 1.6-13.9 degrees Celsius (°C), to a maximum of 11.5-28.0°C in summer.

2.1.2.3 Rivers and Streams, karst, caves, crevices, rocks and other geological features

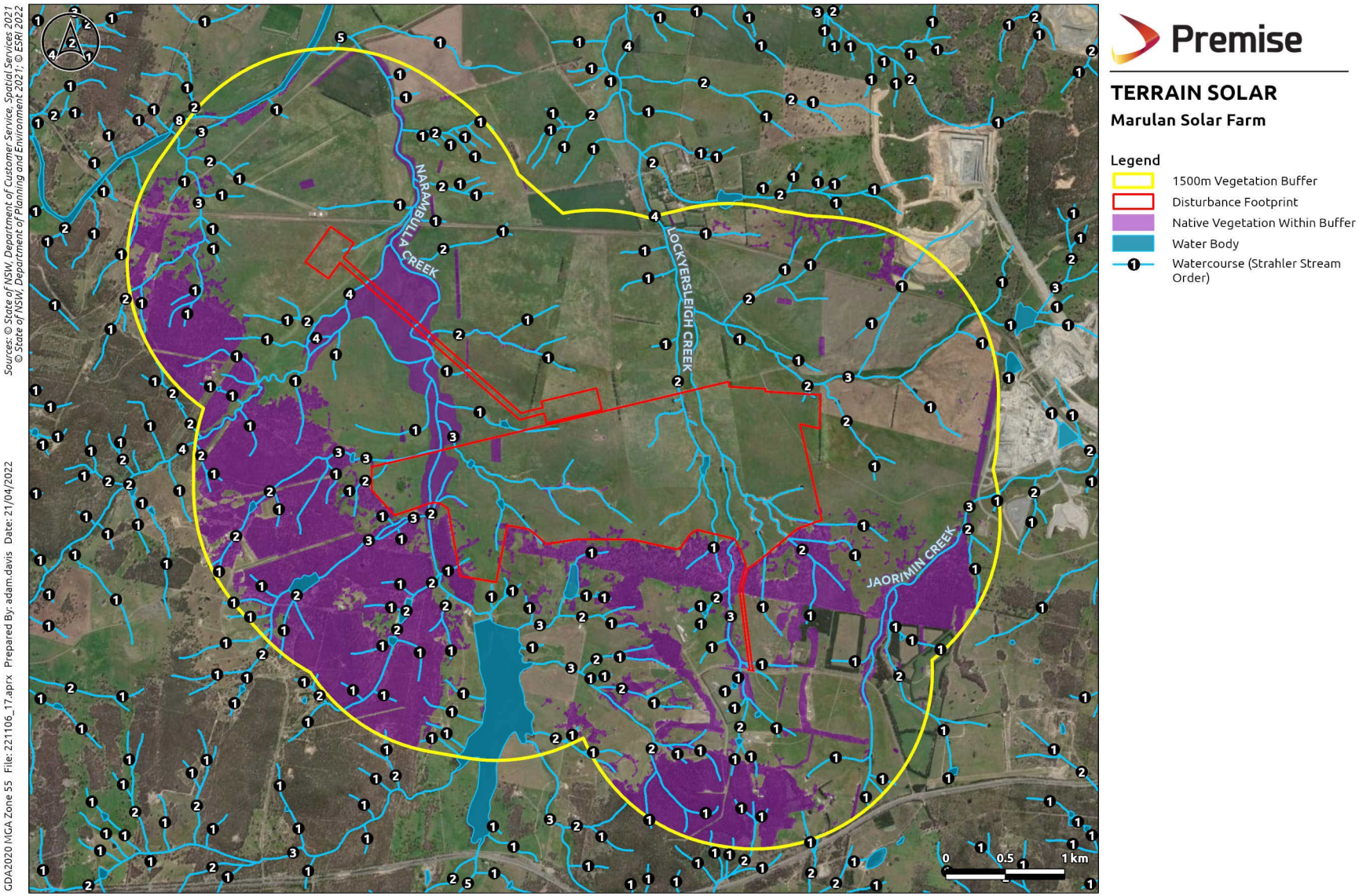
Two creeks transverse the Subject Land. The Narambulla Creek flows southwards across the western extent of the Subject Land, while the Lockyersleigh Creek flows southwards across the eastern extent of the site. Eleven farm dams are also present on the Subject Land. Narambulla Creek and Osborns Creek also transverse the northern Subject Land containing the grid connection disturbance footprint.

No karst, crevices or other geological features occur on the Subject Land. Scattered surface and partially-buried rocks were observed in the south-western extent of the Subject Land, however these areas will be excluded from the solar farm footprint. A small amount of embedded and surface rock is also present along the proposed access route from Munro Road.

2.1.2.4 Areas of Outstanding Biodiversity Value (AOBV)

Two areas are currently designated as AOBV in NSW (NSW DPE, 2022a), and neither of these occur within proximity of the Subject Land.

Figure 6. Location Map (rivers and streams, native vegetation within 1.5km of the Subject Land)



2.1.2.5 Native Vegetation Extent and Habitat Connectivity

The Subject Land is located in a fragmented and highly cleared agricultural district and is bordered by cleared agricultural land with modified pastures to the north and east. Remnant native vegetation on the Subject Land is predominantly restricted to the drainage around the Narambulla Creek, and to scattered trees and small patches with exotic understorey, which are connected to varying degrees with several large but fragmented tracts of remnant woodland which adjoin the Subject Land to the south and west. Higher native vegetation covers at close to natural densities exist along the southern boundary of the Subject Land where the proposed access road alignment will connect to Munro Road. The Bungonia State Conservation Area is located 14 km south-east of the Subject Land and the Pomaderris Nature Reserve is 14km south-west of the Subject Land. Bungonia State Conservation Area has high connectivity in the surrounding landscape as it lies adjacent to Morton National Park, whereas Pomaderris Nature Reserve is surrounded by a mosaic of cleared, semi-cleared and some forested rural lands (NPWS, 1998; OEH, 2014).

The 1.5 km buffer zone around the Subject Land encompasses 3,534.1 ha, of which 939.2 ha (26.6 per cent (%)) is considered native vegetation. This native vegetation includes 919.0 ha of largely intact remnant native woodland and 20.3 ha planted native vegetation. The remainder of the buffer zone is made up of disturbed ground (14.4 ha or 0.4 %), exotic plantings (42.75 ha or 1.2 %) and exotic-dominated pasture grassland (2,537.8 ha or 71.8%) (**Figure 34**).

2.1.2.6 History of Disturbance

The Subject Land occurs on land which is the ancestral country of the Gundangurra nation. It is located within the Lockyersleigh property which was established in 1827 as a land grant to Major Lockyer. Lockyersleigh is one of the oldest privately owned properties in the Goulburn area and has been in the same family since the 1850s. The property was initially cleared of timber for grazing sheep for wool production and has undergone extensive pasture modification. The original vegetation on the Subject Land would have been grassy woodlands.

Most of the current pastures were sown about 15 – 17 years ago after applying 2 – 2.5 tonnes/hectare (t/ha) of lime. Triticale grazing crops have been grown to help reduce weeds. Super phosphate has been applied for over 30 years at a third of the recommended rate. Lime is currently being spread in paddocks outside and east of the Subject Land to reduce the acidity of the surface soil.

Native vegetation considered in this assessment includes remnant native woodland, derived native grassland and native plantings.

2.2 Native Vegetation

2.2.1 REVIEW OF EXISTING INFORMATION

Vegetation mapping using the BioNet Vegetation Classification System has not been completed for this area of the South Eastern Highlands IBRA Bioregion. PCTs described for the South Eastern Highlands IBRA Region were developed using site data from locations further west and north within the Bioregion and therefore the accuracy in applying BioNet PCTs to vegetation assemblages in the Southeast Tablelands is relatively low. Tozer et al. (2010) produced a vegetation classification and associated maps for the state-wide Native Vegetation Mapping Program (NVMP) specifically for this region, which are publicly available via the SEED portal in the *Southeast NSW Native Vegetation Classification and Mapping* dataset (SCIVI VIS_ID 2230). The floristic assemblages described by Tozer et al. (2010) describe vegetation communities based on geographic location, climate, terrain, substrate and vegetation structure. This classification system is not in use as part of

the BAM 2020 but nevertheless provides a more accurate description of floristic assemblages in the region around the Subject Land. On the SEED portal, vegetation is mapped on the Subject Land and immediate surrounds as Tableland Hills Grassy Woodland, Tableland Swamp Flats Forest, Tableland Grassy Box-Gum Woodland, Eastern Tablelands Dry Forest and Tableland Low Woodland (**Figure 7**).

Figure 7. Vegetation Mapping available for the South Coast Region (based on Tozer et al. 2010)

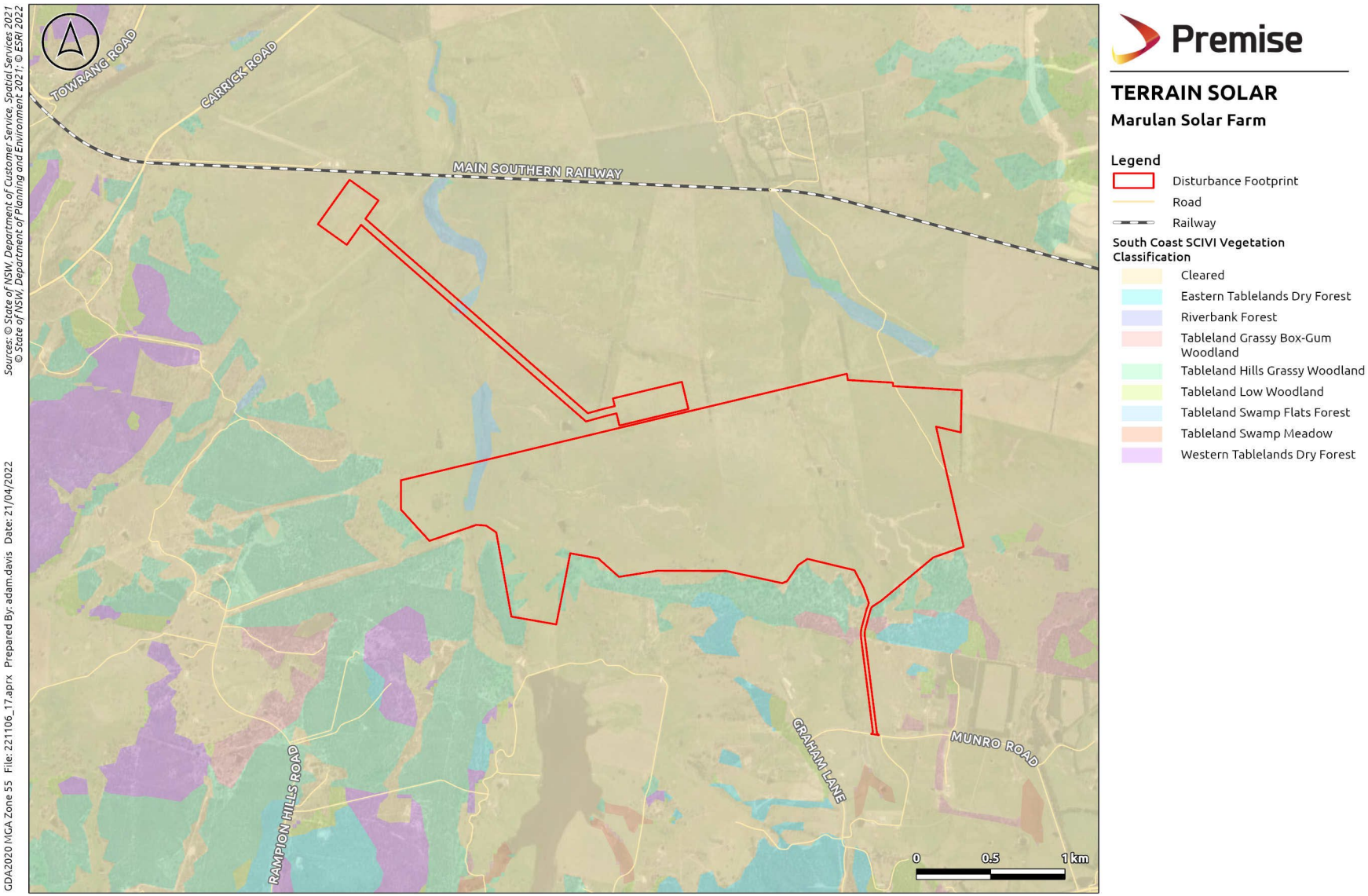
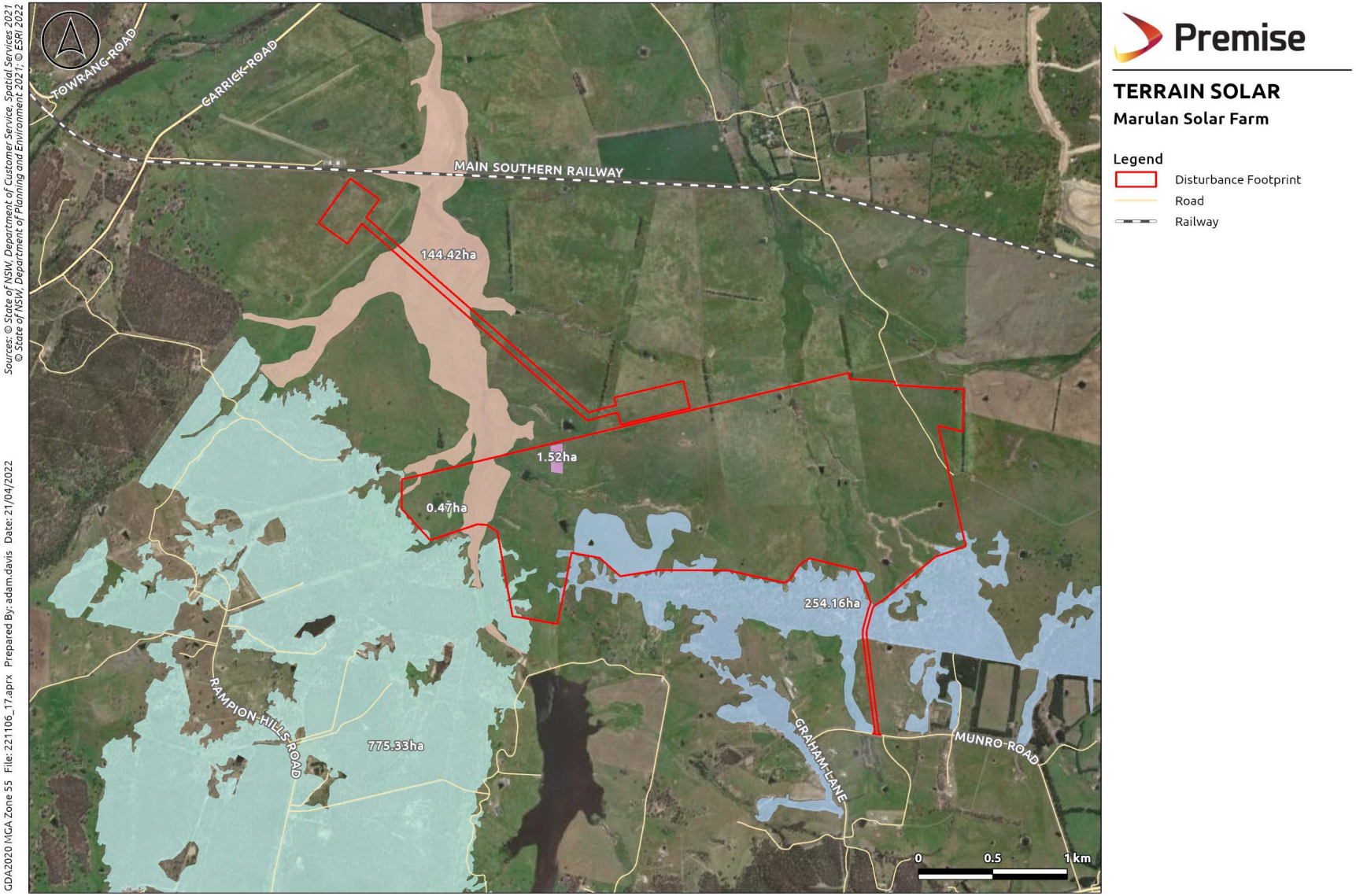


Figure 8. Patch sizes of native vegetation on the Subject Land



2.2.2 VEGETATION SURVEY METHODS

Vegetation surveys were carried out 19th to 24th November 2019, 5th to 8th October 2021 and 18th February 2022. Vegetation sampling included:

- Initial field mapping of vegetation communities conducted in 2019 and revised in October 2021.
- Thirty BAM-compliant Vegetation Integrity (VI) plots, of which 18 were sampled in 2019 and 13 were sampled between the 5th and 8th October 2021, with the addition of one plot in February 2022 (**Figure 9**).
- Scattered tree assessment progressively on all visits.
- Targeted threatened species flora searches in October 2021 and February 2022.

A full species list from each sampling location is included as **Appendix B**.

BAM VI Plots were undertaken in native vegetation remnants, native plantings and exotic-dominated pasture to provide floristic and structural data, as well as to calculate the VI score at each location. In accordance with the prescribed method in BAM Section 4.2, floristic data was collected in a 20 × 20 m (400m^2) sub-plot within a 1000 m^2 quadrat. A list of all vascular plant species was made in the floristic plot with estimates of abundance and ground cover for each species. Functional and structural characteristics were measured in the full 1000m^2 area (50 × 20 m) and consisted of estimates of leaf litter cover on five 1m^2 sub-plots, length of logs in metres and classification of trees into size class with documentation of the presence or absence of hollows in each tree.

Munro Road was examined in May 2022 to determine the applicable PCT of roadside vegetation and assess the potential for native vegetation to be impacted by any required widening.

Figure 9. Vegetation Zones and Sampling on the Subject Land

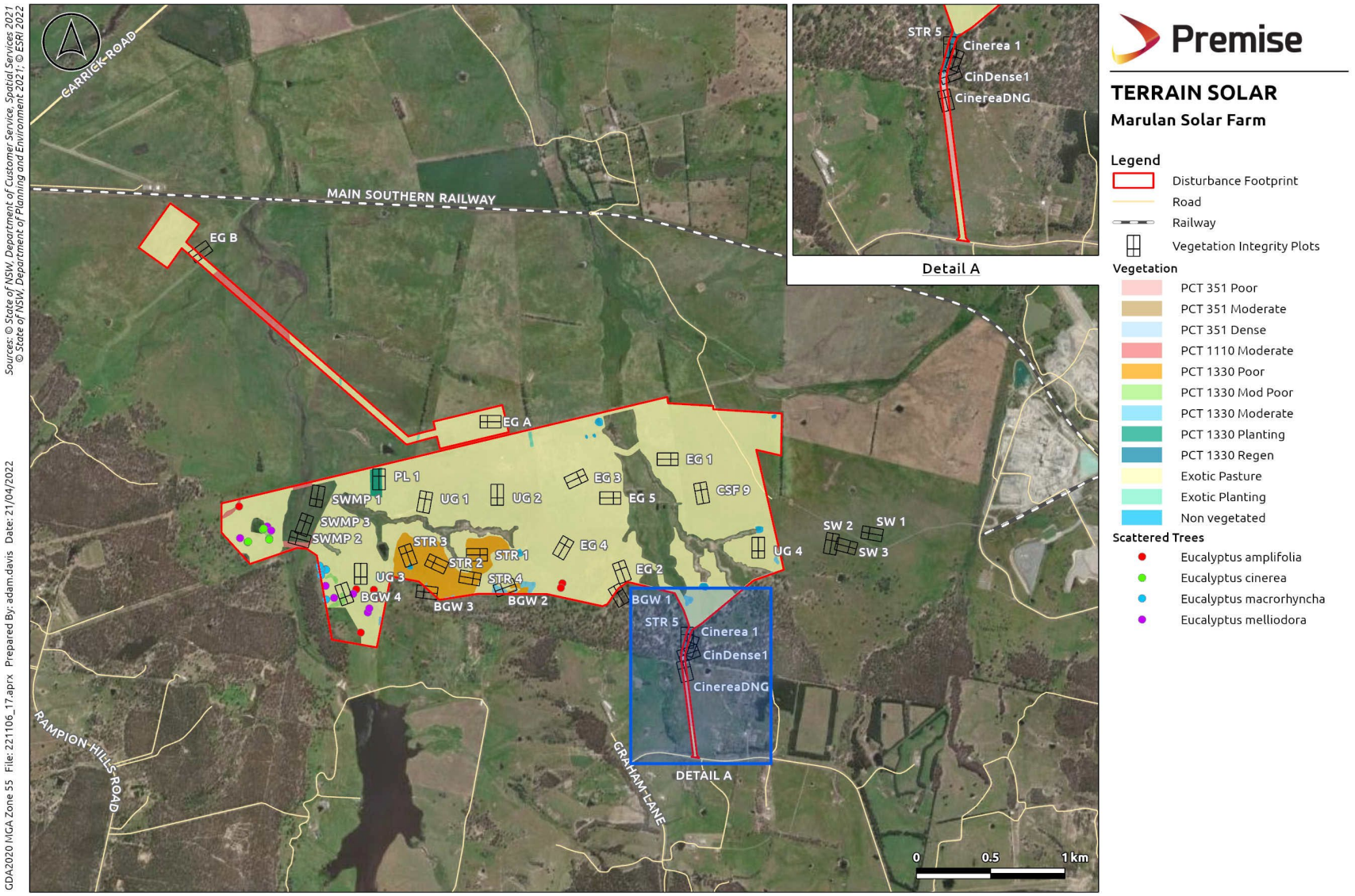
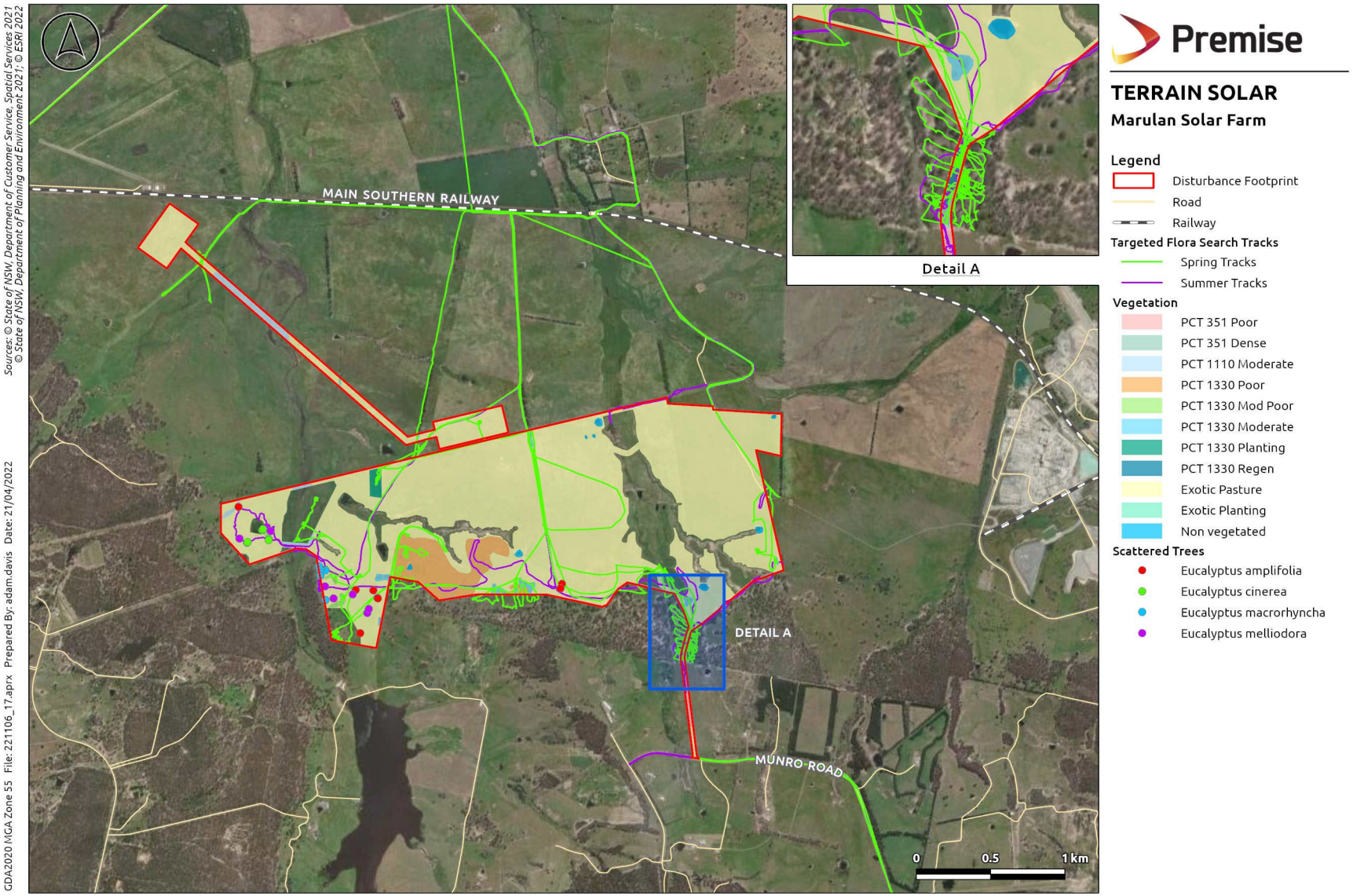


Figure 10. Targeted Threatened Flora Species Search Track Log



The site history of clearing, grazing and pasture modification with fertiliser application has resulted in degradation of the natural grassy composition over a large portion of the Subject Land. Native grasses and forbs have almost entirely been replaced by annual and perennial exotic grasses and legumes for grazing. Native groundcovers have been retained in the drainage around Narambulla Creek, although this area is also degraded through introduction of weeds such as Blackberry (*Rubus fruticosus* agg.) and *Phalaris aquatica*. Native groundcovers have also been retained to an extent on rocky outcrops on the southwestern extent of the site and in the understorey of densely spaced trees within the proposed access route to Munro Road in the southeast. Where trees include a spacing of more than 20 metres, exotic pastures have been sown and fertiliser applied.

Targeted searches were therefore concentrated in areas of the least thinned and disturbed habitats that were considered most likely to support sensitive threatened species. These included rocky outcrops, the Narambulla Creek drainage, the transition zone between the woodland and modified pasture along the southern boundary of the Subject Land, and the native understorey of the proposed access route. These areas were searched in accordance with the current guidelines: *Surveying threatened plants and their habitats: NSW survey guide for the Biodiversity Assessment Method* (DPIE, 2020b) using approximately parallel transects 10 m apart (**Figure 10**). Areas of more disturbed habitat where visibility was higher, and threatened species are less likely to occur, were searched at 20 m intervals. Searches were conducted in October 2021 which encompassed the appropriate survey period for five spring-flowering species and four species which are detectable year-round, and a further search was conducted in February 2022 to search for Austral Toadflax (*Thesium australe*) which is a summer-flowering species. The survey period for *Acacia flocktoniae* is between July and September however this species was not considered likely to occur because it is only found on sandstone which is not applicable to the site, and all shrubs within the Subject Land were identified to species.

Species encountered with uncertain identity were sampled and identified using keys available in PlantNET (2021). No threatened flora species were found on the Subject Land during targeted searches.

2.2.3 PLANT COMMUNITY TYPES

Vegetation on the proposed solar farm area consists of cleared modified pastures, low-lying wetland areas with native grasses and sedges, patches of semi-cleared and remnant native woodland, and one native planting.

Sampling by Premise has identified three PCTs on the Subject Land:

- PCT 351 - Brittle Gum - Broad-leaved Peppermint - Red Stringybark open forest in the north-western part (Yass to Orange) of the South Eastern Highlands Bioregion
- PCT 1110 - River Tussock - Tall Sedge - Kangaroo Grass moist grasslands of the South Eastern Highlands Bioregion (in a number of separated and disconnected patches)
- PCT 1330 - Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion

Using the vegetation classifications developed by Tozer et al. (2010, most of the woodland vegetation on the site conforms to the Tableland Grassy Box-Gum Woodland (Map Unit GW p24) and Tableland Swamp Flats Forest (GW p520).

Assessment of suitable plant community types (PCTs) has considered several factors including landform, soils, dominant overstorey species and structure. Vegetation identified on the Subject Land was compared to the vegetation community details and scientific descriptions for the relevant PCTs using the BioNet Vegetation Classification System (DPIE, 2021a). Justification for the identification of PCTs is given in sections 2.2.4.1 to

2.2.4.3 below. The distribution of patches of connected native vegetation associated with each PCT is shown on **Figure 10**.

2.2.4 VEGETATION COMMUNITY DESCRIPTIONS

Sections 2.2.4.1 to 2.2.4.3 provide descriptions of the PCTs, native plantings and exotic-dominated grasslands on the Subject Land based on field sampling. The descriptions also include justification for the selection of PCTs for the vegetation on the Subject Land.

2.2.4.1 PCT 351 -. Brittle Gum - Broad-leaved Peppermint - Red Stringybark open forest

Description:	Mid-high to tall open forest dominated on the Subject Land by Red Stringybark (*Eucalyptus macrorhyncha*) and Argyle Apple (*Eucalyptus cinerea*) on sandy Yellow Podzolic soils. Shrub layer includes scattered low shrubs, and grasses are patchy with areas of bare soil.
Samples:	CinDense1, CinDNG1.
Trees:	The dominant species are Red Stringybark (*Eucalyptus macrorhyncha*) and Argyle Apple (*E. cinerea*).
Shrubs:	Shrubs in this vegetation type consist of Sifton Bush (*Cassinia sifton*), Heath Wattle (*Acacia brownii*), Peach Heath (*Lissanthe strigosa*) and *Dillwynia* spp.
Vines / Creepers:	Dusky Coral Pea (*Kennedia rubicunda*) and *Isotropis foliosa*.
Ground Covers:	The ground layer in this PCT on the site is relatively patchy and sparse, and includes some exotic species such as A Fescue (*Vulpia* spp.) and Wimmera Ryegrass (*Lolium rigidium*), but is predominantly comprised of native grasses and grass-like plants including Snow Grass (*Poa sieberiana*), Weeping Grass (*Microlaena stipoides*,) Speargrasses (*Austrostipa scabra and A. mollis*), Common Bog-rush (*Schoenus apogon*), *Luzula densiflora*, Wattle Mat-rush (*Lomandra filiformis* subsp. *coriacea*) and Purple Wiregrass (*Aristida ramosa*). Native forbs include Common Raspwort (*Gonocarpus tetragynus*), Forest Goodenia (*Goodenia hederacea*), Common Everlasting (*Chrysocephalum apiculatum*) and Trailing Speedwell (*Veronica plebeia*).
PCTs considered:	BioNet Vegetation Classification System was used to identify the most likely PCT for this vegetation community. The BioNet Vegetation Classification PCT spreadsheet was filtered for PCTs with *E. cinerea* listed as an upper stratum species in the NSW South Eastern Highlands IBRA Region. The Bungonia Subregion was originally used for the search but this provided too few options to consider, so the search was only refined to the regional scale. Five possible PCTs were identified: 344, 351, 653, 731 and 778.
Justification of PCT 351:	PCT 351 is considered the most likely to occur in portions of the Subject Land dominated by Red Stringybark and Argyle Apple. The Subject Land lies within the known distribution of this PCT, which includes the Bungonia subregion of the NSW South Eastern Highlands IBRA Bioregion. This PCT is associated with Footslopes, Gullies and Hills on soils derived from Phyllite , Sandstone , Granite , Siltstone and Shale. The Subject Land includes colluvial and volcanic sediments and the vegetation represented by this community is located on a gently undulating hillslope with sandy Podzolic soils. Some historical clearing has been carried out which is evident in sections where a large proportion of

	the trees have a DBH <30cm. The groundcovers and shrub layer seem to have survived sheep grazing, possibly due to the density of trees and the distance of the site from stock waterpoints. Although this PCT is associated with the northwestern part of the IBRA Bioregion from Yass to Orange, it is considered the best fit to describe the vegetation on the Subject Land due to a combination of a landform element and lithology which is consistent with the site and dominant species. This PCT contains the greatest number of matching species with the site including the dominant overstorey, shrub and groundcover species. Other PCTs were discounted on the basis of not having both co-dominant upper storey species, having no matching or few matching shrub species and few groundcover species. Lithology and landform information was not available for all PCTs.
Equivalent NSW Threatened Ecological Community (TEC):	No equivalent community.
Equivalent Commonwealth TEC:	No equivalent community

Plate 1 - Patch of PCT 351 (CinereaDense)

Plate 2 - PCT 351 in Poor Condition (CinereaDNG)

2.2.4.2 PCT 1330 - Blakely's Red Gum – Yellow Box grassy tall woodland

Description:	Medium-high open woodland with Forest Red Gum (*Eucalyptus tereticornis*), Cabbage Gum (*E. amplifolia*), Yellow Box (*Eucalyptus melliodora*) and Apple Box (*Eucalyptus bridgesiana*). Vegetation on the site is a mix of large scattered trees, regeneration and derived low quality shrubland.
Samples:	BGW 1, BGW 2, BGW 3, BGW 4, STR 1, STR 2, STR 3, STR 4, STR 5, PL1.
Trees:	The dominant tree species on the Subject Land are Forest Red Gum (*E. tereticornis*), Cabbage Gum, (*E. amplifolia*), Yellow Box (*E. melliodora*) and Apple Box (*E. bridgesiana*).
Shrubs:	The long grazing history of the Subject Land has resulted in most of the shrub layer being lost except for Sifton Bush (*Cassinia sifton*)
Vines / Creepers:	No vines or creepers were found in this community on the site.
Ground Covers:	The groundcover on the Subject Land is mostly dominated by exotic grasses including Barley Grass (*Hordeum leporinum*), Soft Brome (*Bromus molliformis*) and Wimmera Ryegrass (*Lolium rigidium*). However, in some areas the grass cover is more native and includes the native grasses Speargrass (*Austrostipa scabra*) and Common Couch (*Cynodon dactylon*). The dominant forbs are Common Peppercress (*Lepidium africanum*), Brazilian Whitlow Wort (*Paronychia brasiliana*), Buchan Weed (*Hirschfeldia incana*) and the native forbs Stonecrop (*Crassula sieberiana*), and Climbing Saltbush (*Einadia nutans*).
PCTs considered:	BioNet Vegetation Classification System was used to identify the most likely PCT for this vegetation community. The BioNet Vegetation Classification database spreadsheet was searched for a combination of Yellow Box, the Grassy Woodland Vegetation Formation, the NSW South Eastern Highlands IBRA Region and the Bungonia Subregion. Six potential PCTs were identified: 654, 834, 1103, 1330, 1334, 1401.
Justification of 1330:	PCT 1330 was chosen as the best fit for areas with *E. tereticornis, E. amplifolia* and *E. melliodora* on the Subject Land. PCT 1330 is a broadly defined community which includes Yellow Box, Red Gum and Apple Box at altitudes of between 500 and 900m. The community on the site fits most closely with the soils, land form, altitude and composition of PCT 1330 with only a substitution of *E. tereticornis* and *E. amplifolia* for *E. blakeyli*. This is consistent with what is known about the distribution of Forest Gum around Goulburn where it intergrades with *E. blakelyi* (Harden,1991) (**Plate 3**).

Equivalent NSW Threatened Ecological Community (TEC):	White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland Critically Endangered Ecological Community
Equivalent Commonwealth TEC:	White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland Critically Endangered Ecological Community

Plate 3 - Patch of PCT 1330

2.2.4.3 PCT 1110 River Tussock - Tall Sedge - Kangaroo Grass moist grasslands

Description:	Wetland area within catchment of Narrambulla Creek with dense growth of grass tussocks and scattered Hawthorn and Blackberry, and White Sally (*Eucalyptus pauciflora*) in an adjoining gully. The mapped impacted areas consist of four non-contiguous patches. Two of these are located on the periphery of the creek line area in the western extent of the site, adjacent to the areas of proposed solar infrastructure, but would not be impacted by the solar infrastructure. Impacts in these areas consist of the planting of potential screening vegetation and impacts associated with construction of an access road and creek crossing. A small disconnected patch is located in the north-western extent of the solar infrastructure area and would be impacted solar panels. The fourth area is located in

	the north of the site and is associated with the installation of the transmission line connecting the substation and switching yard. Detailed design has the potential to minimise the extent of this area.
Sample:	SWMP1, SWMP2 and SWMP3, .
Trees:	*E. pauciflora* is present upslope of the wetland as single scattered trees in the drainage gully. Hawthorn (*Cretageus monogyna*) is also present as scattered trees throughout this PCT on the Subject Land.
Shrubs:	Blackberry (*Rubus anglocandicans*) is growing in scattered dense patches.
Vines / Creepers:	No vines or creepers were recorded.
Ground Covers:	The ground cover is dominated by Tall Sedge (*Carex appressa*) and Tussock (*Poa labillardieri*), with Cranesbill Geranium (*Geranium retrorsum*), Phalaris (*Phalaris aquatica*) and Paspalum (*Paspalum dilatatum*) common. Exotic forbs include Catsear (*Hypochaeris radicata*), Lamb's Tongue (*Plantago lanceolata*) and Chilean Whitlow Wort (*Paronychia brasiliana*). Native forbs include Swamp Dock (*Rumex brownii*), Common Woodruff (*Asperula conferta*) and Rough Raspwort (*Haloragis heterophylla*).
PCTs considered:	BioNet Vegetation Classification System was used to identify the most likely PCT for this vegetation community. The PCT list was refined to include those in the NSW South Eastern Highlands IBRA Bioregion, Bungonia Subregion, a vegetation formation of Grasslands, Forested Wetlands or Freshwater Wetlands and with ground stratum species which included Poa labillardieri and Carex appressa. This produced a list of nine possible PCTs: 1102, 797, 894, 895, 1186, 1256, 1271, 766 and 1110.
Justification on Subject Land:	One of the dominant species in this vegetation community on the Subject Land is *Carex appressa* and this was not present in 1102, 797, 894, 895 or 1256. The native wetland grassland was assigned to PCT 1110 based on the dominance *of Poa labillardierei* on the site, the presence of the co-dominant species *Carex appressa* in the species list as well as many of the less common native forbs, the presence of *Eucalyptus pauciflora* on the drainage line above the wetland, consistent with the description of trees and shrubs as occurring as 'scattered individuals on community margins' in the Scientific Description for this PCT, and the position in the landscape which is on river flats and drainage lines on alluvium (DPIE, 2021a) (**Plate 4**).
Equivalent NSW Threatened Ecological Community (TEC):	No equivalent TEC
Equivalent Commonwealth TEC:	Natural Temperate Grassland of the South Eastern Highlands

Plate 4 - Patch of PCT 1110 (SWMP2)

2.2.5 ENDANGERED ECOLOGICAL COMMUNITIES

Threatened Ecological Communities (TEC) associated with each PCT are identified in the BioNet Vegetation Classification System (DPIE, 2020b). Conformance of the vegetation on the Subject Land with a TEC identified through BioNet was verified by reference to the relevant Final Determination of the NSW Scientific Committee (2020) and information guides (DEE, 2016).

PCT 1330 is associated with the *White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland* Critically Endangered Ecological Community, listed under both the NSW BC Act (DPIE, 2020e) and the Commonwealth EPBC Act. This community is commonly known as Box-Gum Woodland.

PCT 1110 is associated with the *Natural Temperate Grassland of the South Eastern Highlands* Critically Endangered Ecological Community listed under the EPBC Act.

2.2.6 VEGETATION ZONES

Initial habitat and vegetation assessment was used to recommend areas for avoidance of disturbance to reduce the impact on native flora and fauna. Native vegetation was originally classified into ten vegetation zones, based on PCT and vegetation condition. Early in the planning process, a revision was made to the overall Subject Land boundary to reduce the area of woodland within the southern extent of the Subject Land. Two revisions were subsequently made to the construction footprint of the Subject Land, with the establishment and refinement of exclusion zones. These are described in more detail in **Section 3.1**.

After avoidance, the remaining native vegetation to be disturbed during construction and operation of the Solar Farm has been mapped and represents nine vegetation zones. A description of each is included in **Table 6** and includes the following vegetation condition zones on the Subject Land:

- Brittle Gum – Broad-leaved Peppermint – Red Stringybark Open Forest in dense condition (PCT 351) – one patch (0.19 ha)
- Brittle Gum – Broad-leaved Peppermint – Red Stringybark Open Forest in derived condition (PCT 351) – one patch (1.14 ha)
- Blakely's Red Gum – Yellow Box Woodland in moderate condition (PCT 1330) – four patches (2.45 ha)
- Blakely's Red Gum – Yellow Box Woodland in mod-poor condition (PCT 1330) – three patches (1.2 ha)
- Derived Native Grassland in poor condition (PCT 1330) – two patches (20.43 ha)
- Regeneration (PCT 1330) – one patch (0.45 ha)
- Plantings (PCT 1330) – one patch (1.52 ha)
- Exotic Grassland (PCT 1330) – one patch (302.4 ha)
- River Tussock – Tall Sedge – Kangaroo Grass Moist Grasslands in moderate condition – two patches (0.94 ha)

A further two zones have been mapped within the Subject Land which describe areas of non-native vegetation and areas of disturbed ground. These two zones do not generate Ecosystem Credits.

Table 6. Vegetation Zones Identified on the Marulan Solar Farm Footprint

Plant Community Types		Survey Sites	Area of disturbance (ha)	Comments
Number	Condition Zone			
1330	Yellow Box - Blakely's Red Gum grassy woodland (moderate condition)	BGW 1, BGW 2 and BGW 3	2.45	Box Gum Woodland dominated by Forest Red Gum (*Eucalyptus tereticornis*), Cabbage Gum (*E. amplifolia*), Yellow Box (*E. melliodora*) and Argyle Apple (*E. cinerea*) with a mixed understorey.
1330	Yellow Box - Blakely's Red Gum grassy woodland (mod-poor condition)	BGW 4	1.2	Box Gum Woodland usually containing monospecific stands of Yellow Box with a predominantly exotic understorey dominated by Barley Grass (*Hordeum leporinum*).

Plant Community Types		Survey Sites	Area of disturbance (ha)	Comments
Number	**Condition Zone**			
1330	Derived Native Grassland (poor condition)	STR 1, STR 2, STR 3 and STR 4	20.43	Grassland derived from nearby Box Gum Woodland containing Forest Red Gum (*Eucalyptus tereticornis*), Yellow Box (*E. melliodora*) and Argyle Apple (*E. cinerea*). DNG contains Sifton Bush (*Cassinia sifton*) and is dominated by exotic grasses including Soft Brome (*Bromus molliformis*), Chilean Whitlow Wort (*Paronychia brasiliana*) and Rat's-tail Fescue (*Vulpia* spp.).
1330	Exotic Pasture	CSF 9, UG 1, UG 2, UG 3, UG 4, EG 1, EG 2, EG 3, EG 4, EG 5, EG A, EG B, SW 1, SW 2 and SW 3	302.4	Exotic-dominated grassland containing a wide variety of exotic grasses including Cocksfoot (*Dactylis glomerata*), Goose Grass (*Eleusine tristachya*), Soft Brome (*Bromus molliformis*), Fescue (*Festuca* .), Serrated Tussock (*Nasella trichotoma*), African Lovegrass (*Eragrostis curvula*), Barley Grass (*Horderum leporinum*), and Rat's-tail Fescue (*Vulpia myuros*). Native grasses are rare but include Common Couch (*Cynodon dactylon*), Speargrasses (*Austrostipa* spp.), Wallaby Grass (*Rytidosperma* spp.) and Hairy Panic (*Panicum effusum*).
1330	Regeneration	STR 5	0.45	Areas of Cabbage Gum (*Eucalyptus amplifolia*) regeneration containing a mixed understorey dominated by Rat's-tail Fescue (*Vulpia myuros*) and Open Summer-grass (*Digitaria diffusa*).
1330	Plantings	PL 1	1.52	Native plantings including several species of Mallee (*Eucalyptus* spp.), White Sally (*E. pauciflora*), Blackwood (*Acacia melanoxylon*), Mountain Swamp Gum (*E. camphora*), Ribbon Gum (*E. viminalis*), Silver Wattle (*Acacia dealbata*) and Red Box (*E. polyanthemos*), as well as numerous native shrubs and exotic-dominated groundcover.
1110	Native Temperate Grassland (Moderate Condition)	SWMP 1, SWMP 2 and SWMP 3	0.94	Moist grassland dominated by the native grasses Tussock (*Poa labillardierei* subsp. *labillardierei*) and Tall Sedge (*Carex appressa*), as well as the exotics Phalaris (*Phalaris aquatica*), a Fescue (*Vulpia* spp.)

Plant Community Types		Survey Sites	Area of disturbance (ha)	Comments
Number	**Condition Zone**			
				and Blackberry (*Rubus fructicosus agg. Anglocandicans*).
351	Brittle Gum - Broad-leaved Peppermint - Red Stringybark (dense condition)	CinDense 1	0.19	Dense native woodland dominated by the trees Red Stringybark (*Eucalyptus macrorhyncha*) and Argyle Apple (*E. cinerea*), the shrub Sifton Bush (*Cassinia sifton*) and the grasses Weeping Grass (*Microlaena stipoides*), Wattle Matt-rush (*Lomandra filiformis*), Purple Wiregrass (*Aristida ramosa*) and Speargrass (*Austrostipa* spp.). Exotic species are rare with low cover.
351	Brittle Gum - Broad-leaved Peppermint - Red Stringybark (poor condition)	CinereaDNG	1.14	Open derived grassland with no overstorey, a mid-storey of Sifton Bush (*Cassinia sifton*) and groundcover of native and exotic grasses dominated by Paddock lovegrass (*Eragrostis leptostachya*), Weeping Grass (Microlaena stipoides) and *Austrostipa mollis*.
-	Exotic Planting	N/A	0.25	Exotic plantings containing monospecific stands of Pine trees (*Pinus radiata*) along the northern boundary of the Subject Land.
-	Non-vegetated	N/A	1.26	Non-vegetated areas include 10 farm dams.

Vegetation zones are based on PCT and tree density, which is relatively uniform between remnant woodland patches across the Subject Land. Although some variation is evident in VI scores between plots within the zones, it is not considered to be extreme, nor was it possible to differentiate and map relatively small differences in ground cover variation within and between patches in the field. Rather, it is considered that the variation in groundcover has been captured in the plots which provide an accurate representation of the variation encountered in the field.

Figure 8 shows vegetation patches (defined as groups of trees within 100 m of each other). **Figure 9** maps the vegetation zones, individual scattered trees and sample locations.

2.2.7 HIGH THREAT, PRIORITY AND NATIONALLY SIGNIFICANT WEEDS

Eleven introduced flora species recorded on the Subject Land are considered High Threat Exotic weed species by the DPIE (2018b); African Boxthorn (*Lycium ferocissimum*), Greater Beggar's Ticks (*Bidens subalternans*), Great Brome (*Bromus diandrus*), Saffron Thistle (*Carthamus lanatus*), Umbrella Sedge (*Cyperus eragrostis*), African Lovegrass (*Eragrostis curvula*), Serrated Tussock (*Nassella trichotoma*), Paspalum (*Paspalum dilatatum*), Sweet Briar (*Rosa rubiginosa*), Blackberry (*Rubus fruticosus agg.*) and Sheep Sorrel (*Rumex acetosella*). Three of these species are listed as Priority Weeds for the Mid-western Regional Council LGA under the NSW *Biosecurity Act 2015* (DPIE, 2020): African Boxthorn, Serrated Tussock and Blackberry. These three HTE species

are also considered Weeds of National Significance as listed by the Australian Weeds Committee of the Australian Government (2012).

2.2.8 SCATTERED TREES

A total of 16 scattered trees were recorded on the Subject Land. Tree species, Diameter at Breast Height (DBH) and hollow size are listed in **Table 7**. Scattered Trees were classified under Category B of the BAM (2020) that is: *have a DBH of greater than or equal to 5 cm and are located more than 50 m away from any living tree that is greater than or equal to 5 cm DBH, and the land between the scattered trees is comprised of vegetation that are all ground cover species on the widely cultivated native species list, or exotic species or human-made surfaces or bare ground.*

Two additional lone trees were mapped but these contain hollows which BMS (2022) considers potential habitat for the Glossy Black Cockatoo and threatened owls. To account for threatened species habitat the canopy of these two trees was mapped and included in the area of PCT 1330 Mod-Poor in the BAM calculator.

Scattered Trees on the Subject Land are located greater than 50 metres from one another, in a matrix of exotic-dominated pasture with a VI score of less than the minimum threshold for offsetting (<15).

Table 7. Tree Sizes and Presence of Hollows in Remnant Scattered Trees

Species	PCT	DBH (cm)	Status	Hollows <5 cm	Hollows 5-20 cm	Hollows 20 cm
Eucalyptus melliodora	1330	83	Stag	-	7m above ground	-
Eucalyptus melliodora	1330	117	Living	--	-	-
Eucalyptus melliodora	1330	103	Living	-	-	-
Eucalyptus melliodora	1330	105	Living	-	-	-
Eucalyptus melliodora	1330	82	Living	-	-	-
Eucalyptus melliodora	1330	101	Stag	6m above ground	7m above ground	-
Eucalyptus amplifolia	1330	82	Living	-	-	-
Eucalyptus amplifolia	1330	122	Living	-	-	-
Eucalyptus amplifolia	1330	136	Living	-	-	-
Eucalyptus amplifolia	1330	87	Living	-	-	-
Eucalyptus amplifolia	1330	143	Living	-	-	-
Eucalyptus macrorhyncha	351	83	Stag	7m above ground	-	-
Eucalyptus macrorhyncha	351	56	Living	-	-	-
Eucalyptus macrorhyncha	351	73	Living	7m above ground	-	-
Eucalyptus cinerea	351	38	Living	-	-	-
Eucalyptus cinerea	351	30	Living	-	-	-

2.3 FAUNA SURVEY

Fauna surveys were undertaken by Biodiversity Monitoring Services (BMS) targeting threatened species on the Subject Land and assessing habitat potentially on the site (BMS, 2022). The fauna investigations included:

- Desktop review of potential threatened species to identify which would require targeted surveys in accordance with the BAM.
- Targeted fauna surveys for suitable species between December 2021 and February 2022 in accordance with State and Commonwealth Guidelines (i.e. timing and duration of surveys, methods to locate species and methods to identify potential habitat).
- Described and mapped habitat features for threatened fauna species that could potentially occur on the Subject Land.

The BMS report is provided in **Appendix E**.

2.3.1 FAUNA SURVEY METHODS

The Study Area was visited between 13th and 15th December 2021 to deploy cameras and conduct targeted bird surveys, spotlighting, call playback, Koala SAT survey and habitat assessment. The Study Area was visited again between 10th and 14th January 2022 to check and rebait cameras, and for further target fauna survey including aural-visual frog searches, diurnal bird survey and target microbat survey. A third site visit was conducted 10th February 2022 to collect cameras and conduct diurnal bird survey, which coincided with a site inspection by DPE in relation to categorisation of Striped Legless Lizard habitat. A fourth visit was conducted between the 22nd and 24th February 2022 to complete spotlighting surveys for arboreal mammals in areas cameras could not be deployed due to lack of access across wet boggy ground, deep grass and access issues with neighbours. Some species could not be surveyed for due to project timing.

Survey effort is summarised in **Table 8** and shown in **Figure 11** (BMS 2022).

Table 8. Total Fauna Survey Effort

Survey technique	No. surveys (Dec 2021: BMS, 2022	No. surveys (Jan 2022: BMS, 2022	No. surveys (Feb 2022: BMS, 2022
Diurnal Bird Survey	3 days (while traversing site)	4 afternoons, 1 morning (while traversing site)	1 morning, 1 afternoon (while traversing site)
Call Playback	1	-	-
Hand Spotlighting	1	-	3
Vehicle Spotlighting Transects	-	-	-
Passive Infrared (PIR) Cameras	4	4	4
SAT survey	3	-	-
Ultrasonic Bat Detection (Anabat)	1 detector night, 1 location	7 detector nights, 2 locations	-
Frog Searches	2 hours	3 hours per night over 4 nights	-

Survey technique	No. surveys (Dec 2021: BMS, 2022	No. surveys (Jan 2022: BMS, 2022	No. surveys (Feb 2022: BMS, 2022
		3 hours per afternoon (4 days) also spent searching for basking locations and assessing habitat	

Figure 11. BMS SAT Survey Locations, Cameras, Anabats and Call Playback

2.3.1.1 Diurnal Birds:

Bird surveys included three surveys across three summer visits (nine days). These were conducted while traversing the whole site, rather than at discrete locations and focussed on treed and creek line areas. Diurnal bird surveys conducted during the summer inspections targeted the Square-tailed Kite (*Lophoictinia isura*), White-bellied Sea Eagle (*Haliaeetus leucogaster*) and Gang-gang Cockatoo (*Callocephalon fimbriatum*). Due to project timing the Little Eagle (*Hieraaetus morphnoides*), Glossy Black-Cockatoo (*Calyptorhynchus lathami*), Barking Owl (*Ninox connivens*), Masked Owl (*Ninox connivens*) and Powerful Owl (*Ninox strenua*) were not targeted during fauna surveys. Of the three threatened owl species, the Barking Owl (*Ninox connivens*) could have been surveyed for in December, but nocturnal access to large areas of site was not possible, however call playbacks were conducted. Call playbacks were also used to target the Bush Stone-curlew (*Burhinus grallarius*) and spotlighting was used to target nocturnal birds. The Biodiversity and Conservation Division (BCD) within DPIE confirmed that the Subject Land is not within a mapped important area for either the Regent Honeyeater or Swift Parrot.

2.3.1.2 Arboreal Mammals:

Baited PIR camera surveys were deployed for 8 weeks, rebaiting every 4 weeks. Due to lack of vehicle access across the site, BMS only deployed four cameras along the southern access road alignment. PIR cameras targeted Squirrel Gliders (*Petaurus norfolcensis*), Koala (*Phascolarctos cinereus*), Greater Glider (*Petauroides volans*) and Eastern Pygmy-possum (*Cercartetus nanus*). Arboreal mammals were also assessed using on foot spotlighting sessions. Searches for tree hollows, trunk scratches and scats were carried out as part of habitat assessments. Additionally, Koalas were assessed using SAT survey, while Squirrel Gliders (*Petaurus norfolcensis*) were also assessed using call playbacks.

2.3.1.3 Terrestrial Mammals:

Evidence of terrestrial animals was searched for across the Subject Land. This included spotlighting and searches for scats.

2.3.1.4 Bats:

Habitat constraints for Large Bent-winged Bat (*Miniopterus orianae oceanensis*), Large-eared Pied Bat (*Chalinolobus dwyeri*) and Grey-headed Flying-fox (*Pteropus poliocephalus*) were assessed. The Southern Myotis (*Myotis macropus*) were surveyed for via ultrasonic detection over two farm dams near the southern boundary of the Subject Land.

2.3.1.5 Reptiles and Frogs:

Habitat assessment was undertaken for the Pink-tailed Legless Lizard (*Aprasia parapulchella*), Striped Legless Lizard (*Delma impar*) and Green and Golden Bell Frog (*Litoria aurea*). Aural-visual surveys were also conducted to assess frog presence.

2.3.2 FAUNA HABITAT

General habitat features recorded on the Subject Land that apply to the potential credit species include:

- Live paddock trees with up to approximately 150 cm DBH
- Dead paddock trees (stags)
- Flowering eucalypts – White Box (*Eucalyptus albens*), Yellow Box (*Eucalyptus melliodora*) and Red Gum (*Eucalyptus amplifolia*,)

- Koala feed species including Forest Red Gum (*Eucalyptus tereticornis*), Blakely's Red Gum (*Eucalyptus blakelyi*), Cabbage Gum (*Eucalyptus amplifolia*), Yellow Box (*Eucalyptus melliodora*), Apple Box (*Eucalyptus bridgesiana*), White Sally (*Eucalyptus pauciflora*) and Red Stringybark (*Eucalyptus macrorhyncha*) – all considered feed species in the Central and Southern Tablelands Koala Management Area under Appendix A of the Koala Habitat Protection Guideline (DPIE, 2021d)
- Trees with hollows ranging from 5 cm – 30 cm in diameter, greater than 4 m above the ground
- Small raptor nests (but no medium-large nests)
- 4 farm dams within Study Area, 11 farm dams proximal but outside footprint, two eroded ephemeral creekline systems, and one large swampy creek line. The creek lines have been excluded from the Subject Land for the most part, but a road crossing of the swampy creek line will be required. One large waterbody exists south of the Subject Land. Most dams and creek lines contain emergent vegetation that form suitable habitat for frogs.
- Small areas of embedded rocks, surrounded by a mix of native and exotic grasses
- Areas of native spear grass (*Austrostipa* spp.), Kangaroo Grass (*Themeda triandra*), Wallaby Grass (*Rytidosperma* spp.) and Red Grass (*Bothriochloa* spp.), along with scattered serrated tussock (*Nassella trichotoma*) and Phalaris (*Phalaris aquatica*).

2.3.3 FAUNA SPECIES

During the 2021-2022 fauna surveys, 160 invertebrate fauna species were recorded, including 106 bird (plus 4 exotic), 23 mammal (plus 10 exotic), 8 amphibian and 13 reptiles (Appendix E).

Two threatened species (Diamond Firetail and Large Bent-winged Bat) were recorded during site investigations. One possible Squirrel Glider sighting was also recorded. However, this is considered more likely to be a Sugar Glider.

2.4 THREATENED SPECIES

The BAM recognises two categories of threatened species (DPIE, 2020a):

- Ecosystem Credit species (i.e. species predicted to be present based on the PCTs present on the Subject Land); and/or
- Species Credit species (i.e. species that cannot be reliably predicted by PCTs).

Threatened species that are Ecosystem Credit species and/or Species Credit species are pre-determined in the BAM Credit Calculator and BioNet Threatened Biodiversity Data Collection (TBDC) (DPIE, 2020b).

2.4.1 DATA SOURCES

Five data sources were used to compile lists of threatened flora and fauna that may potentially occur on the Subject Land (**Table 9** and **Table 10**):

- BAM Credit Calculator – Lists of ecosystem credit species and species credit species generated by the BAM Credit Calculator using inputs on IBRA subregion, site location and vegetation integrity (DPIE, 2021e).
- The NSW BioNet Threatened Biodiversity Data Collection (TBDC) (DPIE, 2020b) – Provides data on PCTs, habitats and habitat constraints for threatened species.
- BioNet website – Searches of the NSW Atlas of Wildlife (DPIE, 2021b)., NSW State Forests, Australian Museum and Royal Botanic Gardens Sydney databases. The search area comprised a 20 × 20 km square

centred on the Subject Land. This search returned a list of threatened species known to occur within the search area.

- Commonwealth Department of Agriculture, Water and the Environment (DAWE) website – Protected Matters Search Tool (PMST) (DAWE, 2021a). 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. The list also includes species which are protected under the Fisheries Management Act (1994).

The BAM Credit Calculator returned 31 ecosystem credit species: all fauna; and 29 species credit species: eight flora and 21 fauna species (**Table 9** and **Table 10**). Five of the fauna species are dual ecosystem and species credit species. All species returned by the BAM Credit Calculator require assessment of habitat suitability on the Subject Land (See **Appendix C**).

The BioNet database search returned records of one fauna species, Eastern Coastal Free-tailed Bat (*Micronomus norfolkensis*) that was not identified by the BAM Credit Calculator. Whereas, the PMST database search returned records of two flora species, Basalt Peppercress (*Lepidium hyssopifolium*) and Cotoneaster Pomaderris (*Pomaderris cotoneaster*), and two fauna species, Giant Burrowing Frog (*Heleioporus australiacus*) and Greater Glider (*Petauroides volans*), that were not identified by the BAMC. The potential for habitat of these species to occur on the site is also assessed in **Table 9** and **Table 10**, and these species were manually added to the BAMC as Species Credit species.

The PMST search returned 21 potentially occurring flora species and 31 fauna species, including one invertebrate, two fish species, 18 birds (9 of which are migratory) and 7 mammals.

A total of 25 threatened flora and 62 threatened fauna species have been identified via database and literature searches as potentially occurring on the Subject Land (**Table 9** and **Table 10**).

Table 9. Threatened Flora Species Returned by Database and Literature Searches of the Surrounding Region

Scientific Name	Common Name	Data Source				Sensitivity to Loss[2]	BRW[2,5]	Conservation Status		Likelihood to be on subject land[7]	Assessment of Likelihood
		BAM C[1]	TBD C[2]	BioNet[3]	PMST[4]			BC Act	EPBC Act		
Eucalyptus aggregata	Black Gum	Sp	Sp	✓	✓	Moderate	2.00	V	V	Nil	Species is distributed across NSW Central and Southern Tablelands on alluvial soils, on poorly-drained flats adjacent to creeks and rivers (DPIE 2021f). Black Gum has been recorded 2 km east of the Subject Land (DPIE 2021c). Although poorly-drained areas exist on the Subject Land, these are usually treeless swampy areas while the remaining area contains moderately drained soils on undulating slopes. Unlikely to occur.
Eucalyptus macarthurii	Paddys River Box	Sp	Sp	✓	✓	High	2.00	E	E	Nil	Species has a restricted distribution between Moss Vale District and Kanangra-Boyd National Park (DPIE 2021f). It occurs in grassy woodland on fertile soils on broad flats and has been recorded 2 km east and 3.7 km south-east of the Subject Land (DPIE 2021c). Unlikely to occur on Subject Land which contains undulating slopes with low to moderate fertility. Suitable flat areas have been cleared for grazing.
Persoonia mollis subsp. revoluta	-	-	Sp	✓	-	Moderate	2.00	V	-	Nil	Endemic to NSW, this species primarily occurs on deep sandy soils between Mittagong, Paddys River and High Range at 600-800 m elevation in areas with 700-900 mm annual rainfall (DPIE 2021f). Species has been recorded south-west of the Subject Land along the Hume Highway. However, this record is an outlier (DPIE, 2021c). Suitable elevation occurs on the Subject Land, but species is unlikely to occur due to clearing and lower annual rainfall.
Acacia bynoeana	Bynoe's Wattle	-	Sp	-	✓	High	2.00	E	V	Nil	Species occurs in small populations across 30 locations between the Hunter District to the Southern Highlands (DPIE 2021f). It inhabits heath or dry sclerophyll forest on sandy soils preferring open areas associated with Red Bloodwood (*Corymbia gummifera*), Scribbly Gum (*Eucalyptus haemastoma*) and Saw Banksia (*Banksia serrata*) which do not occur on the Subject Land. Species has not been recorded in the Marulan area and is unlikely to occur.
Acacia flocktoniae	Flockton Wattle	Sp	Sp	-	-	High	2.00	V	V	Nil	Erect shrub found only in the Southern Blue Mountains (at Mt Victoria, Megalong Valley and Yerranderie) (DPIE, 2021f). Species grows at 500-100 m (ASL) in areas with an average annual rainfall of 800-1200 mm within dry sclerophyll forest on low nutrient soils

Scientific Name	Common Name	Data Source				Sensitivity to Loss[2]	BRW[2,5]	Conservation Status		Likelihood to be on subject land[7]	Assessment of Likelihood
		BAM C[1]	TBD C[2]	BioNet[3]	PMST[4]			BC Act	EPBC Act		
											derived from sandstone (DAWE, 2021b). Associated species include Straight Wattle (*Acacia stricta*) and Prickly Shaggy Pea (*Podolobium ilicifolium*). Although the Subject Land contains suitable elevation, the soils are granite derived and average annual rainfall is much lower than required by this species. Species is also unlikely to occur due to its restricted range.
Caladenia tessellata	Thick-lipped Spider-orchid	Sp	Sp	-	✓	Very High	3.00	E	V	Nil	Within NSW, species is known to occur within the Hawkesbury-Nepean, Hunter-Central Rivers, Southern Rivers and Sydney Metro Catchment Management Regions (DAWE, 2021b). Species grows in grassy sclerophyll woodland on clay loam or sandy soils (DPIE, 2021f). Species has not been recorded near Marulan and is unlikely to occur on the Subject Land due to disturbance through clearing and grazing.
Commersonia prostrata	Dwarf Kerrawang	Sp	Sp	-	✓	High	2.00	E	E	Nil	In NSW, most known sites occur near Tallong, Penrose and Goulburn on the Southern Tablelands (DAWE, 2021b). Dwarf Kerrawang occurs on sandy soils in a variety of habitats and is associated with Blady Grass (*Imperata cylindrica*), Spreading Rope-rush (*Empodisma minus*) and Prickly Tea-tree (*Leptospermum continentale*) which are absent from the Subject Land (DPIE, 2021f). Although this species has been recorded numerous times between Marulan and Bundanoon, it is unlikely to be present on the Subject Land due to the lack of associated species, and the vulnerability of Dwarf Kerrawang to grazing, trampling and weed invasion.
Dodonaea procumbens	Trailing Hop-bush	-	Sp	-	✓	Moderate	1.50	V	V	Nil	In NSW, species is restricted to a small area between Tarago and Bungee Peak in the Southern Tablelands (DAWE, 2021b). It occurs in Natural Temperate Grassland and eucalypt woodland containing Snow Gum (*Eucalyptus pauciflora*) on sandy-clay soils near shale outcrops, growing in open bare patches (DPIE, 2021f). The species has not been recorded north of Tarago and is unlikely to occur on the Subject Land as it is sensitive to heavy grazing and no shale outcrops occur.
Genoplesium baueri	Yellow Gnat-orchid	-	Sp	-	✓	Very High	3.00	E	E	Nil	Species occurs between Ulladulla and Port Stephens in dry sclerophyll forest and moss gardens over sandstone (DPIE 2021f). Yellow Gnat-orchid is unlikely to occur on the Subject Land which

Scientific Name	Common Name	Data Source				Sensitivity to Loss[2]	BRW[2,5]	Conservation Status		Likelihood to be on subject land[7]	Assessment of Likelihood
		BAM C[1]	TBD C[2]	BioNet[3]	PMST[4]			BC Act	EPBC Act		
											contains granite parent material and has experienced heavy grazing in the past.
Haloragis exalata subsp. exalata	Wingless Raspwort	-	Sp	-	✓	Moderate	1.50	-	V	Nil	Occurs across 4 widely scattered locations in eastern NSW including the Central Coast, South Coast and North Western Slopes (DPIE 2021f). Species inhabits protected, shaded damp localities in riparian habitat. Although swampy areas existing on the Subject Land, these are unshaded and are exposed to grazing and weed invasion.
Kunzea cambagei	-	-	Sp	-	✓	High	2.00	V	V	Nil	Predominantly occurs in the western and southern extents of the Blue Mountains in four main populations near Berrima, Loombah Plateau, Oberon-Colong Stock Route and Wanganderry Plateau (DPIE 2021f). Species inhabits damp, sandy soils in wet heath or mallee open scrub on sandstone outcrops at high altitudes. Subject Land contains granite parent rock and moderately to poorly drained soils. Species has not been recorded near Marulan and is unlikely to occur on the site.
Lepidium hyssopifolium	Basalt Peppercress	Sp	Sp	-	✓	High	2.00	E	E	Low	In NSW, species is only known to occur from near Bathurst and Bungendore (DAWE, 2021b). Basalt Peppercress occurs in grassy woodland and grasslands on open, bare ground with limited competition from other plants. Species has recently been recorded in weed-infested areas of heavy modification, high degradation and high soil disturbance such as road and rail verges or within small reserves on agricultural land (DAWE, 2021b). Species may occur along the access road along the southern extent of the site.
Leucochrysum albicans subsp. tricolor	Hoary Sunray	Sp	Sp	-	✓	High	2.00	-	E	Low	In NSW, Hoary Sunray occurs at high elevations in woodland and open forest communities in the area bounded by Goulburn, Albury and Bega (DAWE, 2021b). The species grows on relatively heavy soils and can be found in natural or semi-natural vegetation with and without grazing (species is unpalatable to stock) (DAWE, 2021b). Associated species include Yellow Box (*Eucalyptus melliodora*) which occur across the south-western extent of the Subject Land. The species has been recorded 3.5 km east and 3.8 km south-east of the Subject Land (DPIE 2021c).
Phyllota humifusa	Dwarf Phyllota	-	Sp	-	✓	High	2.00	V	V	Nil	Dwarf Phyllota is distributed across the Bimlow Tableland, west of Mittagong and near Paddys River in dry sclerophyll forest with deep

Scientific Name	Common Name	Data Source				Sensitivity to Loss[2]	BRW[2,5]	Conservation Status		Likelihood to be on subject land[7]	Assessment of Likelihood
		BAM C[1]	TBD C[2]	BioNet[3]	PMST[4]			BC Act	EPBC Act		
											sandy soils or gravely loams over sandstone (DPIE 2021f). Associated species include Brittle Gum (*Eucalyptus mannifera*), Narrow-leafed Peppermint (*Eucalyptus radiata*) and Sydney Peppermint (*Eucalyptus piperita*) which are absent from the Subject Land. Closest recorded sightings are south of Hume Highway near Bundanoon. The species is unlikely to occur on the Subject Land due to its sensitivity to weed invasion and disturbance through grazing.
Pimelea axiflora subsp. pubescens	Bungonia Rice-flower	-	Sp	-	✓	Very High	3.00	E	E	Nil	Endemic to NSW, this species is only known to occur as a single population in Bungonia State Conservation Area, south-east of Goulburn (DPIE 2021f). Species is highly unlikely to occur on the Subject Land due to its restricted distribution and the absence of limestone cliff edges and outcrops.
Pomaderris cotoneaster	Cotoneaster Pomaderris	Sp	Sp	-	✓	High	2.00	E	E	Low	Species has a disjunct distribution near Nungatta, Tantawangalo, Tallong, Bungonia State Conservation Area, Yerranderie, Kanangra-boyd National Park, Canyonleigh and Morton National Park (DPIE 2021f). Species grows on shallow soils with outcropping rock, often associated with cliff lines or riverbanks (DAWE, 2021b). Species is also known to occur in dry, shrubby open forest on north-west to south-west facing slopes. Species may utilise the shrubby woodland along the access road.
Pomaderris delicata	Delicate Pomaderris	-	Sp	-	✓	Very High	3.00	CE	CE	Nil	Species is only known to occur across two sites between Goulburn and Bungonia and south of Windellama in dry open forest dominated by Silvertop Ash (*Eucalyptus sieberi*) with a dense she-oak understorey (DPIE 2021f). Suitable vegetation composition and structure are absent from the Subject Land and species has not been recorded near Marulan.
Pomaderris pallida	Pale Pomaderris	-	Sp	-	✓	Moderate	3.00	V	V	Nil	In NSW, species occurs along the Murrumbidgee, in Tinderry Nature Reserve, along the Queanbeyan River, Kydra Trig and the Shoalhaven River (DAWE, 2021b). Species inhabits shallow, pale brown sandy loams over granite rocks along the plateau edge and very steep upper slopes of cliffs of river valleys growing in near-monospecific stands in shrubland (DAWE, 2021b). Associated shrubland species include Boxthorn (*Bursaria spinosa*), Juniper Grevillea (*Grevillea juniperina*), Red-stemmed Wattle (*Acacia rubida*) and Burgan (*Kunzea ericoides*). Species is unlikely to utilise the

Scientific Name	Common Name	Data Source				Sensitivity to Loss[2]	BRW[2,5]	Conservation Status		Likelihood to be on subject land[7]	Assessment of Likelihood
		BAM C[1]	TBD C[2]	BioNet[3]	PMST[4]			BC Act	EPBC Act		
											Subject Land due to its restricted distribution, the absence of associated species and suitable rocky habitat.
Rhizanthella slateri	Eastern Australian Underground Orchid	-	Sp	-	✓	Very High	3.00	E	E	Nil	Within NSW, species is known to occur in fewer than 10 locations including near Bulahdelah, Watagan Mountains, Blue Mountains, Wiseman's Ferry, Agnes Banks and Nowra (DPIE 2021f). This species grows in eucalypt forest almost completely below the soil surface and is unlikely to occur on the Subject Land due to soil disturbance from grazing. Closest recorded sightings are near Nowra.
Rutidosis leptorhynchoides	Button Wrinklewort	-	Sp	-	✓	High	2.00	-	E	Nil	Perennial plant restricted within NSW to Goulburn, Michelago and Canberra-Queanbeyan area in Box-Gum Woodland and derived native grassland (DPIE 2021f). It is known from <30 sites occurring in grassland and woodland (DAWE, 2021b). Grows on shallow soils with red-brown clay loams but is highly susceptible to grazing. Unlikely to occur on the Subject Land due to presence of grazing.
Senecio macrocarpus	Large-fruit Fireweed	-	Sp	-	✓	Moderate	2.00	-	V	Nil	Perennial endemic to south-eastern Australia predominantly in Victoria and South Australia, with one population occurring near Gundaroo (DAWE, 2021b). Species grows in partly cleared dry forests and box-gum woodlands which transition to Brittle Gum Forest, with a relatively undisturbed understorey dominated by Kangaroo Grass (*Themeda triandra*). Suitable habitat may occur along the access road. However, this area contains very low covers of Kangaroo Grass. Species is also highly unlikely to occur on the Subject Land due to sensitivity to habitat disturbance including grazing, competition and weed invasion (Sinclair 2010).
Solanum celatum	Solanum celatum	-	Sp	✓	-	High	2.00	E	-	Nil	Grows in rainforest clearings or in wet sclerophyll forests, except for the disjunct population at Bungonia State Recreation Area where it occurs in low, dry woodland (DPIE 2021f). Requires fire to germinate seed which also kills the adult plant. Recorded from disturbed margins and clearings, between Wollongong and Bungonia. Unlikely to occur due to unsuitability of habitat.
Swainsona sericea	Silky Swainson-pea	Sp	Sp	-	-	Moderate	2.00	V	-	Low	Species has been recorded from the Northern Tablelands to the Southern Tablelands and further inland on the slopes and plains (DPIE, 2021f). Silky Swainson-pea is found in Natural Temperate

Scientific Name	Common Name	Data Source				Sensitivity to Loss[2]	BRW[2,5]	Conservation Status		Likelihood to be on subject land[7]	Assessment of Likelihood
		BAM C[1]	TBD C[2]	BioNet[3]	PMST[4]			BC Act	EPBC Act		
											Grassland and Box-Gum Woodland sometimes in association with Cypress-pines (*Callitris* spp.). The species has some potential to occur in woodland areas on the site.
Thelymitra kangaloonica	Kangaloon Sun Orchid	-	Sp	-	✓	Very High	3.00	CE	CE	Nil	Species is only known to occur on the Southern Tablelands of NSW in the Moss Vale, Kangaloon and Fitzroy Falls areas in swamps and sedgelands over grey silty grey loam soils (DPIE 2021f). Although swamps occur on the Subject Land, this species is unlikely to occur on due to restricted distribution and unsuitable soils.
Thesium australe	Austral Toadflax	Sp	Sp	-	✓	Moderate	1.50	V	V	Low	Austral Toadflax has a scattered distribution across eastern NSW, along the coast and across Northern and Southern Tablelands (DPIE 2021f). It is mainly hemiparasitic on Kangaroo Grass (*Themeda triandra*) and possibly *Poa* species on a wide range of substrates occurring within grassland or grassy woodlands. Low covers of Kangaroo Grass occur along the access road, while high covers of *Poa* spp. occur near Narambulla Creek. Species has not been recorded near the Subject Land. Austral Toadflax is only likely to utilise the areas surrounding Narambulla Creek or the access road where grazing is less severe.

0 Biodiversity Assessment Method online Credit Calculator (DPIE, 2021e)

2 Threatened Biodiversity Data Collection (DPIE, 2021c)

3 NSW Atlas of Wildlife (DPIE, 2021c)

4 Protected Matters Search Tool (DAWE, 2021a)

5 Biodiversity Risk Weighting

6 Sp = Species Credit Species E = Endangered, CE = Critically Endangered, V = Vulnerable

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Table 10. Threatened Fauna Species Returned by Database and Literature Searches of the Surrounding Region

Scientific Name	Common Name	Data Source				Sensitivity to Loss[2]	BRW[2,5]	Conservation Status		Likelihood to be on Subject Land	Assessment of Likelihood
		BAMC[1]	TBDC[2]	BioNet[3]	PMST[4]			BC Act	EPBC Act		
Synemon plana	Golden Sun Moth	-	Sp	-	✓	Very High	3.00	E	CE	Nil	The Golden Sun Moth's NSW populations are found in the area between Queanbeyan, Gunning, Young and Tumut (DPIE, 2021f). The species' historical distribution extended through natural temperate grasslands and grassy Box-Gum Woodlands in which the ground layer is dominated by wallaby grasses *(Rytidosperma* spp.) with inter-tussock spaces of bare ground (DPIE, 2020c). Low covers of Wallaby Grass occur across the central and western exotic grassland extents of the Subject Land. These covers are considered too low to support this species which has also not been recorded in the Marulan/Goulburn surrounds.
Keyacris scurra	Key's Matchstick Grasshopper	Sp	Sp	-	-	High	2.00	E	-	Nil	Key's Matchstick Grasshopper is found in native grasslands and grassy woodlands with tall stands of *Themeda triandra* and associated species of *Asteraceae*. (DPE, 2022c). The closest record to the site is 14km south-west in the Pomaderris Nature Reserve. The species is flightless and does not disperse more than 10 metres from its location after hatching. The species is sensitive to overgrazing and weed invasion by exotic grasses. The Subject Land contains some patches of *Themeda* but these are very small and isolated. The history of heavy grazing, soil compaction and extensive cover of exotic annual and perennial grasses throughout grassland and the understorey of woodland on the site indicate that the Subject Land is too degraded to support the species.
Prototroctes maraena	Australian Grayling	-	-	-	✓	-	-	-	V	Nil	These fish species occur in large permanent rivers with deep waterholes (DAWE, 2021b). No suitable permanent watercourses occur on or near the Subject Land.
Macquaria australasica	Macquarie Perch	-	-	-	✓	-	-	-	E	Nil	
Heleioporus australiacus	Giant Burrowing Frog	Sp	Sp	-	✓	Moderate	1.50	V	V	Low	Species occurs in two distinct populations including on sandstone between the Sydney Basin and Ulladulla, and between Narooma and Walhalla (DPIE 2021f). Giant Burrowing Frog inhabits heath, woodland and dry sclerophyll forest, burrowing under the soil or leaf litter. 300m away from this habitat is their breeding habitat which occurs along creeks or swamps. The Subject Land has been predominantly cleared for grazing, however remnant woodland areas occur in the access road easement which are <300m from

Scientific Name	Common Name	Data Source				Sensitivity to Loss[2]	BRW[2,5]	Conservation Status		Likelihood to be on Subject Land	Assessment of Likelihood
		BAMC[1]	TBDC[2]	BioNet[3]	PMST[4]			BC Act	EPBC Act		
											potential breeding habitat (Lockyersleigh Creek and associated farm dams). Closest recorded sightings include along Wollondilly River west of Goulburn and east of the Subject Land at Bundanoon.
Litoria aurea	Green and Golden Bell Frog	Sp	Sp	-	✓	High	2.00	E	V	Low	A predominantly coastal species with large populations in Sydney, Shoalhaven and mid-north coast (DPIE 2021f). Suitable habitat for the Green and Golden Bell Frog includes waterbodies containing emergent vegetation, ephemeral creeks, swampy areas and flooded paddocks/contour channels (BMS, 2022). Fifteen farm dams exist within or near the Subject Land, most containing emergent vegetation. Most potential habitat on the Study Area has been excluded from the Subject Land. Closest recorded sighting is at Goulburn and Tallong (ALA 2021).
Litoria booroolongensis	Booroolong Frog	Sp	Sp	-	-	High	2.00	E	E	Nil	Medium-sized tree frog restricted to NSW and north-eastern Victoria along western-flowing streams of the Great Dividing Range (DPIE, 2021f). Species inhabits permanent, cobble bedded streams with fringing vegetation and rock crevices. Suitable habitat is absent from the Subject Land which contains farm dams and two shallow grass-bedded creeks.
Aprasia parapulchella	Pink-tailed Legless Lizard	Sp	Sp	-	✓	Moderate	2.00	V	V	Low	The Pink-tailed Legless Lizard inhabits sloping, open woodland areas with predominantly native grassy ground layers dominated by Kangaroo Grass (*Themeda triandra*). Sites are typically well-drained, with rocky outcrops or scattered, partially-buried rocks (DPIE 2021f). This species is regularly recorded in Canberra and has been recorded twice north of Marulan near Taralga. Suitable partially-buried rocks occur on hill tops on the Subject Land, however Kangaroo Grass is absent from these areas and only occurs as low covers along the access track. Species may occur in the native groundcover dominated remnant woodland and derived native grassland, and within 50m of rock outcrops (BMS, 2022). Targeted searches for this species were not conducted due to project timing constraints (BMS, 2022).
Suta flagellum	Little Whip Snake	Ec	Ec	-	-	Moderate	-	V	-	Low	Small snake found between Crookwell, Braidwood, Bombala and Tumbarumba in grasslands and grassy woodlands dominated by Snow Gum (*Eucalyptus pauciflora*) or Yellow Box (*Eucalyptus melliodora*) (DPIE, 2021f). Species has also been recorded in

Scientific Name	Common Name	Data Source				Sensitivity to Loss[2]	BRW[2,5]	Conservation Status		Likelihood to be on Subject Land	Assessment of Likelihood
		BAMC[1]	TBDC[2]	BioNet[3]	PMST[4]			BC Act	EPBC Act		
											secondary grasslands derived from cleared woodlands on well drained hillsides containing scattered loose rocks. Closest recorded sightings occur north of Goulburn, near Crookwell and east of Tarago (ALA, 2021). Species is likely to utilise remnant woodland (PCT 1330) along the south western extent and central southern extent of the Subject Land on hillslopes containing scattered surface rocks and Yellow Box trees.
Varanus rosenbergi	Rosenberg's Goanna	Ec	Ec	-	-	Moderate	-	V	-	Low	Within NSW this species occurs on Sydney sandstone between Wollemi National Park, Goulburn and Cooma in heath, open forest and woodland (DPIE, 2021f). Species is associated with termites, as termite mounds are considered a critical habitat component. Rosenberg's Goanna also relies on hollow logs, rock crevices and burrows for shelter. Species has not been recorded near Marulan and is unlikely to utilise the Subject Land due to the absence of and rock crevices, however termite mounds and suitable rocks occur within remnant woodland along the southern extent of the Subject Land.
Delma impar	Striped Legless Lizard	Sp	Sp	-	✓	Moderate	1.50	V	V	Low	Found mainly on the Southern Tablelands and South West Slopes in Natural Temperate Grassland and occasionally in open Box-Gum Woodland. Preferred grasslands are dominated by perennial, tussock-forming grasses including Kangaroo Grass (*Themeda triandra*), spear-grasses (*Austrostipa* spp.) and Poa (*Poa* spp.), however species is also associated with Phalaris (*Phalaris aquatica*) in grasslands adjoining woodlands or areas where open woodlands have been cleared for agriculture. Sheltering occurs beneath logs or rocks in winter (DPIE 2021f). Areas with partially buried rock occur on the south-western corner of the site at the crest of the hill, and Phalaris dominated areas occur along the upper banks of Narambulla Creek. Species is likely to utilise these areas on the Study Area. Although targeted searches were not conducted due to project timing constraints, species is considered likely to occur on-site (BMS, 2022).
Botaurus poiciloptilus	Australasian Bittern	-	Ec	-	✓	High	-	E	E	Nil	Australasian Bitterns are widespread but uncommon over south-eastern Australia, excluding far north-west NSW (DPIE 2021f). They favour permanent freshwater wetlands with tall, dense vegetation, particularly bulrushes (*Typha* spp.) and spikerushes (*Eleocharis* spp.). Suitable aquatic habitat on the Subject Land may include

Scientific Name	Common Name	Data Source				Sensitivity to Loss[2]	BRW[2,5]	Conservation Status		Likelihood to be on Subject Land	Assessment of Likelihood
		BAMC[1]	TBDC[2]	BioNet[3]	PMST[4]			BC Act	EPBC Act		
											Narambulla Creek, however this area is only seasonally wet and contains low abundances of emergent vegetation.
Rostratula australis	Australian Painted Snipe	-	Ec	-	✓	High	-	E	E	Nil	Australian Painted Snipe occurs across the Murray Darling Basin with scattered records in northern Australia (DPIE 2021f). Species inhabits freshwater swamps and marshes with a cover of grasses, lignum, low scrub and open timber (Blakers *et al.*, 1984). Foraging occurs on mud-flats and in shallow water, while nesting occurs among tall vegetation. Suitable habitat is absent from the Subject Land.
Gallinago hardwickii	Latham's Snipe	-	-	-	✓	-	-	-	Migratory	Low	Non-breeding migrant to Australia. Inhabits freshwater wetlands and bogs, including tussock grasslands. May utilise the Narambulla creek floodout area during flooding, if it coincides with its migratory period.
Actitis hypoleucos	Common Sandpiper	-	-	-	✓	-	-	-	Migratory	Nil	Migratory species which is found throughout Australia during its non-breeding period. Mainly coastal but also uses inland habitat. Uses bare soft mud at the edges of wetlands. Habitat on the Subject Land is not suitable due to the dense cover of grassy vegetation around wet areas.
Calidris acuminata	Sharp-tailed Sandpiper	-	-	-	✓	-	-	-	Migratory	Low	Migratory species which visits Australia during its non-breeding period. Inhabits shallow freshwater wetlands and mudflats with sedges and emergent vegetation. May utilise the floodout area of Narambulla Creek during flooding.
Calidris melanotos	Pectoral Sandpiper				✓	-	-	-	Migratory	Nil	Migratory species which is found throughout Australia during its non-breeding period. Mainly coastal but also found inland. Prefers open mudflats with fringing vegetation. Habitat on the Subject Land is not suitable due to the lack of exposed mudflats.
Calidris ferruginea	Curlew Sandpiper	-	Ec/Sp	-	✓	Very High	3.00	E	CE	Nil	Forages mainly on coastal estuarine mudflats, but also in inland lakes and lagoons with extensive shallows (DPIE 2021f). Closest recorded sightings are near Tarago, south of Goulburn. Although creeks and dams occur on the Subject Land, these are likely too deep for this species and suitable vegetation such as waterweed, seagrass or seaweed is absent.
Haliaeetus leucogaster	White-bellied Sea-Eagle	Ec/Sp	Ec/Sp	-	-	Moderate	2.00	V	-	Low	Species is distributed along the Australian coastline and along major rivers within the Murray Darling Basin (DPIE, 2021f). Breeding typically occurs in large emergent eucalypts within tall open forest and woodland. Suitable breeding habitat includes live

Scientific Name	Common Name	Data Source				Sensitivity to Loss[2]	BRW[2,5]	Conservation Status		Likelihood to be on Subject Land	Assessment of Likelihood
		BAMC[1]	TBDC[2]	BioNet[3]	PMST[4]			BC Act	EPBC Act		
											large old trees within 1 km of waterbodies such as rivers, creeks or large farm dams. Species predominantly forages on fish and freshwater turtles, but also reptiles, mammals and waterbirds (DPIE, 2021f). Species is well known in the area with multiple recorded sightings near Goulburn and along the Wollondilly and Shoalhaven Rivers, including twice approximately 700m sough of the Subject Land at Shellys Flat (ALA, 2021). Species may utilise the Subject Land for foraging, however, it is unlikely to utilise the site for nesting as no stick nests were observed during targeted searches.
Hieraaetus morphnoides	Little Eagle	Ec/Sp	Ec/Sp	-	-	Moderate	1.50	V	-	Low	This medium-sized bird of prey is found throughout mainland Australia, excluding densely forested areas of the Great Dividing Range, and has regularly been recorded in Goulburn and Marulan with one sighting occurring approximately 700m south of the Subject Land at Shellys Flat (ALA, 2021; DPIE, 2021f). Species inhabits open eucalypt forest and riparian woodland, utilising large mature trees for nesting in remnant patches. Species has been observed hunting over open country and paddock trees have been identified as potential breeding habitat (Blakers et al. 1984). Species is likely to utilise the site for foraging due to the Subject Land's proximity to the Wollondilly River and the open condition of the site. The presence of nest trees was targeted during fauna surveys, however, no suitably large stick nests were identified (BMS, 2022).
Falco hypoleucos	Grey Falcon	-	Ec	-	✓	High	-	E	V	Nil	Species is sparsely distributed across NSW throughout the Murray-Darling Basin with occasional sightings recorded east of the Great Dividing Range (DPIE 2021f). The Grey Falcon inhabits shrubland, grassland and wooded watercourses in arid and semi-arid areas. Species has not been recorded near Goulburn or Marulan and is unlikely to occur on the Subject Land due to lack of suitable habitat from clearing. Large stick nests are also absent from the Subject Land (BMS, 2022).
Falco subniger	Black Falcon	Ec	Ec	-	-	Moderate	-	V	-	Low	The Black Falcon is a highly mobile species that is widely, but sparsely distributed in NSW, primarily occurring in inland regions along tree-lined watercourses and in isolated woodlands, mainly in arid and semi-arid areas

Scientific Name	Common Name	Data Source				Sensitivity to Loss[2]	BRW[2,5]	Conservation Status		Likelihood to be on Subject Land	Assessment of Likelihood
		BAMC[1]	TBDC[2]	BioNet[3]	PMST[4]			BC Act	EPBC Act		
											(Birdlife 2021; DPIE, 2021f). Paddock trees are considered important breeding habitat and species utilise abandoned stick nests high in the tree. Foraging occurs across open areas. Species has been recorded twice at Goulburn and numerous times near Crookwell (ALA, 2021). Species may utilise the Subject Land for foraging as no suitable stick nests were observed during fauna surveys (BMS, 2022).
Ninox connivens	Barking Owl	Ec/Sp	Ec/Sp	-	-	Moderate	2.00	V	-	Low	Medium-sized owl found throughout Australia except for the central arid regions, with core populations occurring on the Western Slopes and Plains (DPIE, 2021f). Species inhabits woodland and open forest, including fragmented remnants and partly cleared farmland. Roosting occurs in tall mid-storey trees with dense foliage (*Acacia* and *Casuarina* spp.), while nesting occurs in tree hollows (20cm diameter, >4m above the ground) and foraging occurs over open areas (DPIE, 2021e). The Subject Land contains suitable foraging habitat and six suitable nesting trees. Species has not been recorded near Marulan and only one night conducting spotlighting and call playbacks was conducted along the southern access road (ALA, 2021; BMS, 2022)
Ninox strenua	Powerful Owl	Ec/Sp	Ec/Sp	-	-	Moderate	2.00	V	-	Low	The Powerful Owl is endemic to eastern Australia, predominantly occurring east of the Great Dividing Range (DPIE, 2021f). Within NSW, this species is widely distributed throughout woodland, open sclerophyll forest, tall open wet forest and rainforest. Species requires large areas of woodland habitat with high connectivity for roosting and hunting. Open habitats are also occasionally utilised for hunting. Roosting occurs in trees such as Rough-barked Apple (*Angophora floribunda*) and nesting occurs in large tree hollows (0.5m deep, >20cm diameter, 80-240cm DBH) (DPIE, 2021e). Suitable hollows occur on the Subject Land which may also be utilised for foraging. Species is regularly recorded east of Marulan south of Penrose (ALA, 2021). Species was not targeted during fauna surveys due to project timing constraints (BMS, 2022).
Tyto novaehollandiae	Masked Owl	Ec/Sp	Ec/Sp	-	-	Moderate	2.00	V	-	Low	Medium-sized owl occurs throughout most of NSW, excluding the most arid north-western corner, occupying

Scientific Name	Common Name	Data Source				Sensitivity to Loss[2]	BRW[2,5]	Conservation Status		Likelihood to be on Subject Land	Assessment of Likelihood
		BAMC[1]	TBDC[2]	BioNet[3]	PMST[4]			BC Act	EPBC Act		
											dry eucalypt forests and woodlands between sea level to 1100m elevation (DPIE, 2021f). Roosting and breeding occurs in moist eucalypt forested gullies, utilising large tree hollows or caves for nesting. Species has been known to occupy small patches (<5 ha). Species is likely to rarely utilise the Subject Land due to its proximity to large eucalypt woodland patches and the presence of suitable foraging habitat. Suitable hollow-bearing trees are present on the Subject Land, however species was not targeted during fauna surveys due to project timing constraints (BMS, 2022). Species has been recorded east of Marulan along the coast (ALA, 2021).
Numenius madagascariensis	Eastern Curlew	-	Ec/Sp	-	✓	Very High	3.00	-	CE	Nil	The Eastern Curlew has a primarily coastal distribution on mudflats in estuaries. Species is found in all states, particularly the north, east, and south-east regions including Tasmania (DAWE 2021b). Eastern curlews are rarely recorded in inland wetlands, which are absent from the Subject Land and surrounds.
Glossopsitta pusilla	Little Lorikeet	Ec	Ec	-	-	Moderate	-	V	-	Low	NSW provides a large portion of the Little Lorikeet's core habitat, occurring as far west as Dubbo (DPIE, 2021f). This highly mobile, nomadic species forages on flowering eucalypts, *Angophora* and *Melaleuca*, and nests in small tree hollows (entrance 3cm, 2-15m above ground). Species has been recorded twice in Marulan with scattered records occurring in the surrounding area (ALA, 2021). Species may rarely utilise the Subject Land for foraging and nesting as the site contains numerous suitable hollows.
Calyptorhynchus lathami	Glossy Black-Cockatoo	Ec/Sp	Ec/Sp	✓	-	Moderate	2.00	V	-	Low	The Glossy Black-Cockatoo is uncommon but widespread across the Central Western Plains, Southern Tablelands and Riverina of NSW in open forest and woodlands (DPIE 2021f). Associated foraging species include *Allocasuarina* species and Belah (*Casuarina cristata*). Species is regularly recorded between Canberra and Sydney with one recorded sighting in Marulan (DPIE 2021c). Little-no foraging habitat is present on the Subject Land in the form of very few, young, planted and natural Casuarina and Allocasuarina trees. Potential breeding habitat is present on the Subject Land as eucalypt trees with hollows >15 cm diameter, >5m above ground (BMS, 2022).

Scientific Name	Common Name	Data Source				Sensitivity to Loss[2]	BRW[2,5]	Conservation Status		Likelihood to be on Subject Land	Assessment of Likelihood
		BAMC[1]	TBDC[2]	BioNet[3]	PMST[4]			BC Act	EPBC Act		
Callocephalon fimbriatum	Gang-gang Cockatoo	Ec/Sp	Ec/Sp	✓	-	Moderate	2.00	V	-	Low	In NSW, this species occurs from the south coast to the Hunter region, and inland to the Central Tablelands and south-west slopes (DPIE 2021f). It inhabits mountain forests and woodlands in spring and summer, and dry, open eucalypt forests and woodlands in autumn and winter. Species is common in the Canberra and Goulburn surrounds and has been sighted 2 km north-east of the site (DPIE 2021c). Species favours old growth forest and woodlands which are absent from the Subject Land due to agricultural development and clearing. Species may rarely utilise the Subject Land for foraging and nesting as numerous suitable hollows (>9cm) occur on the site. Species was not recorded during fauna surveys (BMA, 2022).
Neophema pulchella	Turquoise Parrot	Ec	Ec	-	-	Moderate	-	V	-	Low	Species' range extends from southern QLD through to northern Victoria, from the coastal plains to the western slopes of the Great Dividing Range (DPIE, 2021f). The Turquoise Parrot inhabits eucalyptus woodland adjoining clearings, timbered ridges and creeks in farmland. Species is tolerant of disturbance and forages on the ground, while nesting occurs in tree hollows, logs or posts. Scattered recorded sightings occur near Goulburn and species is likely to utilise the Subject Land for foraging and nesting due to its proximity to a large western remnant woodland patch and the presence of farm dams and creeks on the site.
Lathamus discolor	Swift Parrot	Ec/Sp	Ec/Sp	-	✓	Very High	3.00	E	CE	Low	The Swift Parrot is a migratory species that breeds in Tasmania and winters on the mainland, where it feeds on flowering eucalypts (DPIE 2021f). It requires winter-flowering eucalypts, including White Box (*Eucalyptus albens)*, Spotted Gum (*Corymbia maculate*) and Red Bloodwood (*Corymbia gummifera*), as well as lerp infested trees such as Blackbutt (*Eucalyptus pilularis*) and Yellow Box (*Eucalyptus melliodora*). Scattered records occur near Goulburn and Marulan but it is unlikely this species inhabits the Subject Land due to the absence of suitable trees and low abundances of Yellow Box. Subject Land has not been mapped as Important Areas.
Chthonicola sagittata	Speckled Warbler	Ec	Ec	✓	-	Moderate	-	V	-	Low	A sedentary species occurring in a patchy distribution across eastern NSW, predominantly in the hills and tablelands of the Great Dividing Range (DPIE 2021f). Species inhabits Eucalypt dominated communities with grassy understories, rocky ridges or

Scientific Name	Common Name	Data Source				Sensitivity to Loss[2]	BRW[2,5]	Conservation Status		Likelihood to be on Subject Land	Assessment of Likelihood
		BAMC[1]	TBDC[2]	BioNet[3]	PMST[4]			BC Act	EPBC Act		
											gullies. The Speckled Warbler is commonly recorded around Goulburn and Marulan with one record 3.8 km east and three records north-east of the Subject Land (DPIE 2021c). Species may rarely utilise remnant woodland patches on the Subject Land for foraging.
Climacteris picumnus victoriae	Brown Treecreeper	Ec	Ec	-	-	Moderate	-	V	-	Low	Endemic to eastern Australia, the Brown Treecreeper occurs in eucalypt forests and woodlands on the inland slopes and plains of the Great Dividing Range (DPIE, 2021f). It inhabits grassy Box-Gum woodland with rough-barked trees at close to natural densities, sparse shrub cover and fallen timber on the ground (DPIE, 2021e). Species has not been recorded at Marulan but is common in the Canberra surrounds (ALA, 2021). Species may rarely utilise remnant woodland along the access road for foraging as it occurs at close to natural densities with an intact shrubby mid-storey and abundant logs.
Anthochaera phrygia	Regent Honeyeater	Ec/Sp	Ec/Sp	-	✓	Very High	3.00	CE	CE	Low	The Regent Honeyeater occurs across a patchy distribution, inhabiting temperate woodlands and open forests across the inland slopes of south-east Australia (DPIE 2021f). This nomadic/migratory nectar-dependent species requires woodlands containing large numbers of mature trees, high canopy cover and abundance of mistletoes. Although these habitat requirements are absent from the Subject Land, they are likely to occur in the remnant woodland adjoining the site. Therefore, species may utilise the site for nesting as the Regent Honeyeater's breeding territory (nest tree and surrounding foraging trees) extend 5-40m from the nest tree (Higgins et al., 2001). Species is more likely to utilise the Subject Land for foraging due to the presence of key feed species such as Apple Box (*Eucalyptus bridgesiana*) and Yellow Box (*Eucalyptus melliodora*). The Subject Land is not mapped as an Important Area for this species.
Grantiella picta	Painted Honeyeater	Ec	Ec	-	✓	Moderate	-	V	V	Nil	Inhabits Weeping Myall (*Acacia pendula*), Brigalow (*A. harpophylla*), Box-Gum Woodlands and Box-Ironbark Forests across the inland slopes of the Great Dividing Range in NSW (DPIE 2021f). A specialist feeder on the fruits of mistletoes growing on woodland eucalypts and acacias. Species has not been recorded in the Goulburn/Marulan area and is unlikely to occur on the

Scientific Name	Common Name	Data Source				Sensitivity to Loss[2]	BRW[2,5]	Conservation Status		Likelihood to be on Subject Land	Assessment of Likelihood
		BAMC[1]	TBDC[2]	BioNet[3]	PMST[4]			BC Act	EPBC Act		
											Subject Land as it relies on large, mature trees containing mistletoe which are absent from the Subject Land.
Melithreptus gularis	Black-chinned Honeyeater (eastern subspecies)	Ec	Ec	-	-	Moderate	-	V	-	Low	The Black-chinned Honeyeater occurs between central QLD, through NSW and Victoria to south-eastern SA, occurring in a widespread distribution through the NSW tablelands and western slopes of the Great Dividing Range (DPIE, 2021f). Species occupies upper levels of dry open forests and woodlands dominated by box and ironbark eucalypts including White Box (*Eucalyptus albens*), Yellow Box (*Eucalyptus melliodora*) and Blakely's Red Gum (*Eucalyptus blakelyi*). Black-chinned Honeyeaters forage over the largest woodland patches in the landscape, while nesting occurs in the tree crown. Species has been recorded twice in the Marulan surroundings but is considered more common west of Gundagai (ALA, 2021). Species may rarely utilise the access road for nesting or foraging, however, is more likely to utilise the larger remnant woodland patch directly west of the Subject Land.
Motacilla flava	Western Yellow Wagtail	-	-	-	✓	-	-	-	Migratory	Nil	Breeds in Europe and Asia. Inhabits open country near water, such as wet meadows and marshland. Most records of the species in NSW occur east of the Dividing Range. The closest record is from the Kangaroo Valley east of the Subject Land. Not likely to visit the Subject Land.
Monarcha malanopsis	Black-faced Monarch	-	-	-	✓	-	-	-	Migratory	Nil	Mainly occurs in rainforest, wet sclerophyll and in densely vegetated gullies of dry sclerophyll forest. Suitable habitat is absent from the Subject Land.
Myiagra cyanoleuca	Satin Flycatcher	-	-	-	✓	-	-	-	Migratory	Nil	Inhabits heavily vegetated gullies in tall eucalypt-dominated forest and wet sclerophyll forest. Habitat on the Subject Land is not suitable.
Rhipidura rufifrons	Rufous Fantail	-	-	-	✓	-	-	-	Migratory	Nil	Prefers moist eucalypt forest and rainforest, particularly in densely vegetated gullies and areas of deep shade. No suitable habitat on the Subject Land.
Apus pacificus	Fork-tailed Swift	-	-	-	✓	-	-	-	Migratory	Nil	Fork-tailed Swifts are almost exclusively aerial and spend most of their lives flying and breed in cliffs in Central Asia. They occasionally forage over open forest and waterways. No roosting or breeding habitat occurs on the Subject Land and the species is unlikely to utilise the site.

Scientific Name	Common Name	Data Source				Sensitivity to Loss[2]	BRW[2,5]	Conservation Status		Likelihood to be on Subject Land	Assessment of Likelihood
		BAMC[1]	TBDC[2]	BioNet[3]	PMST[4]			BC Act	EPBC Act		
Hirundapus caudacutus	White-throated Needletail	Ec	Ec	✓	✓	Moderate	-	-	V	Nil	Migratory bird occurring in large gregarious flocks when in Australia. Breeds in Asia and moves through Australia, mostly in coastal regions of NSW and Queensland, extending inland to the western slopes of the Great Divide and occasionally on the adjacent inland plains (Birdlife Australia, 2020). The habitat is almost exclusively aerial, from 1-1,000 m above the ground. Species has been sighted twice 2 km north-east of the Subject Land, however, is unlikely to utilise the Subject Land due to its almost exclusively aerial lifestyle (DPIE 2021c).
Petroica boodang	Scarlet Robin	Ec	Ec	✓	-	Moderate	-	V	-	Moderate	In NSW, the Scarlet Robin occurs from the coast to the inland slopes, breeding in high-altitude eucalypt forest with an open understorey containing scattered shrubs (DPIE, 2021c). Species has been recorded in mature and regrowth vegetation with abundant logs and fallen timber. Species is likely to utilise the plantings and access road alignment on the Subject Land. Species has been recorded 2 km west, 2.8 km south and 3.8 km east of the Subject Land (ALA, 2021).
Petroica phoenicea	Flame Robin	Ec	Ec	-	-	Moderate	-	V	-	Moderate	Species is endemic to south-eastern Australia, breeding in upland areas containing tall moist eucalypt forests and woodland along ridges and slopes, and wintering on the inland slopes and plains (DPIE, 2021c). The Flame Robin prefers clearings and areas with open understoreys dominated by native grasses. Paddock trees are also considered important foraging and nesting components. Species is likely to utilise the plantings and access road alignment for foraging. Species is commonly recorded in the Marulan surrounds (ALA, 2021).
Melanodryas cucullata	Hooded Robin	Ec	Ec	-	-	Moderate	-	V	-	Low	A sedentary species that occurs throughout most of Australia except for desert and wetter coastal areas (DPIE, 2021c). Species prefers lightly wooded country including open eucalypt woodland, acacia scrub and mallee, often in or near clearings and open areas. Paddock trees are considered important habitat components if they connect adjacent remnant woodland patches. The Hooded Robin requires complex habitat structures with eucalypt saplings, shrubs and moderately tall native grasses which

Scientific Name	Common Name	Data Source				Sensitivity to Loss[2]	BRW[2,5]	Conservation Status		Likelihood to be on Subject Land	Assessment of Likelihood
		BAMC[1]	TBDC[2]	BioNet[3]	PMST[4]			BC Act	EPBC Act		
											are present along the southern access road alignment on the Subject Land. This species may also utilise the south-western remnant woodland patches for foraging as they connect to adjacent woodland patches. Species is rarely sighted in the Marulan area with most records occurring in the Blue Mountains and Canberra (ALA, 2021).
Epthianura albifrons	White-fronted Chat	Ec	Ec	-	-	Moderate	-	V	-	Nil	Species occurs across the southern half of NSW in damp open habitats or open grasslands along the coast or on foothills and lowlands up to 100m (ASL) near inland waterways (DPIE, 2021c). Foraging occurs on bare or grassy ground in wetland areas, while open-cup nesting occurs in low vegetation. Species is regularly recorded in Canberra with one record occurring at Goulburn (ALA, 2021). Subject Land is considered too degraded for this species as the groundcover is dominated by exotic species and remnant woodland predominantly occurs as small, isolated patches.
Daphoenositta chrysoptera	Varied Sittella	Ec	Ec	✓	-	Moderate	-	V	-	Low	Birds of tall woodlands and open forests, usually with rough-barked eucalypts including stringybarks and ironbark's (DPIE, 2021c). Species favours mature trees with hollows or dead limbs. Species has been recorded 3.8 km east of the Subject Land, as well as south-west along Hume Highway (DPIE 2021c). Species is likely to utilise the access road on the Subject Land for foraging as it is dominated by mature rough-barked trees.
Artamus cyanopterus cyanopterus	Dusky Woodswallow	Ec	Ec	✓	-	Moderate	-	V	-	Moderate	Found in larger blocks of woodland and dry sclerophyll forests, usually dominated by eucalypts (Scientific Committee, 2016). Also recorded in shrublands, heathlands and regenerating forests. The understorey is typically open with sparse eucalypt saplings, acacias and other shrubs. Species has been sighted 3.8 km east of the Subject Land and 4 km north-east of the site (DPIE 2021c). The Dusky Woodswallow may utilise plantings and the access road alignment on the Subject Land for foraging.
Stagonopleura guttata	Diamond Firetail	Ec	Ec	✓	-	Moderate	-	V	-	High	Widespread in open forest and woodland mostly on the inland side of the Great Dividing Range in eastern NSW (Blakers *et al.*, 1984). Favours open grassy woodlands with a native understorey. Species has also been recorded in riparian areas (rivers and creeks) and in lightly wooded farmland. The Diamond Firetail has been recorded three times 4 km north-east of the Subject Land (ALA, 2021). Species is likely to utilise the southern remnant woodland

Scientific Name	Common Name	Data Source				Sensitivity to Loss[2]	BRW[2,5]	Conservation Status		Likelihood to be on Subject Land	Assessment of Likelihood
		BAMC[1]	TBDC[2]	BioNet[3]	PMST[4]			BC Act	EPBC Act		
											and plantings for foraging due to their native understorey and proximity to farm dams and creek on the Subject Land. Species was observed foraging during fauna surveys (10/2/2022) in the ephemeral creek line (BMS, 2022).
Dasyurus maculatus	Spotted-tailed Quoll	Ec	Ec	-	✓	High	-	V	E	Nil	Generally confined to extensive areas of native forest and woodland where it nests in rock caves or hollow logs (Edgar, 1983). The habitat on the Subject Land and surrounds is too highly disturbed to be suitable for this species.
Phascolarctos cinereus	Koala	Ec/Sp	Ec/Sp	✓	✓	Moderate	2.00	V	E	Moderate	Within NSW, Koalas occur along the coast, extending into the Riverina and Murray-Darling Depression bioregions, with high abundances occurring on the North and Central Coast (DAWE, 2021b). Species occurs in eucalypt woodland and forest communities, preferring trees on fertile clay soils. Species is known to occur in the area as evident by two roadkill observations 2 km south-east of the Subject Land along Hume Highway and is likely to utilise the southern remnant woodland patches and the access road alignment (DPIE 2021c). Species was not found during targeted SAT searches (BMS, 2022).
Pseudomys novaehollandiae	New Holland Mouse	-	Ec	-	✓	Moderate	-	-	V	Nil	Species occurs in a fragmented distribution across NSW, primarily along the coast between Lismore and Tomerong with scattered sightings near Canberra (DPIE, 2021c). The New Holland Mouse inhabits open heathlands, woodlands and forests, living predominantly in burrows. Species has not been recorded near Marulan and is unlikely to occur on the Subject Land due to its sensitivity to habitat modification and weed invasion.
Petaurus norfolcensis	Squirrel Glider	Sp	Sp	✓	-	Moderate	2.00	V	-	Low	Inhabits mature or old growth Box, Box-Ironbark woodlands and River Red Gum forest west of the Great Dividing Range (DPIE, 2021c). Prefers mixed species stands with a shrub or Acacia mid-storey. Requires abundant tree hollows for refuge and nest sites, which are present on the Subject Land in small quantities, although understorey shrubs are generally lacking except in the native plantings and along the access road alignment. Species has been recorded three times within 3 km of the Subject Land (DPIE 2021c). Species was not recorded during fauna surveys along the southern access road alignment. Adequate targeted surveys were not completed over other treed portions of the Subject Land due to access constraints (BMS, 2022).

Scientific Name	Common Name	Data Source				Sensitivity to Loss[2]	BRW[2,5]	Conservation Status		Likelihood to be on Subject Land	Assessment of Likelihood
		BAMC[1]	TBDC[2]	BioNet[3]	PMST[4]			BC Act	EPBC Act		
Petauroides volans	Greater Glider	Sp	Sp	-	✓	Moderate	2.00	-	V	Low	Species is found in greatest abundance in taller, montane, moist eucalypt forests with relatively old trees and abundant hollows (DAWE, 2021b). The Greater Glider favours forests with a diversity of eucalypt species and has a home range of 1-3 ha. Species has been recorded once at Marulan and is more common further east along the Great Dividing Range (ALA, 2021). Suitable nesting and breeding habitat is present Subject Land along the access road alignment. Species was not found during the completed one night of fauna survey conducted (BMS, 2022). Further survey effort was not completed due to access constraints.
Cercartetus nanus	Eastern Pygmy-possum	Sp	Sp	-	-	Moderate	2.00	V	-	Nil	In NSW, species extends from the coast inland as far as the Pilliga, Dubbo, Parkes and Wagga Wagga on the western slopes (DPIE, 2021c). Species prefers heath and woodlands, and has been recorded occupying small patches of vegetation in fragmented landscapes, although they prefer habitat with a rich shrub understorey. The presence of Eucalypts alone is sufficient to support low density populations. Species forages on banksias, eucalypts and bottlebrushes, while sheltering occurs in tree hollows, rotten stumps, holes and abandoned bird nests. Closest recorded sightings are south-west of Canberra and along the coast, particularly between Wollongong and Sydney (ALA, 2021). Species is unlikely to utilise the Subject Land due to their restricted distribution, lack of coarse woody debris and presence of foxes (BMS, 2022).
Petrogale penicillata	Brush-tailed Rock Wallaby	Sp	Sp	-	✓	High	3.00	-	V	Nil	Occurs in the eastern third of NSW on rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges, often facing north. Browse on vegetation in and adjacent to rocky areas eating grasses and forbs as well as the foliage and fruits of shrubs and trees (DPIE, 2021c). Suitable extensive rocky habitats are absent from the Subject Land which contains poor habitat connectivity.
Pteropus poliocephalus	Grey-headed Flying-fox	Ec/Sp	Ec/Sp	-	✓	Moderate	2.00	V	V	Low	The Grey-headed Flying Fox mostly occurs on the eastern side of the Great Dividing Range but may establish temporary roosts west of the divide when food supplies are abundant (DPIE, 2021c). This species depends on eucalypt nectar which occur in low abundances on the Subject Land. Species has been recorded multiple times at Goulburn with scattered sightings south of

Scientific Name	Common Name	Data Source				Sensitivity to Loss[2]	BRW[2,5]	Conservation Status		Likelihood to be on Subject Land	Assessment of Likelihood
		BAMC[1]	TBDC[2]	BioNet[3]	PMST[4]			BC Act	EPBC Act		
											Marulan (ALA, 2021). The Grey-headed Flying-Fox may rarely utilise the remnant woodland on the Subject Land for foraging. No breeding camps were observed during fauna surveys (BMS, 2022).
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	Ec	Ec	✓	-	Moderate	-	V	-	Low	The Yellow-bellied Sheathtail-bat has been recorded 3 km north-east of the Subject Land, as well as once along Hume Highway (DPIE 2021c). It roosts in tree hollows and forages over the tree canopy or open country. Species has been recorded multiple times near Marulan and Goulburn (ALA, 2021). Species may forage over the remnant woodland patches on the Subject Land due to its proximity to larger intact woodland to the west.
Micronomus norfolkensis	Eastern Coastal Free-tailed Bat	Ec	Ec	✓	-	Moderate	-	V		Low	Species is found along the NSW coastline between Lismore and Eden with scattered sightings recorded near Marulan, Goulburn and Crookwell (ALA, 2021). This bat inhabits dry sclerophyll forest, woodland, swamp forests and mangrove forests roosting in hollows, under loose bark or in man-made structures. Species has been recorded once 3.8 km south-east of the Subject Land and is likely to utilise the Subject Land for foraging (DPIE 2021c)
Falsistrellus tasmaniensis	Eastern False Pipistrelle	Ec	Ec	✓	-	Moderate	-	V		Nil	Species is distributed along the south-east coast and ranges of NSW, being regularly recorded in the Marulan area (ALA, 2021; DPIE, 2021c). The bat prefers moist habitats with trees taller than 20 m. Roosting occurs in eucalypt hollows, under loose bark or in buildings, while hunting occurs above or just below the canopy. Species has been recorded once 3.8 km east of the site but is unlikely to utilise the Subject Land which contains dry sclerophyll woodland remnants (DPIE, 2021c).
Miniopterus orianae oceanensis	Large Bent-winged Bat	Ec/Sp	Ec/Sp	✓	-	Moderate	3.00	V	-	Low	The Large Bent-winged Bat roosts in caves and man-made structures such as mines and storm-water drains and forages in wooded areas, flying above the tree tops. It is unlikely to have breeding habitat in the Subject Land but may forage over the woodland as the species has been recorded six times within 10 km of the Subject Land (DPIE 2021c). Caves and adits are not present in or around the Study Area (BMS, 2022).
Chalinolobus dwyeri	Large-eared Pied Bat	Sp	Sp	✓	✓	Moderate	3.00	V	V	Nil	Species roosts in caves, mine tunnels and the abandoned nests of Fairy Martins, and forages over areas of continuous forest habitat (Greg Richards and Associates, 2000; 2005). Roosting habitat is absent from the Subject Land and surrounds. Although the species

Scientific Name	Common Name	Data Source				Sensitivity to Loss[2]	BRW[2,5]	Conservation Status		Likelihood to be on Subject Land	Assessment of Likelihood
		BAMC[1]	TBDC[2]	BioNet[3]	PMST[4]			BC Act	EPBC Act		
											has been recorded 1.4 km east of the Subject Land, as well 3 km south-east along Hume Highway, roosting habitat is absent from the Subject Land (DPIE 2021c). Caves and adits are not present in or around the Study Area (BMS, 2022).
Myotis macropus	Southern Myotis	Sp	Sp	-	-	Moderate	2.00	V		Low	Species is found in a coastal band from the north-west of Australia, across the top-end and south to western Vic. It is rarely found more than 100 km inland, except along major rivers (DPIE, 2021c). Species has been recorded multiple times in the Marulan surrounds including 3 km west of the Subject Land near Carrick Road (ALA, 2021). Species is likely to utilise hollow-bearing trees in two locations on the Subject Land that are within 300m of water. Species was not found during fauna surveys (BMS, 2022).

[1] Biodiversity Assessment Method online Credit Calculator (DPIE, 2021e): Ec = Ecosystem credit species; Sp = Species credit species.

[2] Threatened Biodiversity Data Collection (DPIE, 2021f)

[3] NSW Atlas of Wildlife (DPIE, 2021c)

[4] Protected Matters Search Tool (DAWE, 2021a)

[5] Species with two likelihoods recorded are dual ecosystem credit and species credit species. The first likelihood refers to ecosystem credits and the second to species credits.

[6] NSW *Fisheries Management Act 1994*.

[7] Foraging/Breeding likelihood for dual species (both Ecosystem and Species Credit Species).

E = Endangered; CE = Critically Endangered; V = Vulnerable; M = Migratory

2.4.2 LIKELIHOOD OF THREATENED SPECIES OCCURRENCE ON THE SUBJECT LAND

The BAM Credit Calculator allows the assessor to include or exclude candidate threatened species selected by the BAM Credit Calculator if the species:

1. has habitat constraints listed in the TBDC and none of these constraints are present on the Subject Land;
2. is vagrant in the area (taken as the record being well outside the species range or natural distribution); and
3. is unable to use the habitat constraints listed in the TBDC or known microhabitats that the species requires to persist on or use because the habitat constraints are degraded to the point where the species will no longer be present.

The likelihood of occurrence of each candidate species has been assessed in **Table 9** and **Table 10** based on distribution records in the NSW Atlas of Wildlife (DPIE, 2021c), and information in both the TBDC (DPIE, 2021b) and referenced scientific publications.

Five threatened flora species and 36 threatened fauna species were identified in **Table 9** and **Table 10** respectively to have suitable habitat on the Subject Land.

2.4.2.1 Threatened Flora

Targeted searches for threatened flora species encompassed all eight species identified by the BAM calculator, plus an additional two species which were identified by PMST results, due to the lack of habitat constraints listed for each species in the BAM Calculator. Searches conducted in October 2021 and February 2022 did not find any threatened flora species on the Subject Land. Justification for excluding the ten threatened flora species from the BAM Calculator is given in **Table 11**.

Table 11. Justification for Exclusion of Six Flora Species from Species Credit calculation.

Threatened Flora Species	Justification of survey location	Survey Method	Results of survey	Require further consideration?
Basalt Peppercress	Basalt Peppercress occurs in grassy woodland and grasslands on open, bare ground and has been recorded growing under paddock trees (DPIE, 2021f). The species was searched for within the highest quality habitat along the proposed access route and around trees within woodland patches. PCT 1330 Mod-Poor zone patches were not searched due to the highly degraded state of the groundcover within this zone.	10m transects in spring	Species was not found during targeted searches.	No
Hoary Sunray	A plant principally of grasslands and grassy woodlands on relatively fertile soils, often clays or clay-loams derived from basalt or dolerite, or at higher altitudes, from sedimentary parent material (DPIE, 2021f). Fertile soils are present in the Subject Land. The Hoary Sunray relies on the presence of bare ground for germination and	10m transects in spring	Species was not found during targeted searches	No

Threatened Flora Species	Justification of survey location	Survey Method	Results of survey	Require further consideration?
	establishment (Sinclair, 2011). In lowland areas, periodic disturbance such as fire creates these bare areas. At higher altitudes natural spacing between grass tussocks provides germination opportunities. The improved pastures on the Subject Land are consistently too dense to allow germination of this species. The Hoary Sunray is known to occur in the Bungonia sub-region and is likely to inhabit semi-natural vegetation across the south-western extent of the Subject Land.			
Cotoneaster Pomaderris	Species occurs in dry, shrubby open forest on north-west to south-west facing slopes and is associated with shallow soils, outcropping rock, clifflines or riverbanks (DPIE, 2021f). Species may utilise the shrubby woodland along the access road, however this is considered unlikely due to the species' highly restricted distribution. The Cotoneaster Pomaderris is known to occur in the Bungonia sub-region.	10m transects in spring	Not found during targeted searches	No
Silky Swainson-pea	The Silky Swainson-pea was formerly a widespread, common species in Box-Gum Woodlands and likely to have been common in the Mudgee district (DPIE, 2021f). It is very sensitive to grazing and is only likely to have survived in the southern access road alignment and less disturbed remnant woodland patches. Surviving populations are mostly found on roadsides, railway easements, cemeteries, reserves and lightly grazed situations including some crown leases and State Forests. Species is predicted to occur in the Bungonia sub-region.	10m transects in spring	Not found during targeted searches	No
Austral Toadflax	Species is predicted to occur in the Bungonia sub-region of the South Eastern Highlands within grasslands or grassy woodlands containing Kangaroo Grass and *Poa* species (DAWE, 2021b). Low covers of Kangaroo Grass occur along the access road, while high covers of *Poa* spp. occur near Narambulla Creek. Austral Toadflax is only likely to utilise the areas surrounding Narambulla Creek or the access road where grazing is less severe.	10m transects in summer	Not found during targeted searches	No

Threatened Flora Species	Justification of survey location	Survey Method	Results of survey	Require further consideration?
Flockton Wattle	Flockton Wattle is only found in the Blue Mountains (DPIE, 2021f). The species is associated with sandstone which is not applicable to the Subject Land. The species was nevertheless searched for within remnant woodland where some shrub cover remains on the site.	10m transects in spring	Not found during targeted searches	No
Thick Lip Spider Orchid	This species is not associated with the area around Goulburn however a lack of records may be due to a paucity of data (DPIE, 2021f). The species is known from grassy sclerophyll woodland and the most intact remnant within the Subject Land occurs along the access route.	10m transects in spring	Not found during targeted searches	No
Dwarf Kerrawang	Dwarf Kerrawang is known from specific locations within the Southern Tablelands and Highlands, where it is associated with sandy and peaty soils within a variety of habitats including with Stringybark forest (DPIE, 2021f). The species would be most likely to occur within the remnant woodland on the Subject Land.	10m transects in spring	Not found during targeted searches	No
Black Gum	Black Gum is associated with low-lying wet areas and frost hollows (DAWE, 2021b). It may have once occurred on the Subject Land within the floodout of Narambulla Creek. Snow Gum is present in a gully just above the creek.	Visual assessment, identification of trees within proximity to wet areas.	Not found during targeted searches	No
Paddy's River Box	This species has distinctive narrow leaves and brown box bark, and is found in grassy woodlands on broad cold flats (DAWE, 2021b). The most suitable habitat on the Subject Land occurs around Narambulla Creek.	Visual assessment, identification of trees within woodland patches and isolated paddock trees.	Not found during targeted searches	No

2.4.2.2 Threatened Fauna

Thirty-seven threatened fauna species potentially occur on the Subject Land based on habitat assessment and recorded sightings on the BioNet database (**Tables 9** and **10**). These include **two frogs** (**Table 12**): Giant Burrowing Frog and Green and Golden Bell Frog; **four reptiles** (**Table 13**): Pink-tailed Legless Lizard, Little Whip Snake, Rosenberg's Goanna and Striped Legless Lizard; **twenty-two birds** (**Table 14**): Barking Owl, Black Falcon, Black-chinned Honeyeater (eastern subspecies), Brown Treecreeper (eastern subspecies), Diamond Firetail, Dusky Woodswallow, Flame Robin, Gang-gang Cockatoo, Glossy Black-cockatoo, Hooded Robin, Little

Eagle, Little Lorikeet, Masked Owl, Powerful Owl, Regent Honeyeater, Scarlet Robin, Speckled Warbler, Superb Parrot, Swift Parrot, Turquoise Parrot, White-bellied Sea Eagle and Varied Sittella; **seven mammals** (**Table 15**): Eastern Coastal Free-tailed Bat, Greater Glider, Grey-headed Flying-fox, Koala, Large Bent-winged Bat, Southern Myotis, Squirrel Glider and Yellow-bellied Sheathtail-bat. **Two migratory species**: Latham's Snipe and Sharp-tailed Sandpiper are considered to have potential to occasionally utilise the site.

Areas of suitable habitat within native vegetation on the Subject Land are shown in **Figure 12** to **Figure 16**.

Table 12. Frog Species with Potential Habitat within the Subject Land

Threatened reptile species with habitat potential on-site	Results of BMS Fauna Surveys (2022)	Require consideration or further survey effort
Giant Burrowing Frog	Burrowing habitat within woodland often occurs 300m from breeding habitat along creeks and swamps. Suitable burrowing habitat exists in remnant woodland areas within the southern access road easement. Suitable breeding habitat also occurs on the Subject Land (Lockyersleigh Creek and associated farm dams). Species is known to occur in the Bungonia sub-region but was not found during targeted surveys.	Nil
Green and Golden Bell Frog	The Green and Golden Bell Frog is known to occur in the Bungonia sub-region. Suitable habitat includes ephemeral creek lines, swamps and farm dams with emergent vegetation within 1km of the Subject Land. Twelve suitable farm dams occur on the Subject Land, however species was not found during targeted searches.	Nil

Table 13. Reptile Species with Potential Habitat within the Subject Land

Threatened reptile species with habitat potential on-site	Results of BMS Fauna Surveys (2022)	Require consideration or further survey effort
Pink-tailed Legless Lizard	Suitable habitat occurs on Subject Land in treed areas with native groundcover within 50 m of rock outcrops. Targeted searches were not conducted due to project timing constraints.	Assumed present. Assessed as species credit species
Little Whip Snake	Species is known to occur in the Bungonia sub-region of the South Eastern highlands within grasslands and grassy woodlands dominated by Snow Gum or Yellow Box, as well as in secondary grasslands derived from cleared woodlands on well drained hillsides containing scattered loose rocks. Suitable habitat occurs within remnant PCT 1330 woodland along the south western extent and central southern extent of the Subject Land on hillslopes containing scattered surface rocks and Yellow Box trees. Not a species credit species, not observed or assessed further by BMS, 2022.	Assessed as ecosystem credit species

Threatened reptile species with habitat potential on-site	Results of BMS Fauna Surveys (2022)	Require consideration or further survey effort
Rosenberg's Goanna	Rosenberg's Goanna is predicted to occur in the Bungonia sub-region of the South Eastern Highlands within heath, open forest and woodland in association with termite mounds. Species relies on hollow logs, rock crevices and burrows for shelter. Suitable habitat occurs on the Subject Land in PCT 1330 Moderate and PCT 1330 Mod-poor. Not a species credit species, not observed or assessed further by BMS, 2022.	Assessed as ecosystem credit species
Striped Legless Lizard	Striped Legless Lizard is a grassland specialist but is not restricted to native grassland. Many studies have found the species present (and reproducing) in areas with grazing history, and areas dominated by exotic grasses such as *Phalaris aquatica* (DAWE, 2021b). Targeted searches were not conducted due to project timing constraints. Site visit by DPE confirm some marginal suitable habitat occurs on the Subject Land, but most is considered degraded.	Assumed present. Assessed as species credit species

Table 14. Bird Species with Potential Habitat within the Subject Land

Threatened bird species with habitat potential on-site	Results of BMS Fauna Surveys (2022)	Require consideration or further survey effort
Barking Owl	Suitable breeding habitat in the form of 6 living or dead hollow-bearing trees (hollows >20cm diameter and >4m above ground) is present on the Subject Land. However, surveys were not completed due to access constraints (only one night performing spotlighting and call playbacks was conducted along the southern access road alignment).	Assumed present. Assessed as species credit species
Black Falcon	The Black Falcon is known to occur in the Bungonia sub-region of the South Eastern Highlands. Paddock trees in proximity to waterbodies are considered important breeding habitat, while foraging occurs over open areas. Species is rarely recorded at Goulburn and no suitable stick nests were observed during fauna surveys. Not a species credit species, not observed or assessed further by BMS, 2022.	Assessed as ecosystem credit species.
Black-chinned Honeyeater (eastern subspecies)	Species is known to occur in the Bungonia sub-region within woodlands dominated by White Box (*Eucalyptus albens*), Yellow Box (*Eucalyptus melliodora*) and Blakely's Red Gum (*Eucalyptus blakelyi*). Black-chinned Honeyeaters forage over the largest woodland patches in the landscape and are likely to utilise the large	Nil

Threatened bird species with habitat potential on-site	Results of BMS Fauna Surveys (2022)	Require consideration or further survey effort
	remnant woodland patch south and west of the Study Area. Species was not found during targeted fauna searches. Not a species credit species, not observed or assessed further by BMS, 2022.	
Brown Treecreeper (eastern subspecies)	The Brown Treecreeper is known to occur in the Bungonia sub-region of the South Eastern Highlands in grassy Box-Gum Woodlands with rough-barked eucalypts at close to natural densities, sparse shrub cover and abundant logs. Species is considered an ecosystem credit when the site is within 100 m of moderate to good condition suitable vegetation such as that in PCT 351 Dense and PCT 1330 Mod-poor. Species was not found during targeted fauna surveys. Not a species credit species, not observed or assessed further by BMS, 2022.	Assessed as ecosystem credit species
Diamond Firetail	Species favours grassy woodlands with a native understorey, riparian areas and lightly wooded farmland. Species was observed foraging during fauna surveys (10/2/2022) in the ephemeral creek line. Not a species credit species, not observed or assessed further by BMS, 2022.	Assessed as ecosystem credit species
Dusky Woodswallow	Species is known to occur in the Bungonia sub-region of the South Eastern Highlands in larger blocks of remnant eucalypt woodland. Suitable foraging habitat occurs along the southern boundary of the Subject Land in remnant woodland and in the native planting in the north of the site. Not a species credit species, not observed or assessed further by BMS, 2022.	Assessed as ecosystem credit species
Flame Robin	Species is known to occur in the Bungonia sub-region of the South Eastern Highlands in tall moist eucalypt forests and woodlands. Paddock trees are considered key habitat constraints for foraging. Suitable habitat occurs in all remnant woodland and planting areas, excluding PCT 1330 Mod-poor which is considered too degraded for this species. Not a species credit species, not observed or assessed further by BMS, 2022.	Assessed as ecosystem credit species
Gang-gang Cockatoo	Species is known to occur in the Bungonia sub-region. Suitable habitat constraints on the Subject Land include numerous eucalypt trees with hollows >9 cm diameter. Species was not recorded during fauna surveys, but species is considered likely to forage on the site.	Assessed as ecosystem credit species

Threatened bird species with habitat potential on-site	Results of BMS Fauna Surveys (2022)	Require consideration or further survey effort
Glossy Black-cockatoo	Little-no foraging habitat is present on the Subject Land which contains very few, young, planted and some natural Casuarina and Allocasuarina trees. Suitable breeding habitat on the Subject Land includes five eucalyptus trees with hollows >15 cm diameter, >5 m above ground. Habitat constraints are present on the Subject Land, however targeted surveys were not conducted due to project timing.	Assumed present. Assessed as species credit species
Hooded Robin	Habitat constraints for the Hooded Robin include paddock trees which can be important when linking remnant foraging habitat. Such suitable paddock trees occur in PCT 1330 Moderate and PCT 1330 Mod-poor which also contains small remnant woodland patches. Not a species credit species, not observed or assessed further by BMS, 2022.	Assessed as ecosystem credit species
Little Eagle	Species was not targeted during fauna surveys due to lack of suitable breeding habitat (no medium-large raptor nests observed). Suitable foraging habitat occurs across most of the Subject Land in the form of open landscapes.	Assessed as ecosystem credit species
Little Lorikeet	Suitable foraging habitat occurs on the Subject Land within PCT 1330 Moderate and PCT 1330 Mod-Poor. Not a species credit species, not observed or assessed further by BMS, 2022.	Assessed as ecosystem credit species
Masked Owl	Suitable habitat in the form of living and dead hollow-bearing trees (>20 cm diameter hollows) are present on the Subject Land, however species was not targeted during fauna surveys due to project timing constraints.	Assumed present. Assessed as species credit species
Powerful Owl	Suitable habitat in the form of living and dead hollow-bearing trees (>20 cm diameter hollows) are present on the Subject Land, however species was not targeted during fauna surveys due to project timing constraints.	Assumed present. Assessed as species credit species
Regent Honeyeater	Potential feed species present (*E. bridgesiana, E. blakelyi/tereticornis, E. melliodora, Cassinia spp. and Acacia spp).* Important habitat not present (confirmed by BCD) (BMS, 2022). No further assessment required.	Assessed as ecosystem credit species.
Scarlet Robin	Species inhabits eucalypt forest with an open understorey containing scattered shrubs. Suitable foraging habitat occurs within remnant woodland on the Subject Land. Not a species credit species, not observed or assessed further by BMS, 2022.	Assessed as ecosystem credit species

Threatened bird species with habitat potential on-site	Results of BMS Fauna Surveys (2022)	Require consideration or further survey effort
Speckled Warbler	Suitable foraging habitat on the Subject Land includes remnant woodland in PCT 1330 Moderate and PCT 351 Dense. Not a species credit species, not assessed further by BMS, 2022.	Assessed as ecosystem credit species
Superb Parrot	Foraging occurs in Box-Gum Woodlands, feeding in trees, understorey shrubs and on the ground for grass seeds and herbaceous plants. Suitable nesting hollows are present on the Subject Land, however species was not recorded during targeted fauna surveys.	Assessed as ecosystem credit species
Swift Parrot	Suitable foraging habitat occurs on the Subject Land in PCT 1330 Moderate. Important habitat not present (confirmed by BCD) (BMS, 2022). No further assessment required.	Assessed as ecosystem credit species
Turquoise Parrot	Species forages on the ground in eucalyptus woodland adjoining clearings, timbered ridges and creeks in farmland. Suitable foraging habitat constraints occur on the Subject Land in PCT 1330 Moderate, PCT 351 Dense and PCT 1330 Mod-poor. Not a species credit species, not assessed further by BMS, 2022.	Assessed as ecosystem credit species
White-bellied Sea Eagle	Survey constraints include living and dead mature trees that could provide breeding habitat within 1 km of large waterbodies and major watercourses. Suitable foraging habitat includes one large waterbody (Shellys Flat) south of the Study Area. No large stick nests were observed on the Subject Land and species was not found during targeted fauna searches.	Assessed as ecosystem credit species
Varied Sittella	Species inhabits rough-barked eucalypts within tall woodlands and open forests, favouring mature trees with hollows and dead limbs. Suitable foraging habitat occurs in PCT 351 Dense within the southern access road alignment. Not a species credit species, not assessed further by BMS, 2022.	Assessed as ecosystem credit species
Latham's Snipe	Species inhabits freshwater wetlands and bogs, including tussock grasslands. May utilise the Narambulla creek floodout area during flooding, if it coincides with its migratory period. This area has been excluded from the Subject Land and no direct impact on the species is anticipated. Sediment and noise management measures will reduce the potential for indirect impact on the species.	Nil
Sharp-tailed Sandpiper	Migratory species which visits Australia during its non-breeding period. Inhabits shallow freshwater wetlands and mudflats with sedges and emergent vegetation.	Nil

Threatened bird species with habitat potential on-site	Results of BMS Fauna Surveys (2022)	Require consideration or further survey effort
	May utilise the floodout area of Narambulla Creek during flooding. This area has been excluded from the Subject Land and no direct impact on the species is anticipated. Sediment and noise management measures will reduce the potential for indirect impact on the species	

Table 15. Mammal Species with Potential Habitat within the Subject Land

Threatened mammal species with habitat potential on-site	Results of BMS Fauna Surveys (2022)	Require consideration or further survey effort
Eastern Coastal Free-tailed Bat	Suitable foraging habitat includes dry sclerophyll woodlands including the remnant woodland on the Subject Land. Not a species credit species, not assessed further by BMS, 2022.	Assessed as ecosystem credit species
Greater Glider	Suitable hollow-bearing trees are present on the Subject Land. Targeted surveys were conducted along the southern access road alignment and around potential habitat trees over three nights using spotlighting. No individuals were recorded.	Not found. No further survey effort required. Assessed as ecosystem credit species due to presence of suitable habitat.
Grey-headed Flying-fox	Suitable foraging habitat in the form of flowering eucalypts occurs in PCT 1330 Moderate, PCT 1330 Mod-poor and PCT 351 Dense. Breeding camps were not found during targeted fauna surveys.	Assessed as ecosystem credit species
Koala	SAT surveys were conducted and included three nights spotlighting on the southern access road and along the southern extent of the Subject Land four PIR cameras on the southern access road and habitat assessment. Habitat assessment determined Koala feed tree species are present on the Subject Land, however no scats were found during SAT surveys and no individuals were found during spotlighting.	Not found. No further survey effort required. Assessed as ecosystem credit species due to presence of suitable habitat.
Large Bent-winged Bat	Habitat assessment was conducted and no caves, adits or cliff habitat exists within 2 km of the Subject Land. Targeted fauna surveys resulted in a few probable calls of the species identified during ultrasonic bat detection, however Subject Land is likely to form foraging habitat only.	Assessed as ecosystem species.
Southern Myotis	Hollow-bearing trees and roost structures within 200m of riparian zone, as well as waterbodies >3 m diameter were targeted during surveys. Fauna surveys also	Assessed as ecosystem species.

Threatened mammal species with habitat potential on-site	Results of BMS Fauna Surveys (2022)	Require consideration or further survey effort
	involved ultrasonic detection of waterbodies and woodland areas within 200 m. Species was not detected during fauna surveys.	
Squirrel Glider	Suitable habitat is present on Subject Land, however the species was not found during targeted searches. Surveys included three nights spotlighting and four PIR camera traps on the southern access road alignment.	Not present. Assessed as ecosystem species due to presence of suitable habitat.
Yellow-bellied Sheathtail-bat	Suitable foraging habitat occurs on the Subject Land as remnant woodland as species forages over the tree canopy and open country. Not a species credit species, not assessed further by BMS, 2022.	Assessed as ecosystem species.

2.4.3 DERIVATION OF SPECIES CREDITS BASED ON SPECIES POLYGONS

Figures 12 to **Figure 16** show the distribution of threatened fauna species habitat potentially impacted by the proposed solar farm and areas input into the BAM Credit Calculator are provided in **Table 16**.

Species polygons were derived from threatened species buffers applied to habitat areas produced by BMS (2022) as a product of their targeted species searches and habitat assessment. Geoprocessing was used to analyse the intersection of threatened species buffers with mapped native and exotic vegetation on the site to provide areas of threatened species habitat for entry into the BAM Credit Calculator.

Species polygons were derived for the Pink-tailed Legless Lizard, Striped Legless Lizard, Glossy Black-Cockatoo, Barking Owl, Powerful Owl and Masked Owl.

Table 16. Species Polygon Areas (ha) Impacted by the Marulan Solar Farm for Candidate Threatened Species

Confirmed candidate threatened species	PCT 1330 Moderate (ha)	PCT 1330 Mod-poor (ha)	PCT 1330 Poor (ha)	PCT 1330 Pasture (ha)	PCT 1330 Regen (ha)	PCT 1330 Planting (ha)	PCT 1110 Moderate (ha)	PCT 351 Dense (ha)	PCT 351 Poor (ha)	Total Area (ha)
Pink-tailed legless lizard	-	0.14	-	2.44	0.23	-	-	0.19	0.9	3.9
Glossy Black-cockatoo	0.75	0.77	2.55	12.95	0.45	-	-	0.19	0.33	17.99
Striped Legless Lizard	-	-	-	3.6	-	-	0.01	-	-	3.61
Barking Owl	-	0.37	-	6.37	0.21	-	-	-	-	6.95
Powerful Owl	0.48	0.37	0.04	7.95	0.21	-	-	-	-	9.05
Masked Owl	-	0.37	-	6.37	0.21	-	-	-	-	6.95

Figure 12. Pink-tailed Legless Lizard habitat within native vegetation on the Subject Land

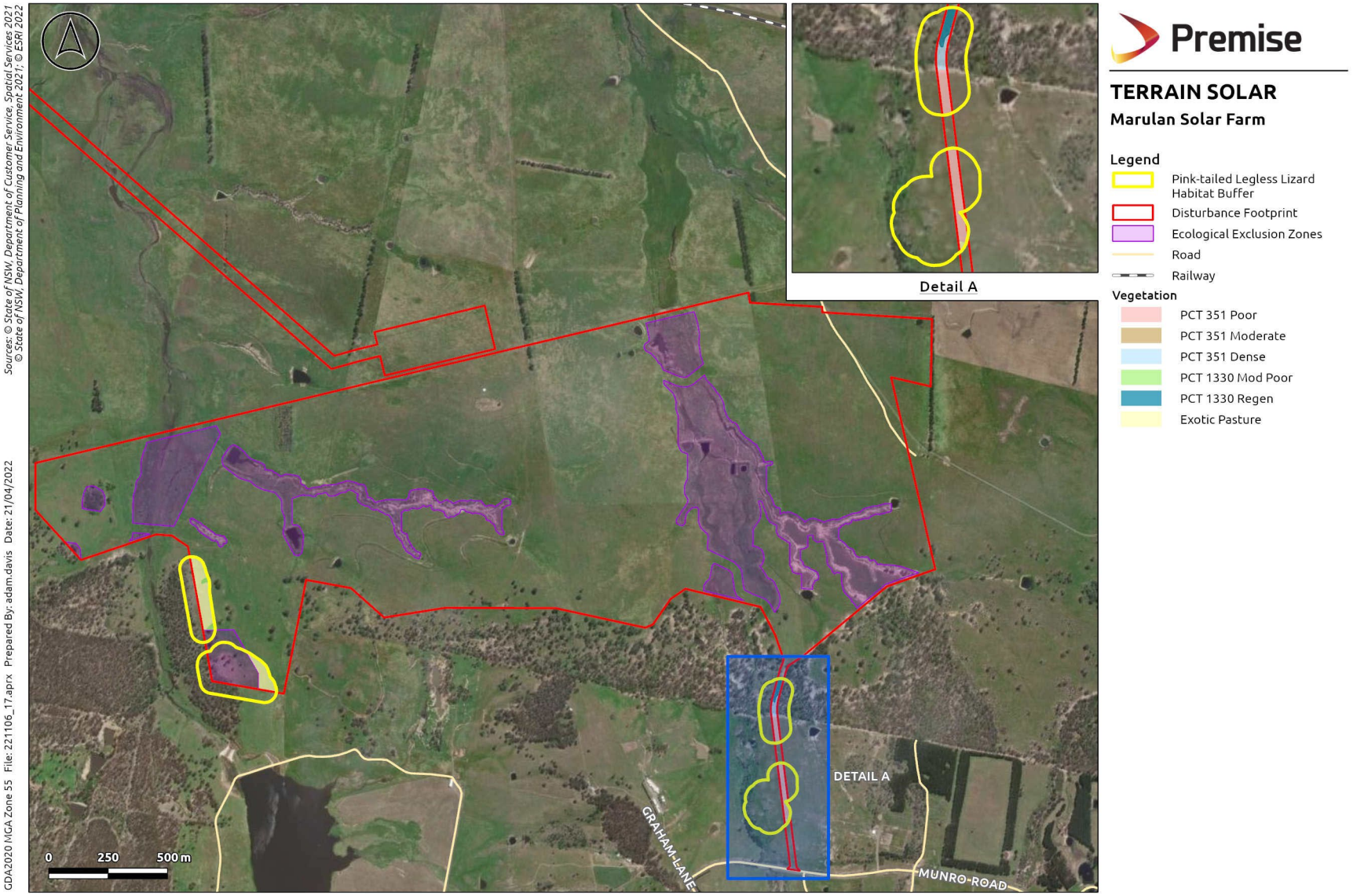


Figure 13. Glossy Black Cockatoo habitat within native vegetation on the Subject Land

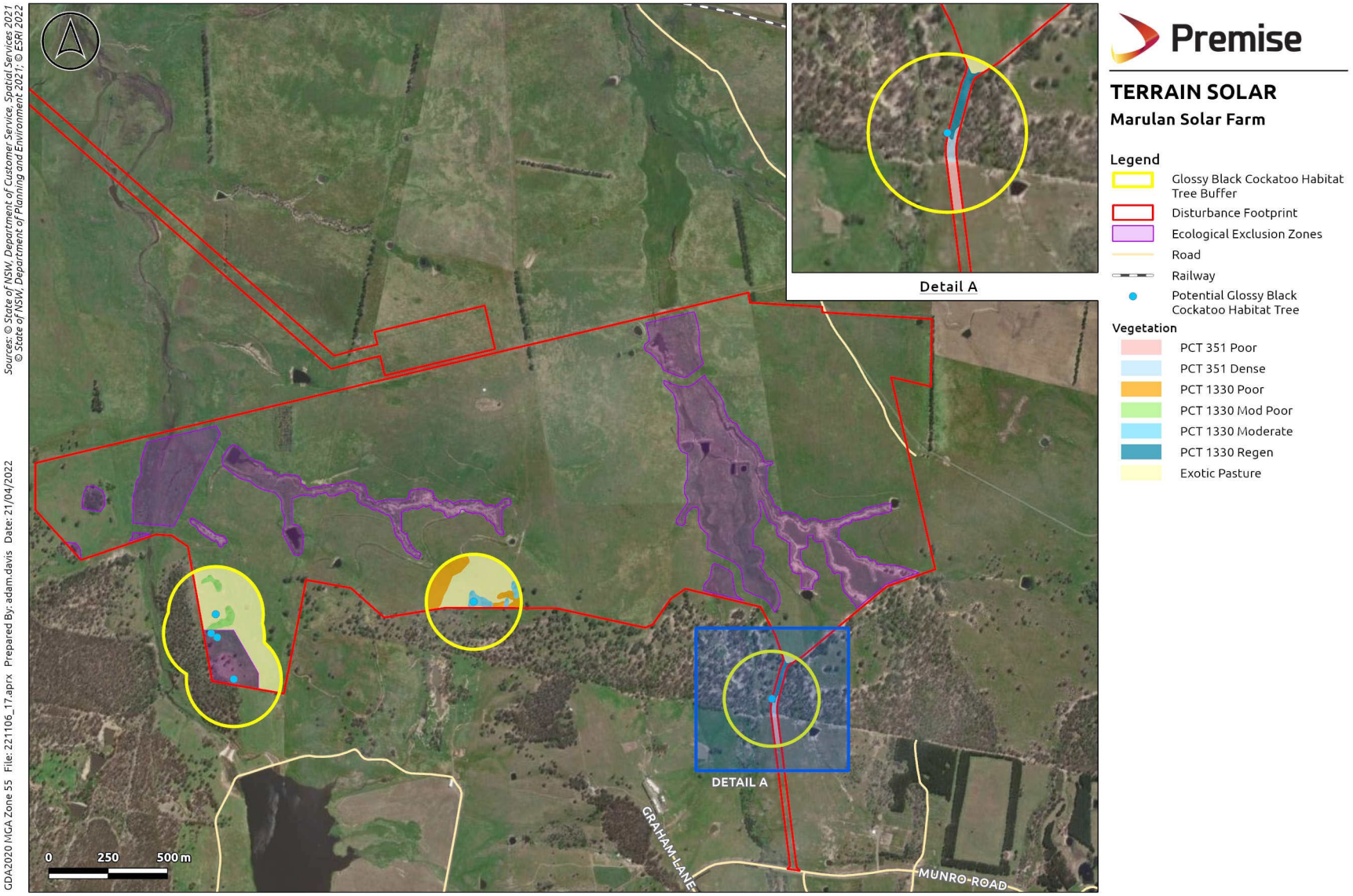


Figure 14. Striped Legless Lizard habitat within native vegetation on the Subject Land

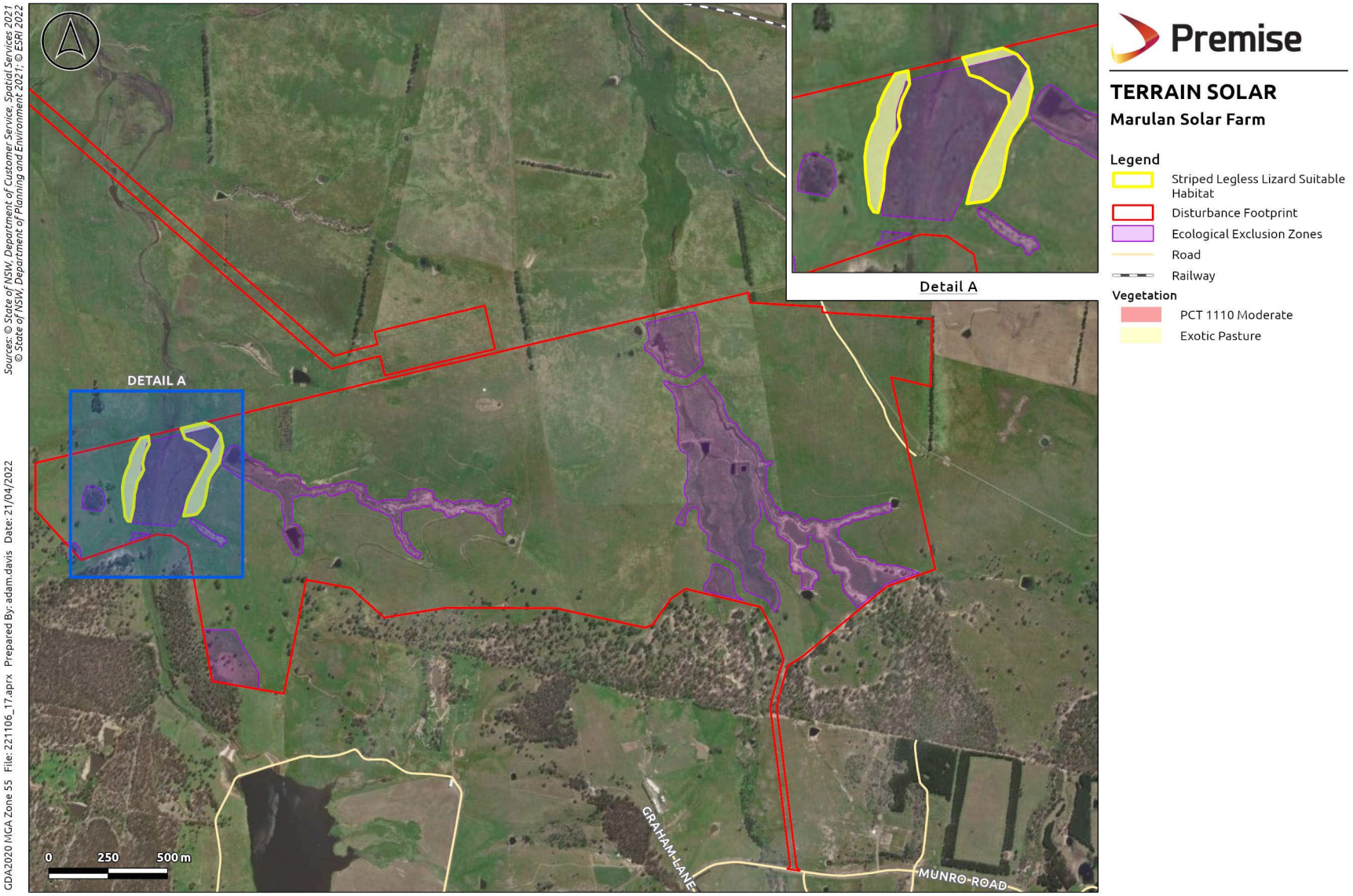


Figure 15. Powerful Owl and Masked Owl habitat within native vegetation on the Subject Land

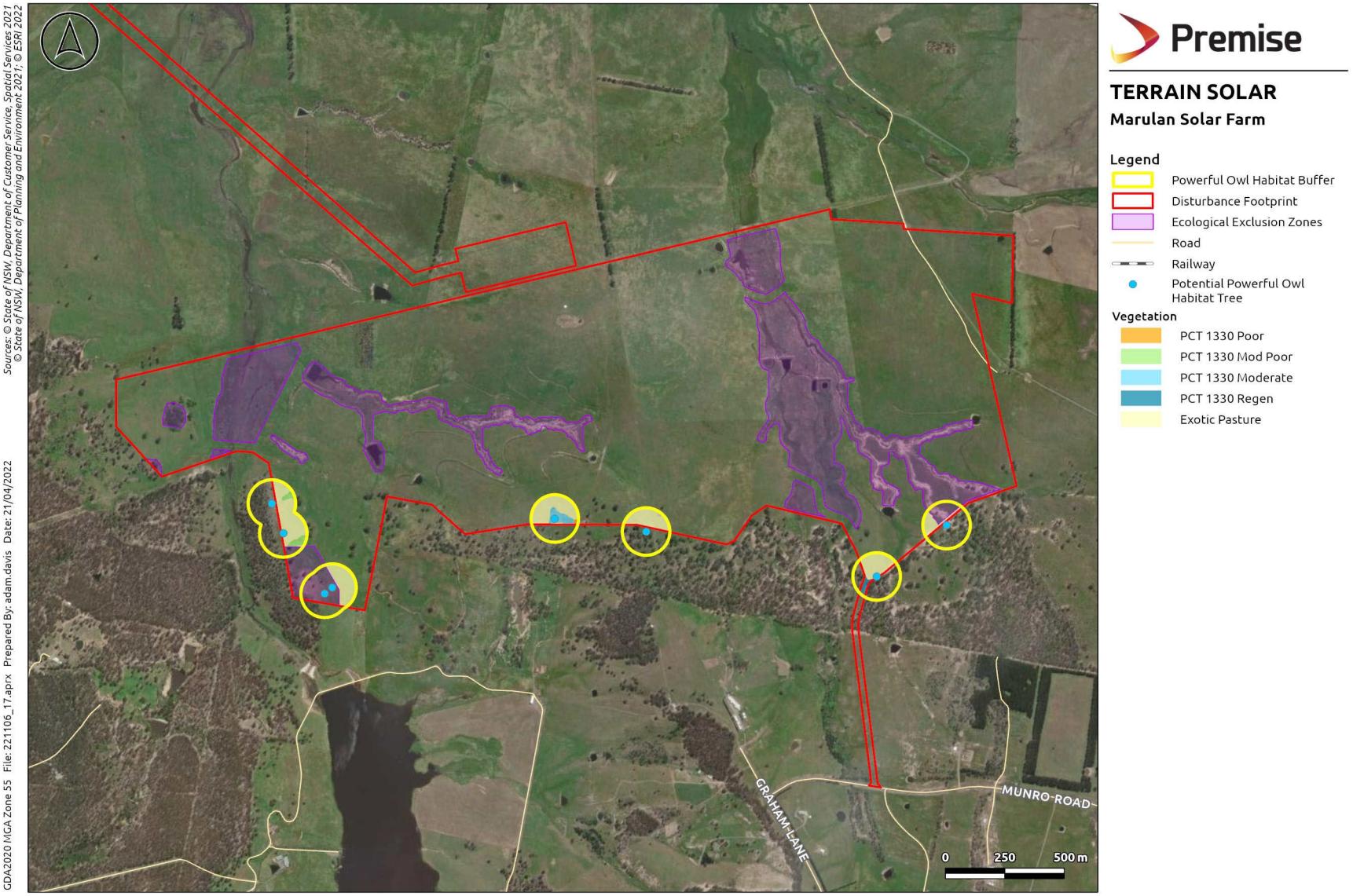
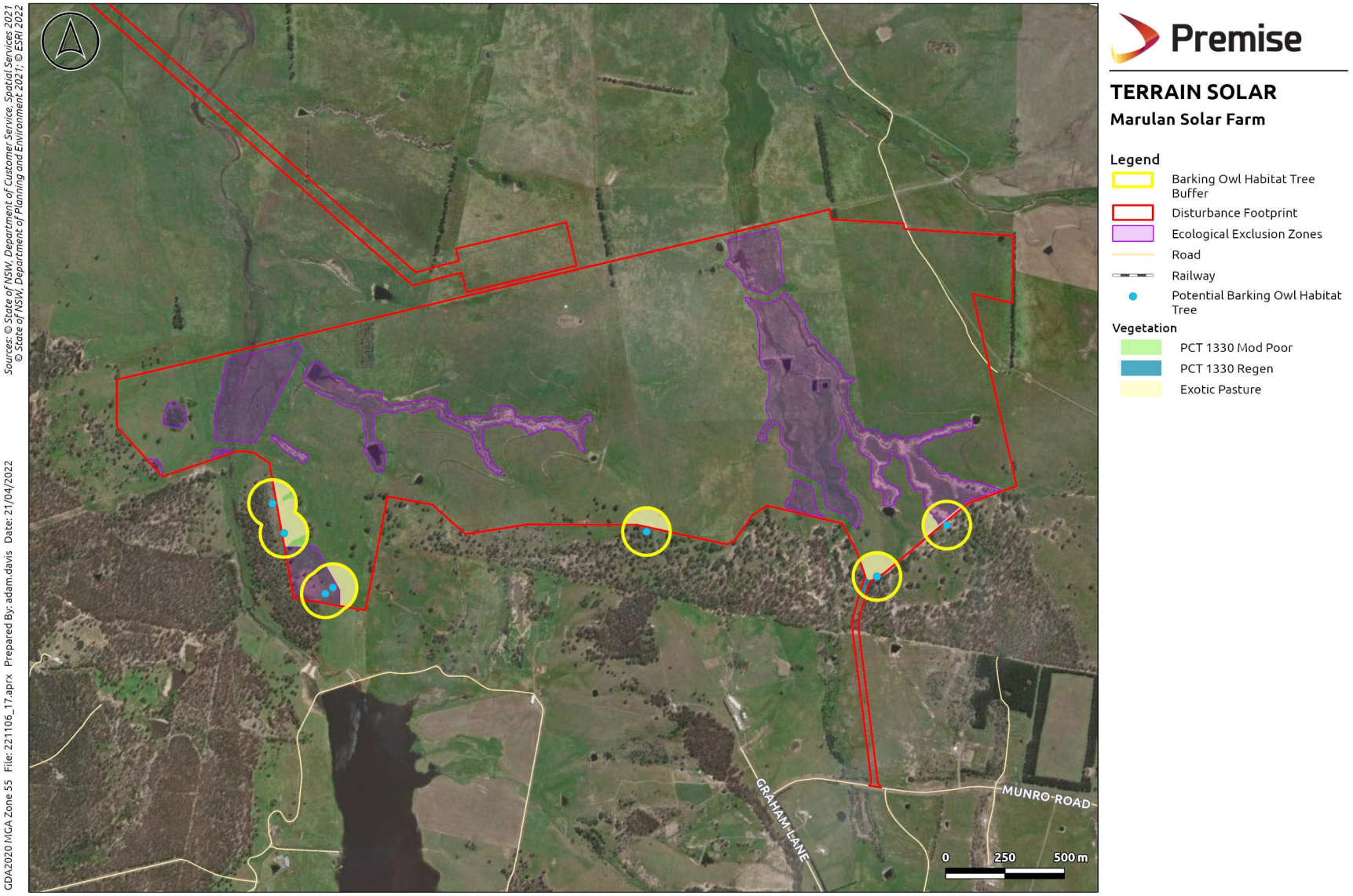


Figure 16. Barking Owl habitat within native vegetation on the Subject Land



2.4.4 ECOSYSTEM CREDIT SPECIES

A total of 25 of the ecosystem credit species identified in association with PCT 351, 1110 and 1330 in **Table 9** and **Table 10** were retained in the BAM Credit Calculator. A further two species were added based on PMST results.

2.4.5 SPECIES CREDIT SPECIES

Of the 33 species credit species identified in association with PCT 351, 1110 and 1330:

- 28 species have been eliminated through habitat assessment and targeted flora and fauna surveys; and
- six species are assumed present, as due to seasonal timing constraints, targeted surveys could not be conducted (**Table 17**).

Table 17. Species Credit Species Impacted by the Project

Common Name	Scientific Name	Biodiversity Risk Weighting	Likelihood of Impact	Area (ha)
Pink-tailed Legless Lizard	*Aprasia parapulchella*	2.00	Low	3.9
Glossy Black Cockatoo	*Calyptorhynchus lathami*	2.00	Low	17.99
Striped Legless Lizard	*Delma impar*	1.50	Moderate	3.61
Barking Owl	*Ninox connivens*	2.00	Low	6.95
Powerful Owl	*Ninox strenua*	2.00	Low	9.05
Masked Owl	*Tyto novaehollandiae*	2.00	Low	6.95

2.4.6 THREATENED SPECIES LISTED UNDER THE EPBC ACT (MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE)

2.4.6.1 Threatened Species

Four fauna species listed under the EPBC Act are considered to have a low probability of utilising the site; the Koala, Greater Glider, Pink-tailed Legless Lizard and the Striped Legless Lizard. Survey has been carried out for the Koala in the form of SATs as detailed in the baseline fauna report (**Appendix C**).

2.4.6.1.1 Pink-tailed Legless Lizard

The Pink-tailed Legless Lizard (*Aprasia parapulchella*) is listed as Vulnerable under the EPBC Act. The Solar Farm occurs within the known range for the species, and the species has been recorded from north of the site at Taralga, NSW. *Aprasia parapulchella* relies on open woodland areas with scattered, partially buried rock and native grasses. Two areas within the project boundary include potential habitat for the species: the south-western corner which includes rocky outcrops, and the southern access road which also includes some native grasses and scattered surface rock. No survey was conducted for the species and therefore presence must be assumed.

The total potential habitat area for the species within the project boundary is 3.25 ha. A total area of 1.91 ha of habitat is to be avoided with a remaining area of 1.34 ha of potential habitat to be disturbed as part of the proposed Solar Farm.

An assessment of significant impact and need for referral can be made with reference to the Matters of National Environmental Significance Significant Impact Guidelines (DoE, 2013). These are a series of questions about the potential impacts. An assessment of the potential impacts of the proposed solar farm on the Pink-tailed Legless Lizard is carried out below.

Under the MNES guidelines, an 'important population' is a population that is necessary for a species' long-term survival and recovery and may include populations identified as such in recovery plans, key source populations either for breeding or dispersal, populations that are necessary for maintaining genetic diversity, and/or populations that are near the limit of the species range.

If a population of the species occurs on the site, it has not been identified within a Recovery Plan or within the Conservation advice as an important population but may constitute a population which is near the eastern limit of the species range.

Will the proposed action:

1. *Lead to a long-term decrease in the size of an important population of a species, fragment an existing important population into two or more populations, or adversely affect habitat critical to the survival of a species?*

The presence of a population on the Subject Land must be assumed, due to the lack of survey. The disturbance of 1.3 ha of potential habitat for the species may lead to a reduction in the overall population size within the locality, if populations are disturbed during rock removal and are not given sufficient time to remove themselves to adjacent habitat.

The two potential populations would not be fragmented since suitable habitat occurs in adjacent areas which will not be impacted by the Solar Farm.

Rocks are important for *Aprasia parapulchella* because they provide shelter and foraging opportunities. The rocks which are to be removed will be placed in the paddock immediately adjacent to the access road, and rocks will not be removed from the ridgeline in the southwest of the site. However the movement of rocks during construction of the access road would have a temporary disruptive effect on a local population through disturbance and would therefore have some negative impact on habitat critical for the species.

2. *Disrupt the breeding cycle of an important population?*

Breeding by the species occurs over spring and summer. If clearing of rocky habitat occurs over this time period, it may have a disruptive effect on the breeding cycle of the local population.

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

Similar rocky habitat is present within adjacent areas on the Lockyersleigh property and the neighbouring property to the south and therefore it is not considered likely that the area of impact constitutes the entire potential habitat and therefore species population in the locality.

In addition, intensive livestock grazing is already impacting on the potential habitat for the species within the site through removal of grass cover and soil compaction. Along the road access, rocks will be moved away from the road corridor to an area immediately adjacent and therefore rocky habitat will be displaced but not removed. It is likely that if this is done carefully and enough time is given for the species to move out of areas where rocks have been removed into adjacent habitat, that the impact on the species may be mitigated.

4. *Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat?*

The proposed Solar Farm is to be constructed on a well-established agricultural property. Pest species which may be introduced are likely to already occur on the site. However, pest animal and weed management measures will be required to reduce the potential for introduction of any additional invasive species to the site and maintain low numbers of existing introduced predators which may impact the species.

5. *Introduce disease that may cause the species to decline?*

Traffic to the site will be low and will mainly occur during the construction and decommissioning phase of the Solar Farm. Biosecurity measures such as vehicle wash-down stations will be used to avoid the transport of contaminated soil onto the site.

6. *Interfere substantially with the recovery of the species?*

Impact on the species will occur during the construction phase of the proposed Solar Farm and will not reduce the potential for recovery of the species in the locality over the long term.

2.4.6.1.2 Striped Legless Lizard

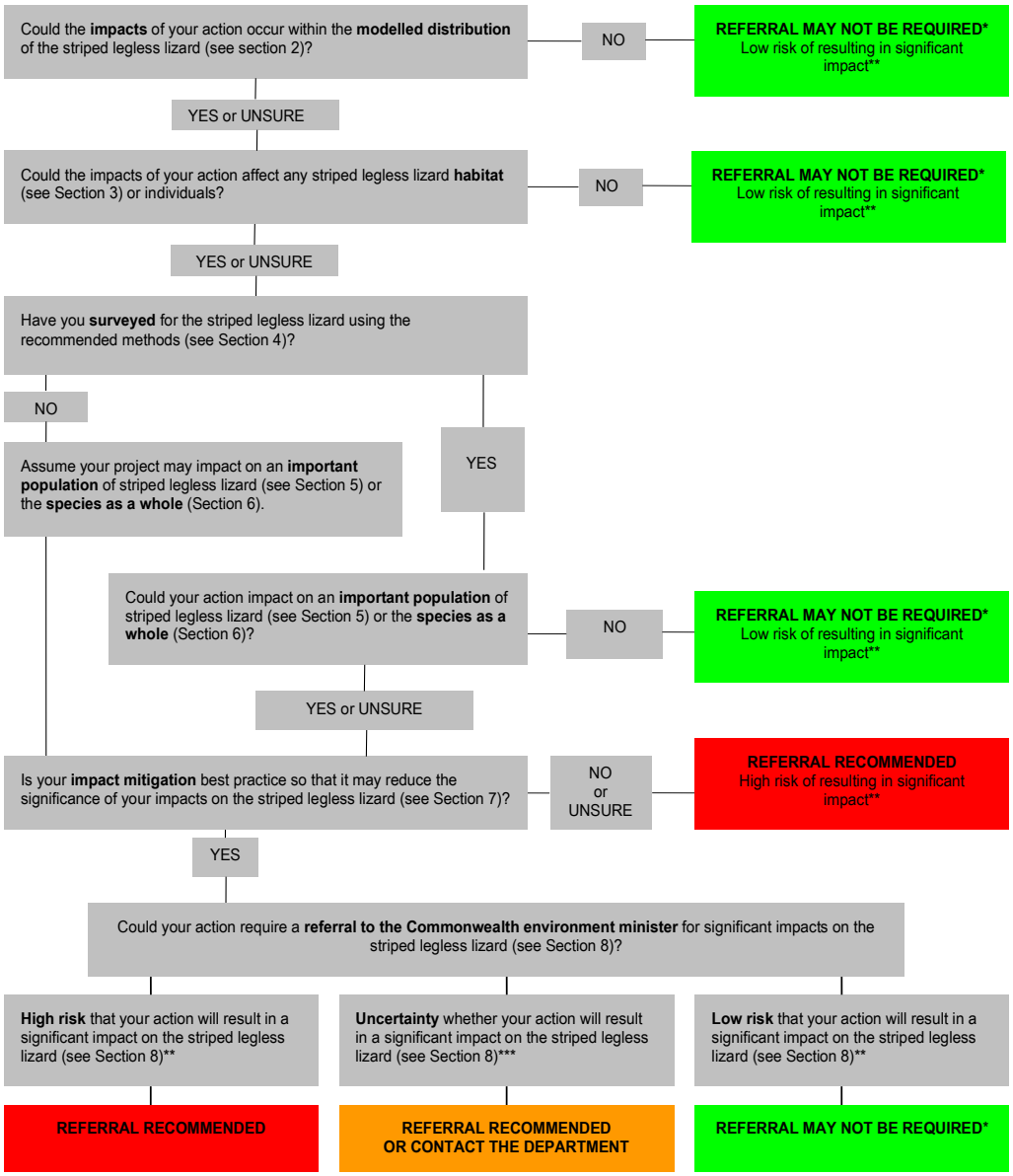
The Striped Legless Lizard (*Delma impar*) is listed as Vulnerable under the EPBC Act. The species has a known population at nearby Goulburn and the Subject Land is located within the modelled distribution for the species. *Delma impar* occurs in areas of natural temperate grassland and exotic pastures converted from these areas, as well as open box gum woodland and derived grasslands (Rob Armstrong, DPE, personal correspondence). The main habitat constraint for the species is the presence of persistent, large perennial tussock grasses or rocky habitat which provide refuge. The western part of Marulan Solar Farm was likely to have been natural temperate grassland historically. Habitat over most of the Subject Land is exotic pasture with dominant cover of exotic annuals and non-tussock forming grasses, and the presence of the species within these areas is not considered likely.

Potential habitat exists on the Subject Land along the outer boundary of the Narambulla Creek drainage which is a Natural Temperate Grassland. This drainage area has not been pasture improved and contains a high cover of native River Tussock (*Poa labillardieri*) and Tall Sedge (*Carex appressa*) and may provide refuge to the species in dry periods. The edges of this habitat include dense *Phalaris aquatica*, and it is considered likely that the species would primarily use this more elevated habitat due to the intermittent flooding and waterlogging that characterises the drainage area around the creek.

A total area of 4.7 ha of exotic pasture has been identified as potential Striped Legless Lizard habitat. 1.1 hectares have been avoided in the planning process and the remaining 3.6 ha of exotic pasture will be cleared as part of the proposed activity.

An assessment of whether a proposed action is likely to have a significant impact on the Striped Legless Lizard must apply the decision matrix provided by the EPBC Act referral guidelines for the species, reproduced in **Figure 17** (DSEWPC, 2011).

Figure 17. EPBC Act Decision Matrix for the Striped Legless Lizard (*Delma impar*)



Due to time constraints of the proposed solar farm the species was not surveyed for and instead presence is assumed, therefore it must be assumed that the proposed solar farm may impact on an important population of the species. While avoidance and minimisation measures will be employed, there is uncertainty whether the action will result in a significant impact on the Striped Legless Lizard and therefore referral is required.

2.4.6.1.3 Greater Glider

The Greater Glider is listed as Vulnerable under the EPBC Act. The species was not found during survey on the site, however suitable habitat potentially occurs on the site along the proposed road access corridor and within patches of woodland on the Subject Land with connectivity to the southern woodland patch. There are currently no referral guidelines specifically written for the species, however it was assessed as eligible for listing under Criterion 1 A2(b)(c), A3(b)(c), A4(b)(c) of the EPBC Act which refers to a reduction in the size of a population as well as its area of occupancy, extent of occurrence and/or quality of habitat (Threatened

Species Scientific Committee, 2016). This decline is attributed to increasing frequency of wildfire in habitat used by the species, as well as fragmentation of forested habitat.

An assessment of significant impact and need for referral can be made with reference to the Matters of National Environmental Significance Significant Impact Guidelines (DoE, 2013). These are a series of questions about the potential impacts. An assessment of the potential impacts of the proposed solar farm on the Greater Glider is carried out below.

Will the proposed action:

1. *Lead to a long-term decrease in the size of an important population of a species, fragment an existing important population into two or more populations, or adversely affect habitat critical to the survival of a species?*

Records for the Greater Glider within 10km of the Subject Land are associated with areas within or adjacent to densely forested National Parks – the most recent record is from Greenwich Park in 2019 to the north east of the Subject Land, in an area adjacent to the Tarlo River National Park. Older records from the Bungonia State Conservation Area to the south of the Subject Land are dated 1998. Additional records of the species are from rescue efforts from 2011 and 2015 in the town of Marulan and a sighting in 2019 at Tallong. No local population has been recorded within the woodland adjoining the Subject Land. Fire Extent and Severity Mapping from the 2019-2020 bushfires (State Government of NSW and Department of Planning, Industry and Environment, 2020) (**Figure 18**) show that an extensive area of forest was burnt to an extreme degree within 13.5km of the Subject Land. Bungonia State Conservation Area and Bungonia National Park are mapped as receiving only low severity fire with unburnt canopy, however the adjacent Morton National Park is mapped as experiencing Low to Extreme fire severity where the full canopy was consumed. It is likely that populations which survived the fires in Morton National Park would have necessarily been pushed into the adjacent Bungonia National Park. The reserve and adjacent forested areas are important refuge habitat for the species as a result. The Tarlo River National Park was not burnt in the most recent fire.

Connectivity between these two national parks and the Subject Land is fragmented. Between Bungonia NP the Hume Highway is a large barrier to dispersal. The Tarlo River National Park is somewhat connected with the western-most extent of the Subject Land but is also fragmented and separated by the town of Towrang and the Wollondilly River. The Greater Glider has a low dispersal ability and requires continuous forested areas of 160km^2 to maintain viable populations (Eyre, 2002). No Greater Gliders were found on the Subject Land or within the woodland to the south and it is unlikely that any population which exists near the Subject Land will be connected with either the Bungonia or Tarlo population. The woodland south of the Subject Land is relatively open and only covers 70 hectares, and therefore it is not likely to support a viable population on its own. Clearing of a small section of access road and trees on the edge of the southern woodland area is unlikely to contribute to a long-term decrease in any existing population to a greater degree than its isolation and small habitat area. Clearing of the access road will not further fragment any population within this woodland due to the narrow point of access.

2. *Disrupt the breeding cycle of an important population?*

Multiple den sites are used per individual with little overlap between individuals except during breeding. Hollow-bearing trees suitable for denning are usually larger (at least 30cm DBH) and occur toward the centre of an individual's home range (Lindenmayer, Pope and Cunningham, 2004). Since no individuals were found during survey it is difficult to pinpoint the 'centre' of the species' potential home range on the site, however it can be assumed that the trees to be removed as part of the project are on the edge of a potential home range as a consequence of occurring on the edge of the woodland areas. The proposed road access is composed of small non hollow-bearing trees (<20cm) and therefore potential breeding or denning trees are not present within the proposed access. It is therefore highly unlikely that removal of trees on the edges of

the woodland or from the proposed access would have any impact to disrupt the breeding cycle of the Greater Glider, if it did occur in the woodland south of the Subject Land.

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

The proposed Solar Farm will require the removal of 3.65 hectares of moderate-poor to moderate quality woodland on the Subject Land, of which only 2.5 hectares is located within 50 metres of the larger southern woodland patch and is therefore sufficiently connected to be used by the species. The woodland is marginal habitat for the Greater Glider due to the open, patchy canopy, and disconnection from other significant forest patches where populations are known to occur. It is unlikely that the removal of trees on the edge of the habitat and from a narrow access will further decrease the quality of this habitat that would cause the Greater Glider to decline. The greater risk to the species in this area is the existing low-quality of the site and lack of connectivity.

4. *Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat?*

The Subject Land is located in an agricultural landscape in which a large number of introduced predators and herbivores already occur. The proposed project is unlikely to have any impact on the numbers or type of invasive animals present in the surrounding area. Invasive plant species on the site include species such as Blackberry (*Rubus fruticosus* agg.) and Serrated Tussock (*Nassella trichotoma*). Weed management will continue for these species as part of planned site management, and new weed introductions will be managed via biosecurity measures such as vehicle wash-down stations.

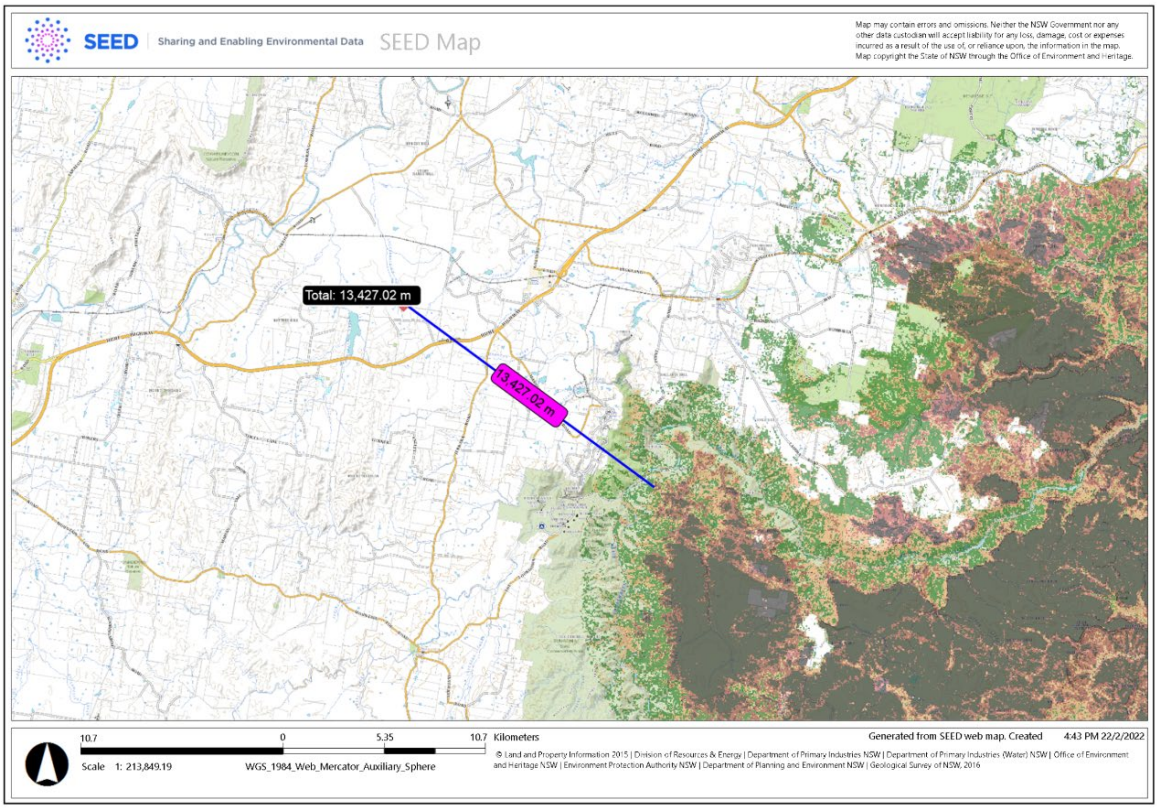
5. *Introduce disease that may cause the species to decline?*

Diseases are not currently a threat to the Greater Glider. Introduction of contaminated soil will be managed through biosecurity measures as part of the operational plan.

6. *Interfere substantially with the recovery of the species?*

The species was not found on the site and is not likely to breed within the Subject Land. Its recovery on the Subject Land would require extensive replanting within the Subject Land, and improved connectivity of the woodland to the south with existing known populations via planted corridors and artificial structures. Currently, barriers to dispersal such as the Hume Highway to the south and Wollondilly River will be a greater interference to the recovery of the species than the proposed removal of woodland on the edge of the potential habitat.

Figure 18. 2019-2020 Bushfire Severity Map within 10km of the Subject Land



2.4.6.1.4 Koala

The Koala has recently been upgraded to the status of Endangered under the EPBC Act. SAT surveys and spotlighting was conducted with the result that no recent or historical evidence of the species was found on the Subject Land. However, the presence of high-use tree species on the Subject Land and proximity of recent records mean that the site is potential habitat for the species (**Appendix C**).

Clearing of habitat will consist of a total area of 3.6 hectares of open woodland to be removed as part of the proposed activity, and a total of 16 paddock trees, all of which are Koala feed species.

The Referral Guidelines for the Vulnerable Koala are no longer current, so an assessment of significant impact and need for referral must be made with reference to the Matters of National Environmental Significance Significant Impact Guidelines (DoE, 2013) for Critically Endangered and Endangered Species.

Updated Conservation Advice for *Phascolarctos cinereus* (Koala) was published by DAWE in February 2022 and includes definition of 'Critical Habitat' for the Koala. Habitat critical to the survival of a species is defined as: the areas that the species relies on to avoid or halt decline and promote the recovery of the species. Under the EPBC Act, the following factors and any other relevant factors may be considered when identifying habitat that is critical to the survival of a species:

(a) whether the habitat is used during periods of stress (examples: flood, drought or fire);

The site is on the northern side of the Hume Highway from the Bungonia State Conservation Area which has recorded Koala presence. Some woodland habitat adjacent to the proposed Solar Farm includes a potential fire refuge for the species despite not currently supporting a population. Paddock trees and small woodland vegetation patches within the proposed Solar Farm footprint occur on the edge of this refuge habitat.

(b) whether the habitat is used to meet essential life cycle requirements (examples: foraging, breeding, nesting, roosting, social behaviour patterns or seed dispersal processes);

The habitat within the Solar Farm is not currently used by the Koala but trees within the Subject Land and within woodland contiguous with habitat on the Subject Land includes feed tree species for the Koala, including *Eucalyptus tereticornis*, *E. melliodora*, *E. macrorhyncha* and *E. amplifolia*. Therefore the habitat within the Subject Land is a potential foraging resource.

(c) the extent to which the habitat is used by important populations;

There is no evidence of occupation of habitat on the Subject Land by the Koala however records of the species include two roadkill records from the Hume Highway within the last 5 years within a distance of 2km. It is therefore feasible that the habitat may at some periods (such as during fire) form part of the home range for some individual Koalas but does not appear to be used extensively and does not support a resident population.

(d) whether the habitat is necessary to maintain genetic diversity and long-term evolutionary development;

Due to the lack of evidence of use of the Subject Land by the Koala it is not likely that available foraging habitat is necessary for maintenance of genetic diversity of the species in the area. The habitat to be removed as part of the proposed Solar Farm does not provide connectivity between fragmented habitats and clearing would have no effect on dispersal of the species within the landscape.

(e) whether the habitat is necessary for use as corridors to allow the species to move freely between sites used to meet essential life cycle requirements;

The habitat on the Subject Land which would be impacted by the proposed Solar Farm does not form a corridor connecting separate sites and is therefore not necessary to allow the species to move freely between sites.

(f) whether the habitat is necessary to ensure the long-term future of the species or ecological community through reintroduction or re-colonisation;

Since the Subject Land is not in active use by the Koala and does not appear to support a population of the species on its own, it is not suitable for the purposes of repopulating surrounding areas. Adjacent woodland habitat would be more likely to provide a refuge for the species during drought and fire, and this will not be removed as part of the proposed Solar Farm construction.

Based on criteria a) and b), the habitat on the Subject Land may be considered Critical Habitat since it occurs adjacent to habitat which meets the criteria.

Under the previous guidelines, the habitat on the Subject Land would be considered Critical Habitat. An assessment using the Koala Habitat Assessment Tool resulted in a score of 7 (**Table 18**).

Table 18. Koala habitat assessment tool as applied to the Subject Land and adjacent habitat

Attribute	Score	Inland	Justification
Koala occurrence	2	Evidence of one or more koalas within the last 5 years	2 records along the Hume Highway within 2km of Subject Land
Vegetation composition	2	Has forest, woodland or shrubland with emerging trees with 2 or more	Includes Eucalyptus blakleyi, E. tereticornis, E. amplifolia, E. melliodora.

Attribute	Score	Inland	Justification
		known koala food tree species	
Habitat connectivity	0	None of the above	Contiguous habitat is less than 500 ha.
Key existing threats	1	Evidence of infrequent or irregular koala mortality from vehicle strike or dog attack at present in areas that score 1 or 2 for koala occurrence	The two records within proximity of the site are roadkill records from the last 5 years.
Recovery value	2	Habitat is likely to be important for achieving the interim recovery objectives for the relevant context, as outlined in Table 1.	Habitat is within proximity of Bungonia State Forest and includes low-lying areas of Blakely's Red Gum, E. amplifolia and E. melliodora within the southern woodland to which the Subject Land is attached. Clearing will affect the edges of this woodland.

An assessment of the potential impacts of the proposed solar farm on the Koala is carried out below.

Will the proposed action:

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

Surveys for the Koala did not find a resident population on the Subject Land and therefore the size of the population is not known. Available Koala habitat within proximity to the Subject Land is woodland which borders the proposed Solar Farm site to the south and southwest. Habitat to be removed is from the edge of the habitat, except for the south-western corner in which 5 large paddock trees are located within a matrix of exotic pasture. Clearing of habitat will consist of a total area of 3.6 hectares of open woodland to be removed as part of the proposed activity, and a total of 16 paddock trees, all of which are Koala feed species. Corridors for movement of the species will be planted as part of the planned screening plantings, which will include feed tree species, and additional planting of feed trees is planned to occur within the existing southern woodland patch. It is therefore not likely that the small amount of clearing will lead to a long-term decrease in available habitat for the Koala and therefore a long-term decrease in population size as a result of the proposed Solar Farm is not likely.

- *Reduce the area of occupancy of the species*

The Koala has not been recorded on the site, but its potential occupancy of the site is a product of the site's proximity to the Bungonia State Recreation Reserve (SRR) south of the Hume Highway, and recent damage to available habitat in the Morton National Park due to fires in the 2019-2020 bushfire season (**Figure 18**). Proposed clearing as part of the activity will remove some potential edge habitat and scattered trees which may be suitable for use by the species. The reduction in extent of habitat is minimal and will be offset by the addition of screening plantings and infill of woodland remnants outside the Subject Land with feed tree species. Connectivity among the southern and western woodland patches will be improved by plantings. Therefore it is not likely that the proposed activity will reduce the area of occupancy of the Koala.

- *Fragment an existing population into two or more populations*

Habitat connectivity is not likely to be impacted by the proposed Solar Farm and will be slightly improved by planned screen plantings. Therefore fragmentation of Koala populations due to habitat fragmentation is not applicable.

- *Adversely affect habitat critical to the survival of a species*

Based on the updated Conservation Advice (TSSC, 2022) and the Koala habitat assessment tool in the previous referral guidelines for the Vulnerable Koala (DoE, 2014), the habitat within the southern woodland which connects to the Subject Land, and includes trees on the Subject Land, can be classified as Critical Habitat. The available habitat on the Subject Land is not currently in use by the Koala. Trees to be removed occur on the edge of this critical habitat and are spaced further apart than the southern woodland with some occurring as individual paddock trees. Trees are large and mature and Koalas are known to preferentially feed on large trees, including paddock trees. For this reason, there may be some adverse effect on the critical habitat in the locality in the short term. Tree planting will replace trees but the lag time between planting and maturity will reduce the number of suitable feed trees in the short term. The area of trees to be removed accounts for approximately 3.3 % of the contiguous critical habitat (the southern woodland covers approximately 110 hectares).

- *Disrupt the breeding cycle of a population*

The breeding season for Koalas extends from September to February, and during this period young males will be the most mobile while searching for suitable habitat unoccupied by other males. Movement occurs at night. Operations and construction activities will not extend beyond daylight hours which will reduce the risk of disturbing or injuring koalas during their movement between habitats. Proposed clearing prior to construction will take place outside of the breeding season and will employ wildlife friendly felling practices to avoid impact on individuals which may be using trees for shelter during the day.

- *Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline*

Available habitat for the Koala will be decreased in area in the short term as a result of the proposed activity. The quality of remaining habitat will not be affected and in the long-term tree plantings will increase the extent and improve the quality of habitat on the Subject Land and immediate surrounds.

- *Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat*

The proposed Solar Farm is located on an agricultural property within a landscape of similar land-use. Pest animals and plants which can be introduced to the site are likely to have already established as a result of past land-use. However, ongoing pest and weed management to be undertaken as part of the operation of the Solar Farm will be intended to prevent the introduction and spread of new invasive species on the Subject Land and immediate surrounds. Dogs are a predator of the Koala but the proposed Solar Farm will not lead to an increase in presence of dogs on the Subject Land or surrounds.

- *Introduce disease that may cause the species to decline, or*

The proposed activity will not introduce pest species to the Subject Land or surrounds, and biosecurity protocols for operation will prevent the introduction of contaminated soil as a potential disease vector, onto the site. No other mechanisms of disease introduction are likely to occur as a result of the proposed activity.

- *Interfere with the recovery of the species.*

The proximity of the 2019-2020 bushfires and the uplisting of the Koala as Endangered under the EPBC Act are both factors which increase the need to consider the recovery of this species in the context of the proposed Solar Farm. The National Recovery Plan (DAWE, 2022) for the Koala refers to habitat loss and fragmentation and habitat degradation as ecological threatening processes which interfere with the recovery of the species. Habitat loss and fragmentation refers to landscape configuration changes, reduction in average habitat (tree) cover within an area, and isolation of populations when corridors are cleared and built on. The habitat on the Solar Farm site will not be isolated from other areas, but there will be a slight reduction in the percentage cover of tree canopy on the edges of the woodland to the south of the Solar Farm. Habitat degradation refers to timber harvesting, agricultural practices on neighbouring land (such as pesticide use), and hydrological impacts from soil erosion. Once construction is completed, feed trees will be replanted in areas around the Solar Farm. Pesticide use will be limited to spot spraying of weeds and will not involve boom sprays which carry the risk of spray drift and impact on habitat trees. Erosion will be carefully managed as part of the Solar Farm construction and operation, which will reduce the risk of indirect impact on habitat trees.

The habitat on the Solar Farm site may form part of an individual's range and be used for dispersal or shelter in drought and during fire. It is not likely that removal of a small number of trees from the edge of the woodland will greatly affect the suitability of the site as a refuge for the Koala, since the woodland along the southern boundary will not be cleared. However, the activity will require referral, to seek guidance in lieu of up-to-date referral guidelines for the species, and the clearing of feed trees from the Subject Land.

2.4.6.2 Threatened Ecological Communities

2.4.6.2.1 Box Gum Woodland

Box-Gum Woodland is listed as a Critically Endangered Ecological Community under the EPBC Act. Areas of remnant Box-Gum Woodland must meet a set of criteria for protection under the EPBC Act (DEH, 2006). These criteria are applied as part of the decision matrix reproduced in **Figure 19**.

Figure 19. EPBC Act Decision Matrix for the Box-Gum Woodland CEEC.

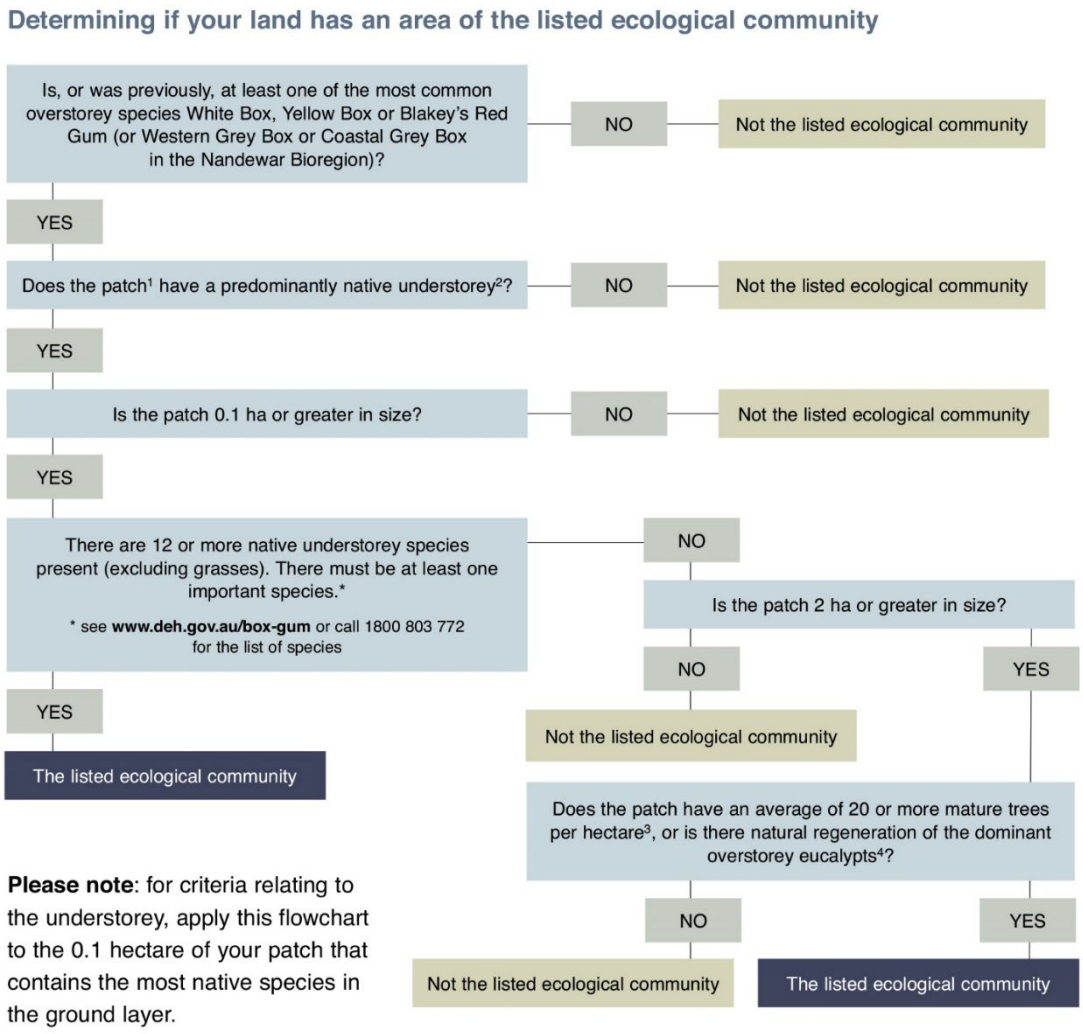


Table 19 presents the ground cover parameters required to progress through the decision matrix. These data demonstrate that none of the four Box-Gum Woodland 50 x 20 m VI plot sites had sufficient native understorey or non-grass ground cover species to qualify for the Commonwealth CEEC. Accordingly, it is concluded that no Box-Gum Woodland patches on the Subject Land meet the Commonwealth criteria for protection under the EPBC Act and referral of the Marulan Solar Farm to the Commonwealth DAWE is not required.

Table 19. Conformance of Remnant Box-Gum Woodlands on the Subject Land to EPBC Act Ground Cover Criteria for the Box-Gum Woodland CEEC.

Vegetation Integrity Plot	Predominantly Native Ground Cover	Greater than 12 native ground cover species other than grasses in 0.01 ha (no.)	Presence of one or more important species (no.)	Conforms to EPBC CEEC?
BGW1	No	2	1	No
BGW2	No	2	0	No

Vegetation Integrity Plot	Predominantly Native Ground Cover	Greater than 12 native ground cover species other than grasses in 0.01 ha (no.)	Presence of one or more important species (no.)	Conforms to EPBC CEEC?
BGW3	No	2	0	No
BGW4	No	0	0	No

2.4.6.2.2 Natural Temperate Grassland of the South Eastern Highlands

Natural Temperate Grassland of the South Eastern Highlands (NTG-SEH) is listed as a Critically Endangered Ecological Community under the EPBC Act. Areas of remnant Natural Temperate Grassland must meet a set of criteria for protection under the EPBC Act (DEH, 2006).

Key diagnostic characteristics of the community which are applicable to the site are:

a. Sites are generally confined to the South Eastern Highlands IBRA Region

Subject Land is located within the South Eastern Highlands Bioregion.

b. Sites typically occur at elevations between 350-1200m above sea level, but may occur as low as 250m due to influences of local microclimate

Elevation of site is minimum of 620m.

c. Native grasses usually are dominant and include one or more of the following: Themeda triandra *syn.* T. australis *(kangaroo grass),* Poa sieberiana *(snowgrass),* Poa labillardierei *(river tussock grass),* Austrostipa bigeniculata *(kneed speargrass),* Austrostipa scabra *(slender speargrass),* Bothriochloa macra *(red grass), various* Rytidosperma *species syn.* Austrodanthonia *species (wallaby grasses) and* Lachnagrostis *spp. (blowngrasses)*

Dominant grass species is *Poa labillardieri* in this zone on the site.

d. Native sedges may be dominant or co-dominant in some associations, typically Carex appressa *(tussock sedge) or* C. bichenoviana *(plains sedge)*

Carex appressa is the co-dominant species with *Poa labillardieri*.

e. *A tree, shrub or sub-shrub layer may be present, with up to 10% projective foliage cover of each layer being present*

Adjacent drainage lines contain a low cover of Snow Gum (*Eucalyptus pauciflora*) at a cover of <10%. This species may have occurred along the Narambulla creek on the fringes of the wet area, but higher than 10% projected cover within the creek is unlikely.

f. The area is not a derived or secondary grassland (i.e. a grassland derived from clearing of a woodland or forest community

Narambulla Creek on the Subject Land does not contain evidence of trees formerly occurring on the site in a density greater than would produce a 10% foliage cover, including stumps or dead timber. Soils are heavier than the surrounding landscape which would limit tree growth.

Based on these diagnostic characteristics, the low-lying wetland area along Narambulla Creek on the Subject land (PCT 1110) meets the diagnostic criteria for NTG – SEH and must be assessed against the condition criteria to determine if EPBC referral is required. Referral is required if the condition of the patch meets either

the Moderate ('B'), or High ('A') condition threshold categories. **Table 20** provides a summary of the adherence of each sample plot within this vegetation zone to the following criteria:

- Method 'A' – High Condition

1. Is the patch at least 0.1 ha in size? AND
2. Is the patch characterised by at least 50% foliage cover of the ground of: *Themeda triandra* (kangaroo grass) OR *Poa labillardierei* (river tussock grass), (generally in flats and drainage lines where this vegetation type naturally occurs). OR *Carex bichenoviana* (a native sedge) (or at least 50 tussocks for every 100 m2).

Poa labillardieri covers a maximum of 35% foliage cover in the Narambulla Creek on the Subject Land, therefore it does not fit the criteria of High Condition. Method 'B' is therefore applied.

- Method 'B' – Moderate Condition

1. The percentage cover of native vascular plants (including annual and perennial species) in the patch is greater than the percentage cover of perennial exotic species AND
2. In sampling plots of 0.04ha (e.g. 20m x 20m): (Favourable sampling times) (usually when most species are evident): At least 8 non-grass native species OR At least 2 indicator species OR A floristic value score (FVS5) of at least 5

In the area of highest native floristic diversity within the Narambulla Creek on the Subject Land, native vascular plants cover >60% of a 20m X 20m plot. Sampling was carried out during October 2021 in favourable conditions, during spring and after a season of high rainfall. Two of the three vegetation integrity sampled in the area of native grasslands in the creek conformed to the EPBC CEEC condition criteria when assessed using Method 'B'.

As per the approved conservation advice for the NTG- SEH:

"*The areas considered critical to the survival of the ecological community cover all patches that meet the key diagnostic characteristics and condition thresholds for the ecological community plus buffer zones*"

Proposed actions such as the construction of a new road are potentially significant impacts on the community since they involve the permanent clearing of an area 'critical to the survival of the community'. At the time of referral, the planned clearing of this community on the site was 5.07 ha. Referral was carried out to assess the impacts of the project on the NTG-SEH CEEC. Based on discussions with DAWE and the proponent, the area of disturbance has been reduced to 0.94 ha.

Table 20. Conformance of Poa Labillardieri Grasslands on the Subject Land to EPBC Act Condition Criteria for the Natural Temperate Grassland CEEC.

Vegetation Integrity Plot	Patch size	>50% cover of Themeda triandra, Poa labillardieri or Carex bichenoviana	Predominantly Native Species Cover	Non-grass native species (no.)	Presence of indicator species (no.)	Floristic Value Score 5 or greater	Conforms to EPBC CEEC?
SWMP1	>40	No	Yes	6	1	Yes	Yes- Method B
SWMP2	>40	No	Yes	4	1	Yes	Yes – Method B
SWMP3	>40	No	Yes	3	0	No	No

2.4.7 STATE ENVIRONMENTAL PLANNING POLICY (BIODIVERSITY AND CONSERVATION) 2021

The NSW *State Environmental Planning Policy (Biodiversity and Conservation) 2021* (BC SEPP) contains the relevant provisions relating to Koala habitat protection in relation to lands zoned RU1 Primary Production in most LGA's.

The Goulburn-Mulwaree Council area falls within the Central and Southern Tablelands Koala Management Area (NSW DPE, 2022b). The Koala is widely recorded in the Goulburn area with most records associated with the Bungonia State Recreation Area and the Mundoonen Nature Reserve. The closest records to the Subject Land are located 2 km south-east along the Hume Highway and are roadkill records (**Figure 20**). The dominant remnant eucalypt species on and around the Subject Land are recognised as Koala feed trees (DPIE, 2018a), namely *Eucalyptus tereticornis*, *E. amplifolia, E. melliodora*, *E. blakelyi*, *E. bridgesiana* and *E. macrorhyncha*.

Under the BC SEPP contains a listing of Koala feed tree species that include *Eucalyptus tereticornis*. The number of *E. tereticornis* trees which form part of the canopy in the Subject Land is greater than 15% which fits the definition for potential habitat under the BC SEPP.

Due to this definition and the proximity of historical records, BMS (2022) undertook koala surveys via a combination of SAT survey and spotlighting over four nights between December 2021 and February 2022. This was considered sufficient survey effort (BMS, 2022). No koalas were sighted or heard during any of the diurnal or nocturnal surveys over those periods and no scats or characteristic scratches on trees were observed during habitat assessment and SAT survey.

Accordingly, the Subject Land is not considered Core Koala Habitat under the BC SEPP, since a resident population of koalas is not present within the area surveyed as determined by a suitably qualified person; therefore, no Koala Management Plan is required.

Figure 20. BioNet Atlas records of the Koala within proximity to the Subject Land

GDA2020 MGA Zone 55 File: 221106_17.aprx Prepared By: adam.davis Date: 21/04/2022

2.5 Prescribed biodiversity impacts on threatened species

Prescribed biodiversity impacts that must be assessed are listed in section 6.7 of the BAM. Each prescribed impact and its relevance to the Subject Land is assessed below (**Figure 21** and **Figure 22**).

2.5.1 KARST, CAVES, CREVICES, CLIFFS, ROCKS AND OTHER GEOLOGICAL FEATURES OF SIGNIFICANCE

No areas of karst, caves, crevices and cliffs were observed by traverses of the entire Subject Land during field surveys by Premise or BMS (2022). The locations of natural rock outcrops recorded by BMS (2022) are shown on **Figure 21** and **Figure 22**. The rock outcrops are generally small occurrences of scattered surface rock and relatively large deeply embedded boulders partially projecting through the surface soil. The outcrops are considered by BMS (2022) to be potential habitat for the Pink-tailed Legless Lizard.

2.5.2 HUMAN MADE STRUCTURES AND NON-NATIVE VEGETATION

The ruins of an old homestead occur within the Subject Land boundary but will be avoided during construction due to heritage concerns, as documented in the EIS. No other human-made structures occur on the Subject Land. Planted non-native vegetation is associated with the old homestead on the south-western corner and as linear shelter belts. BMS (2022) has not associated these plantings as potential habitat for any candidate threatened fauna species. However, Phalaris-dominated pastures associated with previous areas of native grassland are known to provide habitat for the Vulnerable Striped Legless Lizard (BMS, 2022; BCS, 2022 (personal correspondence)).

2.5.3 HABITAT CONNECTIVITY

Connectivity between the eastern and western woodlands is already minimal and trees on either side are separated by >150 metres. The removal of paddock trees and some small patches between these areas will increase this distance but is not considered likely to impact the movement of threatened species which are assumed present on the site.

2.5.4 WATER BODIES, WATER QUALITY AND HYDROLOGICAL PROCESSES

The Narambulla Creek, Lockyersleigh Creek and tributaries as well as several unlisted streams occur on the Subject Land. Approximately 10 constructed water storages (farm dams) also occur within the Subject Land. Farm Dams were not found to provide habitat for threatened species and are therefore not considered a prescribed impact.

2.5.5 WIND FARM DEVELOPMENTS

The proposed development is not a wind farm and impacts on species that may fly, soar, move or migrate over the Subject Land do not require assessment.

2.5.6 VEHICLE STRIKES

Vehicle strikes are a possibility owing to the planned access route through a section of woodland which has a mapped potential breeding tree for threatened owls. Two trees which may provide habitat for threatened owls and two which provide potential habitat for the Glossy Black Cockatoo will be cleared as part of the proposed activity which may also pose a risk of vehicle strike during the tree felling process.

Figure 21. Prescribed Impacts on the Subject Land 1 of 2

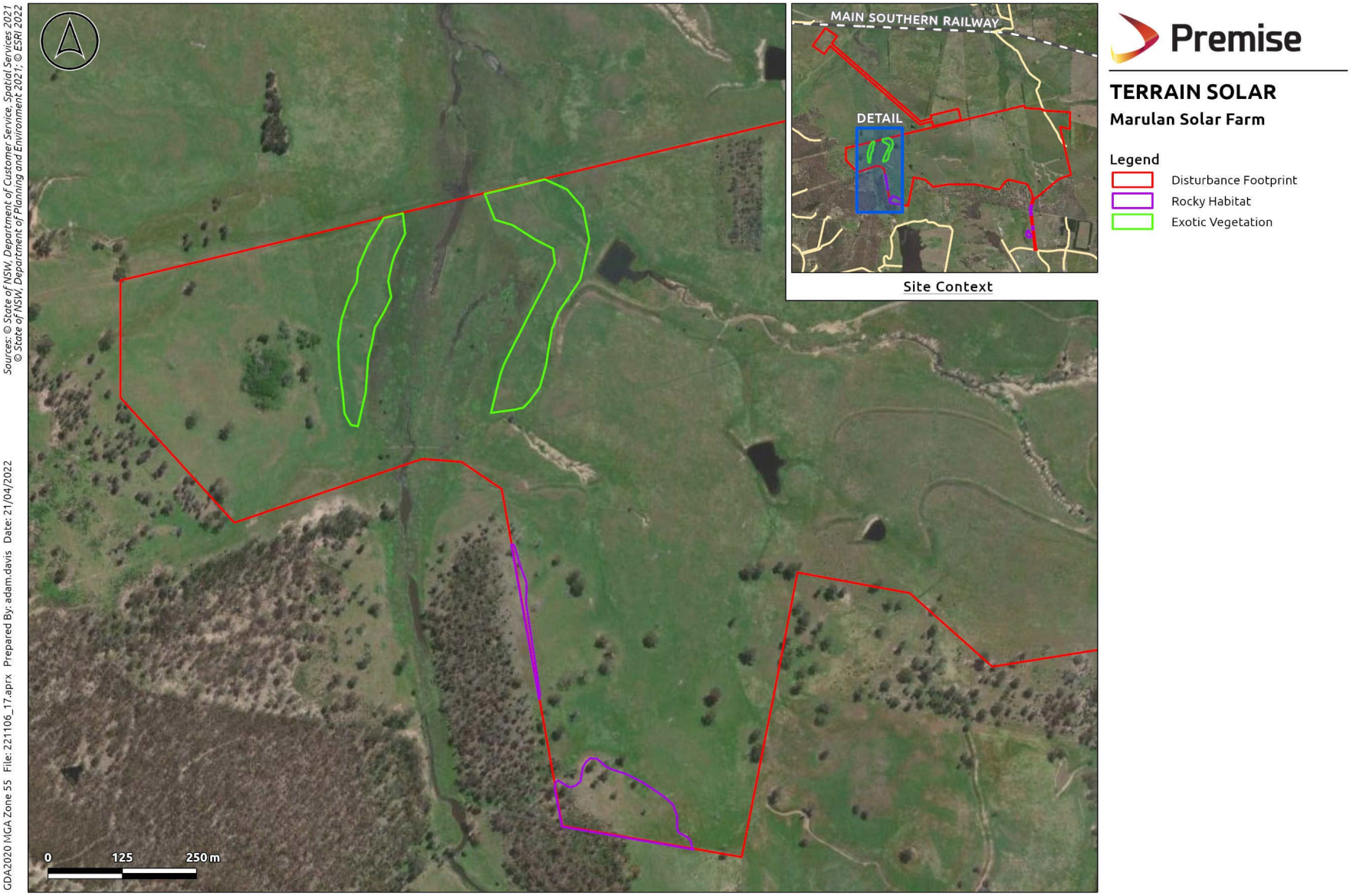
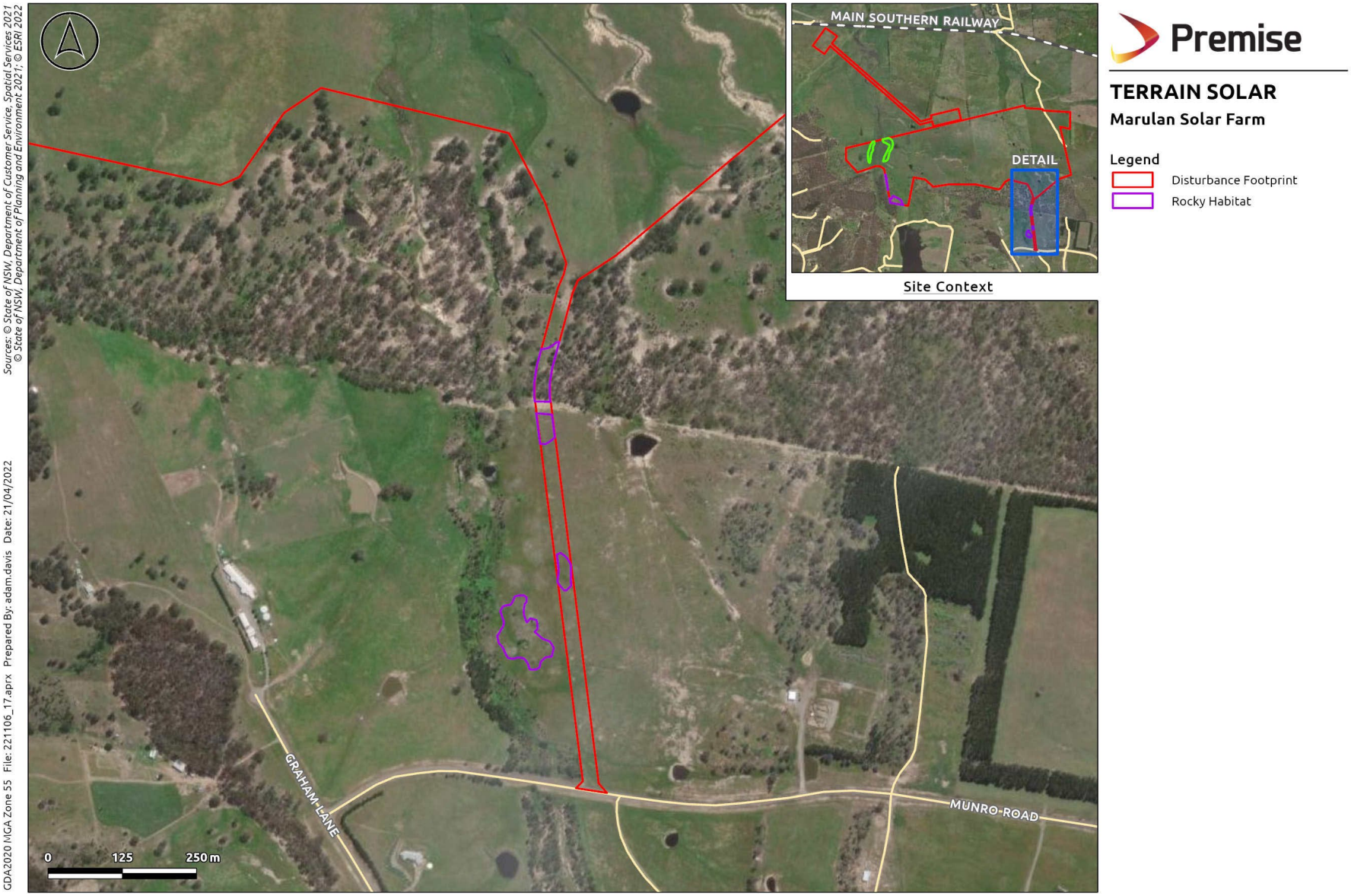


Figure 22. Prescribed Impacts on the Subject Land 2 of 2



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 impacts can include locating and/or designing the proposal to avoid or minimise direct or indirect impacts, and prescribed impacts.

3.1.1 CONSTRAINTS ASSESSMENT AND AVOIDANCE PLANNING

Opportunities to avoid and minimise impacts were considered during the planning stage of the Solar Farm. The Subject Land has been reconfigured in response to on-ground habitat assessment and the identification of sensitive areas. This includes the exclusion of an area of rocky habitat in the southwestern corner, amendment of the southern boundary to avoid areas of native woodland and exclusion of streams and wetland areas where feasible.

A total of three revisions (four iterations) have been made during the planning process to reduce the impact on native vegetation, threatened fauna and threatened ecological communities.

The first iteration (**Figure 23**) was based on the SEARs submitted for the site and included a total footprint of approximately 662 ha. This area included a large area of the disturbance for two CEECs: 74 hectares of Natural Temperate Grassland and 14.1 hectares of Box Gum Woodland (a potential SAII).

To significantly reduce the impact of the Solar Farm on these two threatened entities, the first revision of the Solar Farm footprint was carried out to move the southern extent of the Development Footprint north, away from the woodland, and refine the width of the southern access road and northern electricity transmission easement to reduce the impact of each (**Figure 24)**. This also allowed for a smaller area of focus for the completion of targeted fauna and flora surveys.

Following this revision, habitat assessment was carried out over the revised footprint to assess other sensitive areas including threatened species habitat and areas at risk of erosion. This was combined with a desktop analysis, which also identified listed streams, heritage items and areas mapped on the Biodiversity Values Map (**Figure 25**). The results of this analysis were used to generate Ecological Exclusion Zones, which restricted the operational footprint within the total Subject Land (**Figure 26**).

The fourth and final refinement of the disturbance footprint was carried out as part of the EPBC Referral process (**Section 2.4.6**). Advice from DAWE emphasised the need to further reduce the area of impact on the Natural Temperate Grasslands CEEC (NTG CEEC) (**Figure 27**). The width of two planned access roads, the first along the ETL easement and the second planned to cross Narambulla Creek, was reduced to 6 metres. This reduced the total area of impact on the NTG CEEC to 0.94 ha, from a previous total of 5.07 ha.

Avoidance of features impacting on threatened species is further described with regard to Prescribed Impacts (**Section 3.1.2**) and planned measures to avoid, minimise and mitigate impacts on biodiversity are summarised in **Table 32.**

Figure 23. First iteration of Marulan Solar Farm Disturbance Footprint prior to avoidance measures

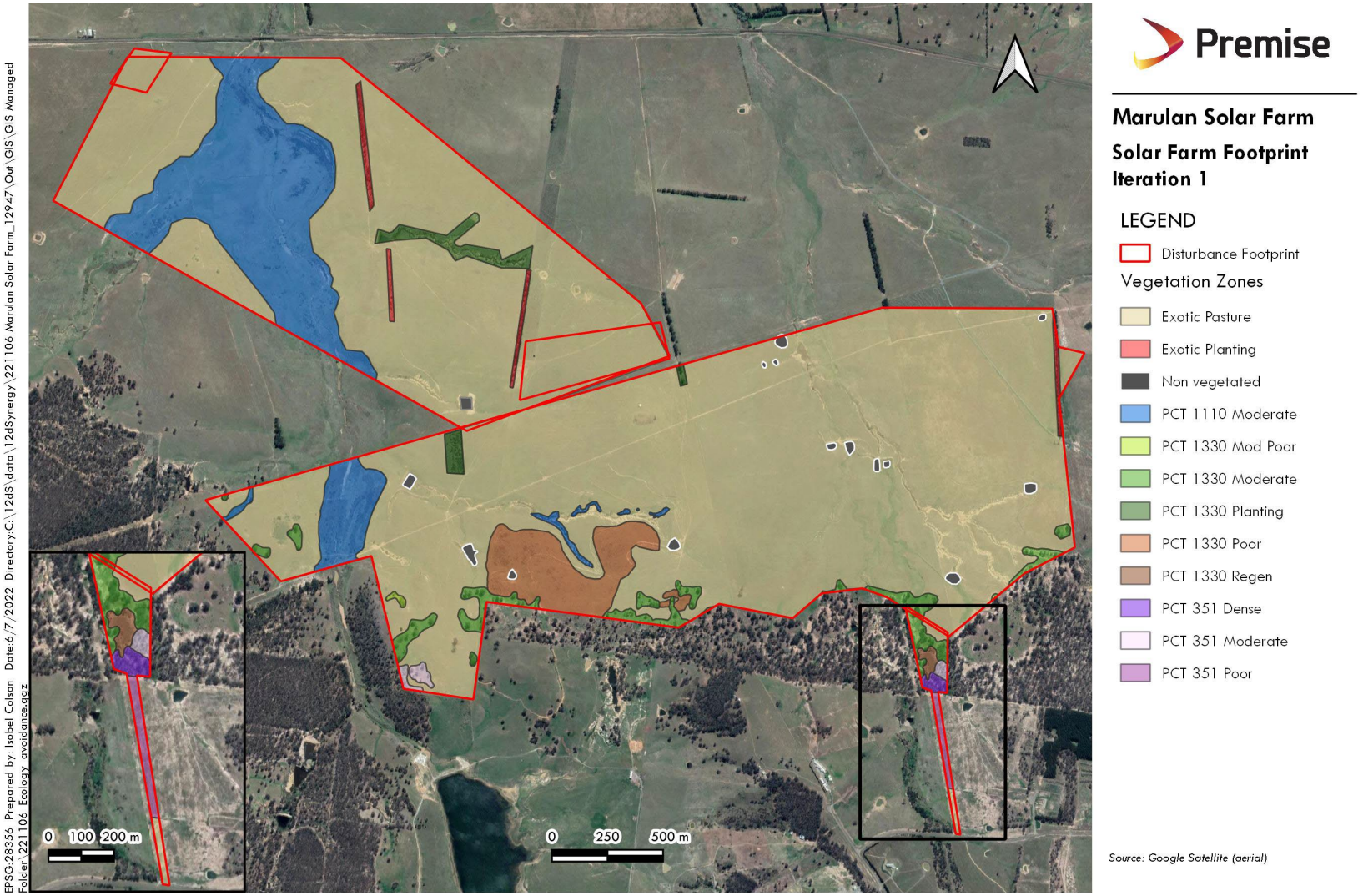


Figure 24. Second iteration of Marulan Solar Farm Disturbance Footprint after refinement of transmission easement, access route and southern boundary

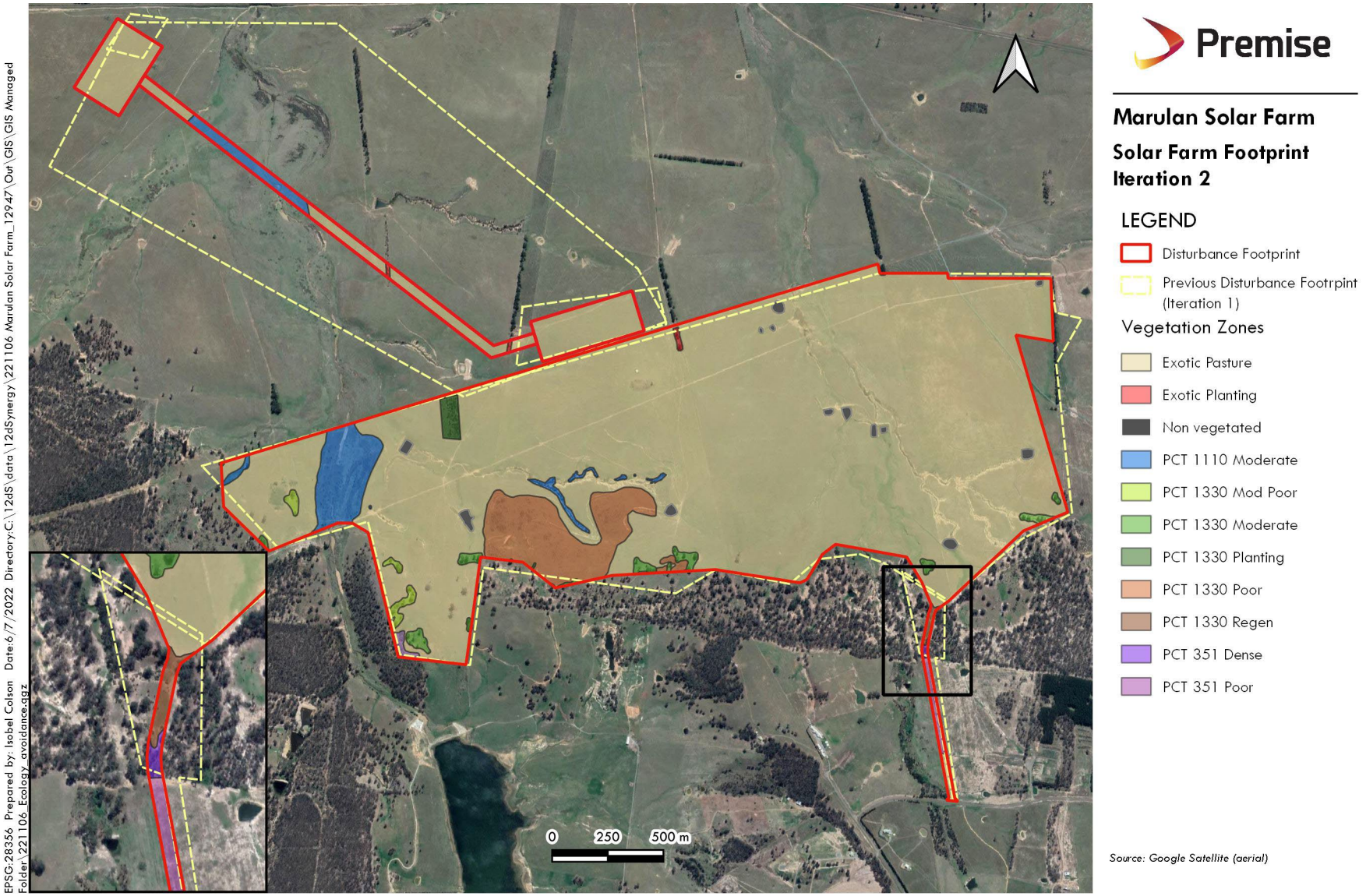


Figure 25. Avoidance of sensitive areas considered when developing Ecological Exclusion Zones for incorporation into Solar Farm design

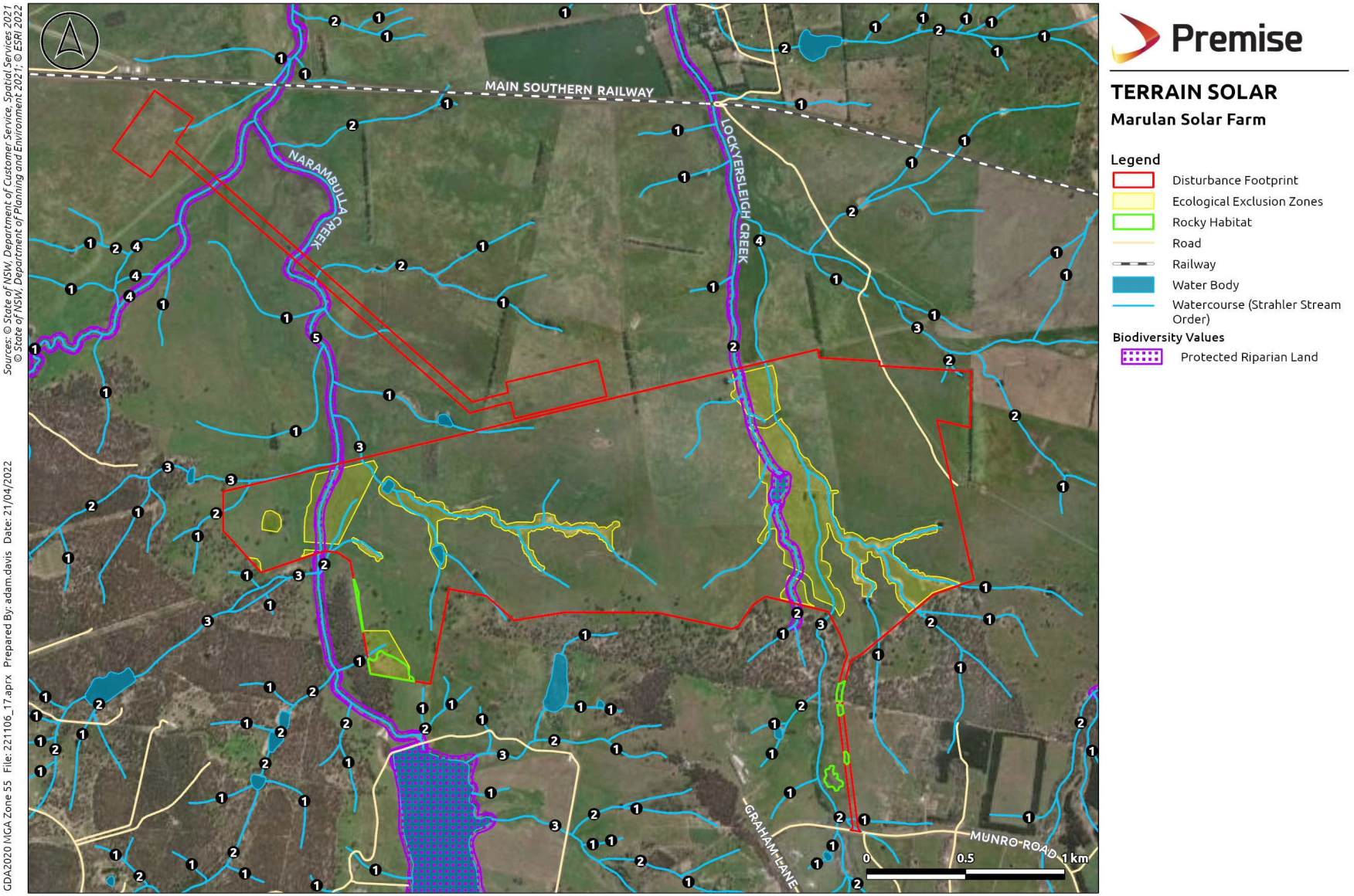


Figure 26. Third iteration of Solar Farm Disturbance Footprint incorporating Ecological Exclusion Zones

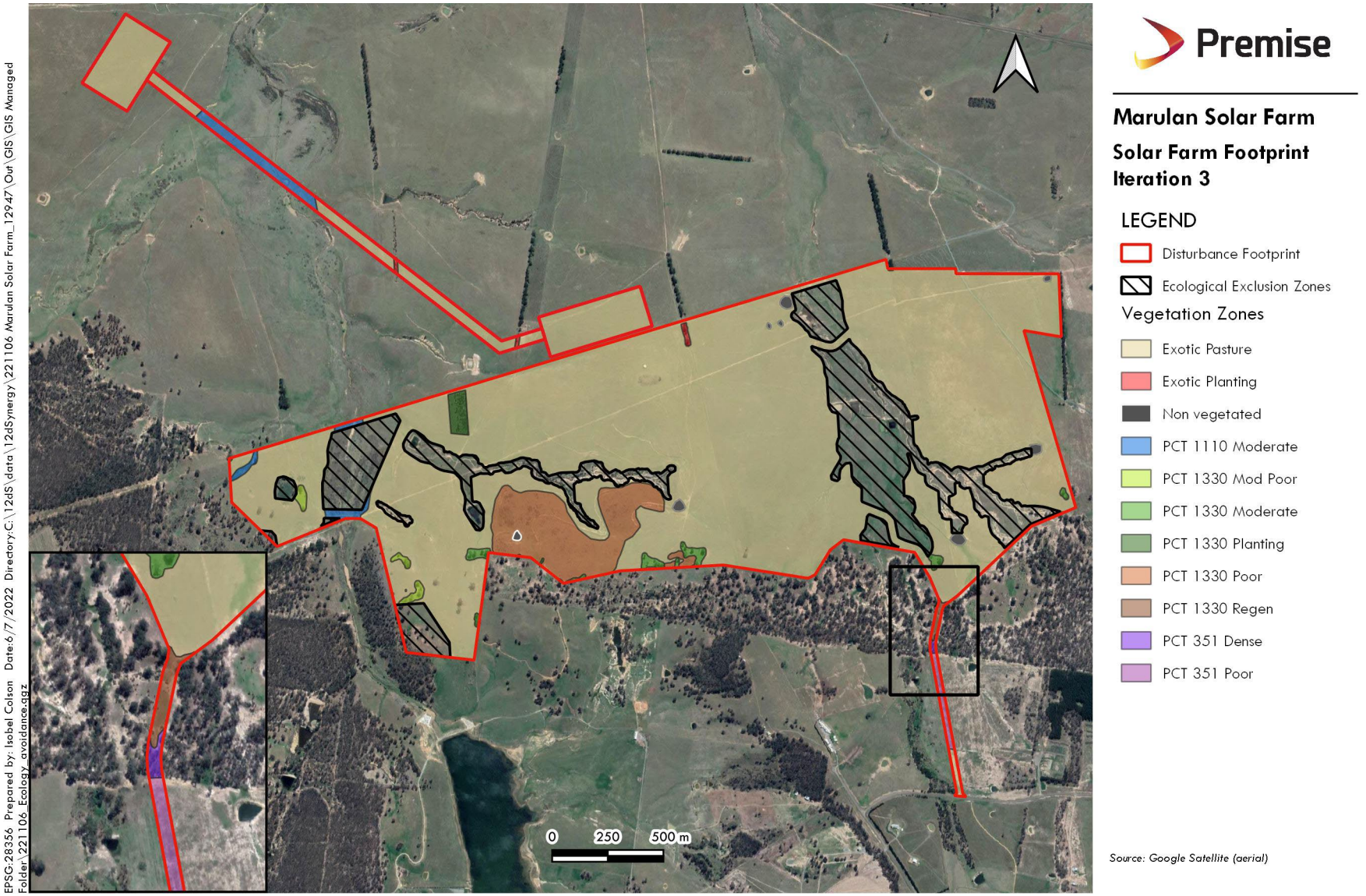
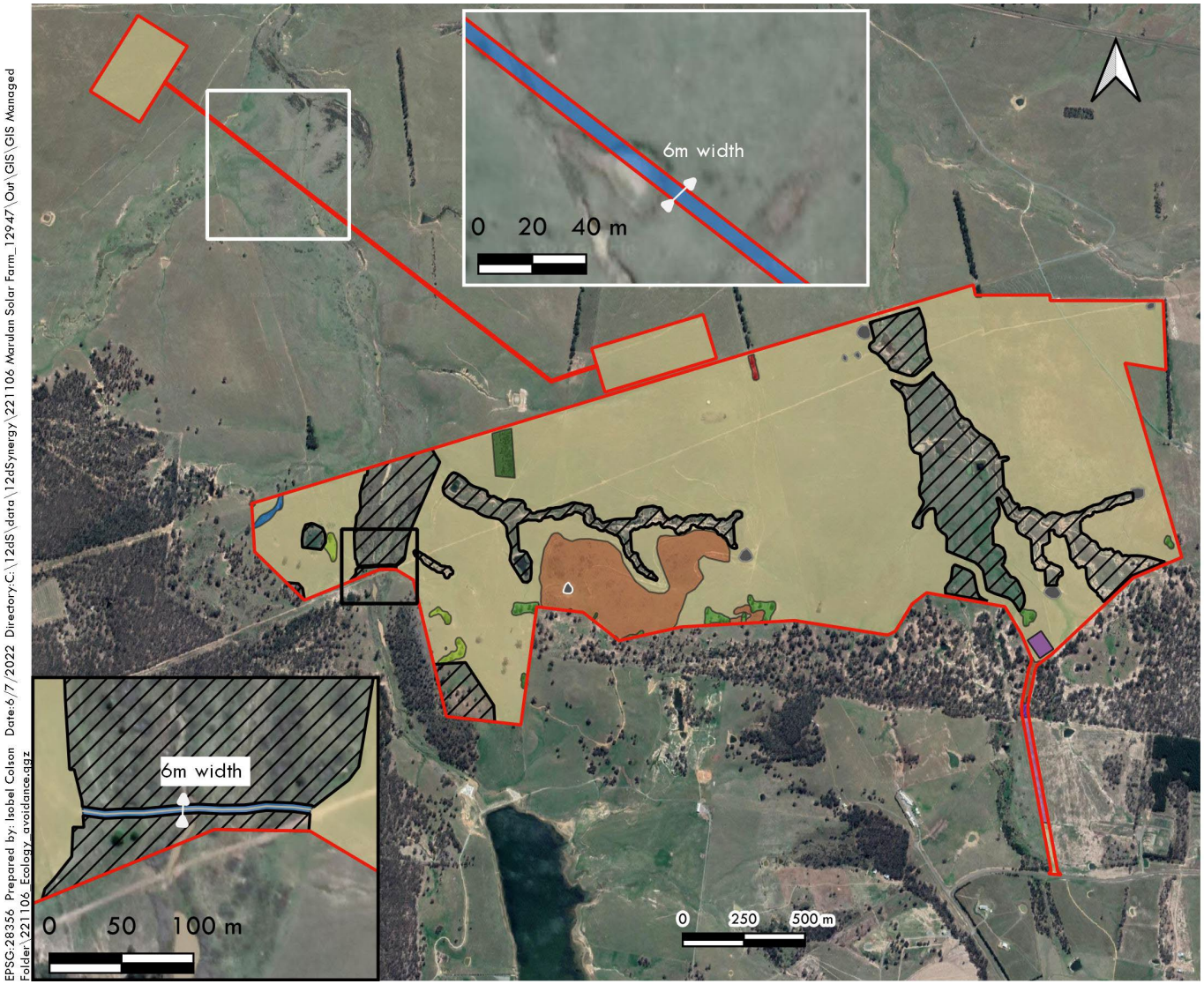


Figure 27. Fourth and final iteration of Solar Farm Disturbance Footprint with reduced disturbance along access roads



Premise

Marulan Solar Farm

Solar Farm Footprint Iteration 4 (Final)

LEGEND

Vegetation Zones

- Exotic Pasture
- Exotic Planting
- Non vegetated
- PCT 1110 Moderate
- PCT 1330 Mod Poor
- PCT 1330 Moderate
- PCT 1330 Planting
- PCT 1330 Poor
- PCT 1330 Regen
- PCT 351 Dense
- PCT 351 Poor

Source: Google Satellite (aerial)

EPSG:28356 Prepared by: Isobel Colson Date:6/7/2022 Directory:C:\12dS\data\12dSynergy\221106 Marulan Solar Farm_12947\Our\GIS\GIS Managed Folder\221106_Ecology_avoidance.qgz

3.1.2 AVOID AND MINIMISE PRESCRIBED BIODIVERSITY IMPACTS DURING PROJECT PLANNING

Four prescribed impacts from Chapter 6 of the BAM have been identified as relevant for threatened species on the Subject Land (**Section 2.5**). These are the presence of rock outcrops, which are potential habitat for the Pink-tailed Legless Lizard (BMS, 2022), exotic-dominated pastures which may form part of the habitat of the Striped Legless Lizard, waterbodies along which the Natural Temperate Grassland occur and a potential breeding habitat tree for threatened owls along the proposed access route.

A large rock outcrop in the south-western corner of the Subject Land has been excluded from the tracker footprint along with a 50m buffer (**Figure 27**). The 26m corridor in which the access route is planned contains small surface rocks and some larger embedded rocks. Small, embedded rocks and a large, embedded rock along the proposed access route cannot be avoided due to the restricted access options for the site.

Sedimentation during construction is a potential impact of the proposed Solar Farm. Trackers will be installed by drilling of post holes and other measures to reduce soil disturbance. Buffers of 40 metres have been applied to the streams and creeks for the construction of solar panel trackers. Several small farm dams will be decommissioned and filled. All constructed dams on the Subject Land were assessed during the targeted searches for threatened fauna species, which concluded that they are not habitat for any threatened species. The Water Cycle Management Study conducted for the site will inform which dams must be left in place to avoid water quality impacts.

3.2 ASSESSMENT OF RESIDUAL IMPACTS

3.2.1 DIRECT IMPACTS ON NATIVE VEGETATION AND HABITAT

Direct impacts on the Subject Land will involve the permanent removal of vegetation for the construction of roads and tracks, installation of solar arrays, underground cabling, inverter stations, a substation and electricity transmission line. It is noted that the total area of actual permanent clearing will be lower than the total area contained within the Subject Land since ground disturbance will be minimised, however permanent clearing must be assumed over the entire area since the final arrangement of panels and associated infrastructure is not confirmed. Over the Subject Land the total direct impacts will include the permanent removal of 2.46 hectares of PCT 1330 Yellow-Box - Red Gum Woodland, 0.45 hectares of good quality derived grassland and 20.43 hectares of poor-quality grassland derived from Yellow-Box woodland, 0.19 hectares of PCT 351 Stringybark woodland, 0.94 ha of PCT 1110 grassland and a total of 16 scattered paddock trees.

In addition to native vegetation, 302.4 ha of exotic dominated pasture, 1.52 ha of native plantings and 0.29 ha of exotic plantings will be cleared as part of the proposed activity

3.2.2 INPUTS TO THE BAM CREDIT CALCULATOR

The vegetation zones, areas and minimum number of quadrats required by the BAM and undertaken on the Subject Land is summarised in **Table 21**. Data from the BAM flora quadrats for input into the BAM Credit Calculator is summarised in **Table 22** to **Table** 25.

Table 21. Vegetation Zones on the Subject Land

Zone No.	Zone Name	Vegetation		Area	No of Quadrants (required/completed)
		Formation	Class		
1	PCT 1330 Moderate	Grassy Woodlands	Southern Tableland Grassy Woodlands	2.45	3/3
2	PCT 1330 Mod Poor			1.2	1/1
3	PCT 1330 Poor			20.43	4/4
4	PCT 1330 Pasture			302.4	15/7
5	PCT 1330 Regen			0.45	1/1
6	PCT 1330 Planting			1.52	1/1
7	PCT 1110 Moderate	Grasslands	Temperate Montane Grasslands	0.94	3/1
8	PCT 351 Dense	Dry Sclerophyll Forests	Southern Tableland Dry Sclerophyll Forests	0.19	1/1
9	PCT 351 Poor			1.14	1/1

Table 22. Inputs to the BAM Credit Calculator for PCT 1330

BAM attribute (400m2)	1330 Moderate (BGW1)		1330 Moderate (BGW2)		1330 Moderate (BGW3)		1330 Mod_Poor (BGW4)		1330 Poor (STR1)		1330 Poor (STR2)		1330 Poor (STR3)		1330 Poor (STR4)		1330 Regen (STR5)		1330 Planting (PL1)	
	No. sp.	Cover (%)	No. sp.	Cover (%)	No. sp.	Cover (%)	No. sp.	Cover (%)	No. sp.	Cover (%)	No. sp.	Cover (%)	No. sp.	Cover (%)	No. sp.	Cover (%)	No. sp.	Cover (%)	No. sp.	Cover (%)
Trees	1	35.0	2	30.0	2	30.0	1	15.0	0	0.0	0	0.0	0	0.0	0	0.0	1	15.0	7	9.0
Shrubs	1	0.1	1	1.0	0	0.0	0	0.0	1	20.0	1	15.0	1	10.0	1	15.0	1	0.1	5	4.8
Grasses / grass-like	2	0.2	4	30.4	3	0.7	0	0.0	5	3.4	2	4.0	3	2.7	2	1.2	7	16.4	5	9.6
Forbs	3	1.2	2	0.2	4	0.4	0	0.0	2	2.1	1	2.0	2	2.1	1	1.0	7	0.8	1	0.1
Ferns	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.1	0	0.0
Other	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
High Threat Exotics	0.2		0.2		0.2		0.1		0.2		2.1		0.6		0.2		5.0		27.4	
No. large trees	4		1		1		2		0		0		0		0		0		0	
No. hollow-bearing trees	5		0		2		0		0		0		0		0		0		0	
Litter cover (1000m²)	69.4		49.0		38.0		23.4		75.0		69.0		61.0		86.0		32.0		52.0	
Length of logs (1000m²)	21.5		3.0		117.0		3.0		0.0		0.0		0.0		0.0		1.0		10.5	
Patch Size (category <5, 5-24, 25-100, >100	101		101		101		101		35		35		35		35		35		70	

Table 23. Inputs to the BAM Credit Calculator for Exotic Pasture

BAM attribute (400m²)	1330 Pasture (CSF9)		1330 Pasture (UG1)		1330 Pasture (UG2)		1330 Pasture (EG1)		1330 Pasture (EG2)		1330 Pasture (EG3)		1330 Pasture (EG4)	
	No. sp.	Cover (%)	No. sp.	Cover (%)	No. sp.	Cover (%)	No. sp.	Cover (%)	No. sp.	Cover (%)	No. sp.	Cover (%)	No. sp.	Cover (%)
Trees	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Shrubs	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Grasses / grass-like	4	11.2	5	3.7	2	1.1	2	0.2	2	1.1	1	0.1	2	5.1
Forbs	3	2.1	2	0.2	0	0.0	1	20.0	1	5.0	1	10.0	1	10.0
Ferns	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Other	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
High Threat Exotics	0.5		5.0		0.1		5.0		0.6		2.7		5.1	
Litter cover **(1000m²)**	27.0		80.0		61.0		81.0		91.0		78.0		78.0	
Length of logs **(1000m²)**	0.0		0.0		0.0		0.0		0.0		0.0		0.0	
Patch Size (category <5, 5-24, 25-100, >100	500		500		500		500		500		500		500	

Table 23. (cont.) – Inputs to the BAM Credit Calculator for Exotic Pasture

BAM attribute (400m²)	1330 Pasture (EG5)		1330 Pasture (SW1)		1330 Pasture (SW2)1		1330 Pasture (SW3)1		1330 Pasture (EGA)		1330 Pasture (EGB)		1330 Pasture (UG4)		1330 Pasture (UG3)	
	No. sp.	Cover (%)	No. sp.	Cover (%)	No. sp.	Cover (%)	No. sp.	Cover (%)	No. sp.	Cover (%)	No. sp.	Cover (%)	No. sp.	Cover (%)	No. sp.	Cover (%)
Trees	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Shrubs	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Grasses / grass-like	4	0.9	4	2.2	6	30.7	4	2.1	3	0.5	0	0.0	8	5.4	3	10.2
Forbs	1	30.0	1	3.0	2	5.1	1	5.0	3	0.3	1	0.1	3	0.4	3	0.4
Ferns	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Other	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
High Threat Exotics	2.1		36.0		4.0		48.2		0.2		0.3		3.2		5.0	
Litter cover **(1000m²)**	68.0		67.0		85.0		61.0		42.0		32.0		6.6		16.4	
Length of logs **(1000m²)**	0.0		0.0		0.0		0.0		0.0		0.0		0.0		2.0	
Patch Size (category <5, 5-24, 25-100, >100	500		500		500		500		500		500		500		500	

Table 24. Inputs to the BAM Credit Calculator for PCT 1110

BAM attribute (400m²)	PCT 1110 Moderate (SWMP1)		PCT 1110 Moderate (SWMP2)		PCT 1110 Moderate (SWMP3)	
	No. sp.	Cover (%)	No. sp.	Cover (%)	No. sp.	Cover (%)
Trees	0	0	0	0	0	0
Shrubs	0	0	1	0.2	1	0.2
Grasses / grass-like	4	61.1	4	25.5	3	62
Forbs	6	2.7	3	15.2	2	0.6
Ferns	0	0	0	0	0	0
Other	0	0	0	0	0	0
High Threat Exotics	9.1		26		43.2	
Litter cover (1000m²)	9.1		26.2		5.9	
Length of logs (1000m²)	0		0		0	
Patch Size (category <5, 5-24, 25-100, >100	125		125		125	

Table 25. Inputs to the BAM Credit Calculator for PCT 351

BAM attribute (400m²)	**PCT 351 Dense (CinDense1)**		**PCT 351 Poor (CinereaDNG)**	
	No. sp.	**Cover (%)**	**No. sp.**	**Cover (%)**
Trees	3	27	0	0
Shrubs	3	20.3	1	5
Grasses / grass-like	13	25.5	11	55.6
Forbs	12	1.6	2	0.6
Ferns	1	0.1	0	0
Other	0	0	0	0
No. large trees	2		0	
No. hollow-bearing trees	1		0	
High Threat Exotics	0.3		0.7	
Litter cover **(1000m²)**	45		1.2	
Length of logs **(1000m²)**	56		0	
Patch Size (category <5, 5-24, 25-100, >100	101		101	

3.2.3 VEGETATION INTEGRITY SCORES

The VI score was calculated using the BAM Credit Calculator for each vegetation zone. The results are summarised in **Table 26**. The VI score exceeds the score of 15 that applies to threatened ecological communities for the PCT 1330 Moderate, PCT 1330 Regen and PCT 1330 Planting zones, the PCT 1110 Moderate zone and the PCT 351 Dense zone. All other vegetation zones do not exceed the minimum VI score of 15. Accordingly, the Biodiversity Offset Scheme is triggered for PCT 1330 Moderate, PCT 1330 Regen, PCT 1330 Planting zones but not for the PCT 1330 Poor, PCT 1330 Pasture or PCT 351 Poor zones.

Table 26. Vegetation Integrity Statistics from the BAM Credit Calculator

Zone	Area	Composition	Structure	Function	Vegetation Integrity
1330 Moderate	2.46	12.5	38.6	65.2	31.5
1330 Mod Poor	1.2	1.4	23.4	39	10.9
1330 Poor	20.43	6.5	7.3	15	8.9
1330 Pasture	302.4	7.3	10.8	15	10.6
1330 Regen	0.45	43.4	43.7	30.5	38.7
1330 Planting	1.52	39.5	22.5	45.7	34.4
1110 Moderate	0.94	33.4	72.9	-	49.4
351 Dense	0.19	68.4	84.9	83.9	78.7
351 Poor	1.14	21.9	33.1	0	1.2

3.2.4 POTENTIAL INDIRECT IMPACTS ON NATIVE VEGETATION AND HABITAT

Potential impacts of developments beyond project boundaries are identified in Section 9.1.4 of the BAM. The relevance of each of these factors to the Subject Land is assessed below.

3.2.4.1 Inadvertent impacts on adjacent habitat or vegetation

Where patches of native vegetation intersect with the Subject Land, there is potential for inadvertent disturbance.

3.2.4.2 Reduced viability of adjacent habitat due to edge effects

The habitat adjacent to much of the Subject Land is cleared agricultural land, which is unlikely to be impacted by edge effects. Avoidance of the southern woodland patch during the planning process has minimised the potential for edge effects on this habitat. The residual clearing of paddock trees and small patches of woodland will not create a 'hard edge' as a result and edge effects are unlikely to reduce the viability of woodland habitat.

3.2.4.3 Reduced viability of adjacent habitat due to noise, dust and light spill

There may be temporary disruption to adjacent habitat areas during construction associated with noise, dust and light spill. Dust has the potential to drift onto adjacent vegetation.

3.2.4.4 Transport of weeds and pathogens from the site to adjacent vegetation

The risk of translocation of weeds and pathogens from the Subject Land to surrounding vegetation is considered to be low since the area is already highly disturbed and likely supports all of the weed and pathogen species likely to be able to establish. Nevertheless, there is a small potential for new weeds and pathogens to be introduced on vehicles and materials brought to the site from outside.

3.2.4.5 Increased Risk of Starvation, Exposure and Loss of Shelter

Displacement of native animals as a result of the construction activities could cause stress on animals forced to move, and increase competition for food and shelter resources amongst wildlife in adjacent areas.

3.2.4.6 Loss of Breeding Habitats

The removal of vegetation in the Subject Land will not impact breeding habitat in adjacent areas, however it will reduce the total number of hollow-bearing trees in the local area, increasing the demand for the hollows in adjacent habitat. Competition for hollows will increase, which would adversely affect some species. Similar habitats are widespread in the region and the loss is considered unlikely to threaten the persistence of any threatened species locally.

3.2.4.7 Trampling of threatened flora species

Threatened flora species have not been identified on the site and are considered highly unlikely to occur in the surrounds owing habitat degradation. The Solar Farm would not result in an increase in human traffic in adjacent areas. Accordingly, trampling of threatened species is therefore considered highly unlikely.

3.2.4.8 Inhibition of nitrogen fixation and increased soil salinity

Not applicable.

3.2.4.9 Fertiliser and chemical drift

Fertiliser drift is not applicable, however the use of chemicals for weed control could potentially be an indirect impact of the Solar Farm.

3.2.4.10 Rubbish dumping

Increased public access to adjacent areas would not be facilitated by the Solar Farm. Rubbish dumping is not currently a problem in the locality and is not expected to be promoted by the proposed activity.

3.2.4.11 Wood collection

Felled trees and fallen logs would be relocated from the disturbance area to adjacent secure areas for habitat enhancement. There would be no public access that would allow wood collection.

3.2.4.12 Bush rock removal and disturbance

Any bush rock removed as part of the Solar Farm would be relocated to adjacent secure areas for habitat enhancement. There would be no public access that would allow bush rock removal.

3.2.4.13 Increase in predatory species populations

The Solar Farm would not create more harbour that may result in an increase predatory species populations. However, displaced individuals of some species may temporarily be more susceptible to predation with the

removal of vegetation in the Subject Land placing a greater demand on shelter in adjacent areas. The relocation of felled trees and fallen timber would reduce this impact.

3.2.4.14 Increase in pest species populations

Installation of panels and removal of farm management may increase the number of pest species within the Subject Land.

3.2.4.15 Increased Risk of Fire

There is a small chance that increased human activity on the Subject Land may heighten the risk of fire.

3.2.4.16 Disturbance to specialist breeding and foraging habitat

The Solar Farm would have no impact on any specialist breeding and foraging habitat adjacent to the Subject Land. The principal habitat features on the Subject Land and the immediate surrounds are mature eucalypts, many with hollows suitable for a variety of wildlife. Trees outside the Subject Land would not be indirectly affected by the development and are expected to persist, albeit with some natural mortality. Hollow-bearing trees and fallen logs on the Subject Land would be relocated to adjacent areas to enhance habitat to mitigate the disturbance.

3.2.5 RESIDUAL PRESCRIBED BIODIVERSITY IMPACTS

3.2.5.1 Karst, caves, crevices, cliffs, rocks and other geological features of significance

After avoidance, a remaining area of 0.71 ha of rocky habitat will be removed from the Subject Land. This has some potential for impact on the Pink-tailed Legless Lizard which uses rocky areas for shelter. Removal of habitat for the Pink-tailed Legless Lizard will be accounted for via Species Credits and will not require further offsetting.

3.2.5.2 Human-made structures or non-native vegetation

No human-made structures will be removed from the Subject Land as part of the proposed activity. A total of 302.4 ha of exotic pasture will be removed as part of the proposed activity. Of this area, 4.7 ha of exotic pasture has been identified as potential Striped Legless Lizard habitat. 1.1 hectares have been avoided and the remaining 3.6 ha of exotic pasture will be cleared as part of the proposed activity. Striped Legless Lizard habitat removal is accounted for via Species Credits which will be applied to these areas of exotic grassland.

3.2.5.3 Habitat connectivity

Habitat connectivity will not be impacted by the proposed activity.

3.2.5.4 Water quality

There is the potential for impacts on water quality of Narambulla Creek via sedimentation during construction, which may impact the Natural Temperate Grasslands CEEC.

3.2.5.5 Wind turbine strikes

Not applicable to the activity.

3.2.5.6 Vehicle strikes

Vehicle strikes are a residual risk to the Glossy Black Cockatoo and three species of threatened owl along the access route: Powerful, Barking and Masked Owls. Clearing of hollow-bearing trees with potential to provide breeding habitat for these species also poses the risk of vehicle strikes during clearing.

3.2.6 CUMULATIVE IMPACTS

The cumulative impact of native vegetation loss in an already highly cleared landscape has been considered. **Table 27** shows that the additional clearance would be in the order of 0.0378 %. This loss would be offset in accordance with the Biodiversity Offset Scheme.

Table 27. Cumulative Losses of Native Vegetation in Affected BioNet NSW Landscapes

BioNet NSW Landscape	Area of Landscape (ha)	Percent Cleared	Solar Farm Clearance (ha)	Additional Clearance (%)
Oberon-Kialla Granites	73691.33	89	27.85	0.0378
Towrang Ranges	60772.2	59	3.59	0.00591
Wollondilly-Bindook Tablelands and Gorges	74235.3	38	1.01	0.00136

Note: Sourced from the 'Over-cleared Landscapes Database' within the BioNet Vegetation Classification Database (DPIE, 2019a)

3.3 MITIGATION OF IMPACTS

3.3.1 MITIGATING IMPACTS ON BIODIVERSITY VALUES

A further consideration is that the Subject Land would be fully developed with no remnant vegetation that may require ongoing management. The Solar Farm is surrounded by agricultural land which would continue to be managed by the existing farm manager, including exclusion areas, that will be re-vegetated in line with the landscape plan and managed on an on-going basis (consistent with current on-farm practises).

Mitigation strategies for the Marulan Solar Farm are described in broad terms in **Section 3.3.1.1**, while more specific mitigation measures for the reduction of impact to threatened species known or predicted to occur on the Subject Land are described in **Section 3.3.1.2.**

3.3.1.1 General Mitigation Strategies

These mitigation strategies are broad and refer to the construction and operation of the Solar Farm.

3.3.1.1.1 Vegetation Removal Strategy

Native vegetation immediately adjoining the Subject Land would be marked to avoid accidental damage during construction. Vegetation removal will be undertaken with reference to best practice guidelines for wildlife-management during felling of native vegetation, e.g. NSW RTA Biodiversity Guidelines (2011). This would minimise harm to wildlife inhabiting hollows in trees proposed to be removed, particularly since the Subject Land supports a variety of other hollow-nesting bird life and microbats (**Appendix C**). Note that:

1. Tree removal would be undertaken with consideration of seasonal factors (wherever practicable, vegetation clearance would be undertaken during late summer/autumn).
2. Felled trees would be inspected for the presence of fauna. Injured fauna would be captured using recommended techniques prescribed by WIRES and WIRES would be contacted for first aid and temporary care of the animal, if needed.
3. Uninjured fauna would be relocated into surrounding native woodland.
4. Felled trees and fallen timber would be relocated to enhance habitat values in surrounding areas.

3.3.1.1.2 Revegetation Strategy

Revegetation is planned as a mitigation strategy for visual amenity and biodiversity impacts of the Solar Farm. A Landscape Concept Plan has been developed by Iris Visual (**Appendix G**) which sets out a planting strategy for broad vegetation types on the Subject Land, including a species list which was developed in consultation with Premise. Two areas of woodland are to be planted with local overstorey species representative of PCT 1330 on the Subject Land.

3.3.1.1.3 Weed management Strategy

Weed control measures to be undertaken on the Subject Land will be based on best practice guidelines published by NSW DPI and may include physical, chemical and biological control methods as appropriate. All weed control will be conducted by a licensed contractor or trained staff member.

The vegetation across much of the Subject Land is already subject to many common weed species that occur on agricultural land. High Threat weeds on the Subject Land include Serrated Tussock (*Nassella trichotoma*) and Blackberry (*Rubus fruticosus*). Weed control will focus on managing existing infestations of Regional Priority species (NSW DPI, 2020), High Threat Weeds (DPIE, 2018b) and WONS (Australian Weeds Committee, 2012) species to negligible levels and the management of any new infestations on the Subject Land as they arise.

3.3.1.1.4 Animal Pest management and Monitoring

Pest animal control measures will include routine monitoring for species including foxes, rabbits, and mice. Control measures if required will refer to industry best practice (for example, Pestsmart guidelines) and may include baiting, destruction of the pest, removal of harbour/habitat and/or exclusion (e.g. fencing), where possible.

Table 32 summarises avoidance and mitigation actions with expected outcomes, timing and management responsibility, in accordance with s2.5 of the BAM Operational Manual Stage 2.

3.3.1.2 Specific Mitigation Strategies

3.3.1.2.1 Natural Temperate Grassland

To minimise impacts to the Natural Temperate Grasslands, it is proposed to include a suite of controls within a project Construction Environmental Management Plan (CEMP) that would be adopted by the project EPC contractor and managed for the life of the project. These measures include but are not limited to the measures outlined by project phase in **Table 28**.

Table 28. Summary of mitigation measures – Natural Temperate Grassland

Phase	Mitigation Measure
Pre-construction	Prepare a detailed NTG management Plan to be incorporated into the project CEMP to outline measures for protection and mitigation (including those outlined within this document), to be prepared in conjunction with project ecologists. Areas of NTG that are not proposed to be disturbed are to be identified prior to works commencing and are to be clearly marked with demarcation tape/fencing to ensure that these areas are clearly understood and to limit inadvertent entry/disturbance
Construction	Areas of NTG are not to be used for equipment laydown areas or for the parking of vehicles Laydown and vehicle parking areas to be established well clear of NTG areas. Run-off from laydown and parking areas to be managed to ensure flows are diverted away from NTG areas No refuelling or maintenance to take place in or near NTG areas Refuelling or maintenance to be completed only in designated areas that are suitably designed and bunded to ensure the capture of pollutants
Post construction	Area of NTG temporarily impacted during construction (such as areas adjacent to disturbance areas or areas where trenching installed) to be appropriately rehabilitated to ensure they return to the condition prior to works commencing Ongoing weed and pest management within NTG areas on site as part of an OEMP to bring about improved outcomes for NTG areas Ongoing monitoring of NTG areas as part of the OEMP and annual reporting

3.3.1.2.2 Striped Legless Lizard (Delma impar)

To minimise impacts to the Striped Legless Lizard, it is proposed to include a suite of controls within a project CEMP that would be adopted by the project EPC contractor and managed for the life of the project. These measures include but are not limited to the measures outlined by project phase in

Table 29**.**

Table 29. Summary of mitigation measures – Striped Legless Lizard

Phase	Mitigation Measure
Pre-construction	Prepare a detailed Fauna Management Plan to be incorporated into the project CEMP to outline measures for protection and mitigation (including those outlined within this document), to be prepared in conjunction with project ecologists. Areas outside of the project footprint assessed as being potential habitat for the striped legless lizard to be identified with demarcation fencing to ensure no inadvertent access during construction.
Construction	Areas outside of the project footprint assessed as being potential habitat for the striped legless lizard are not to be used for equipment laydown areas or for the parking of vehicles

	Laydown and vehicle parking areas to be established well clear of potential habitat for the striped legless lizard.

3.3.1.2.3 Pink-tailed Legless Lizard (*Aprasia parapulchella*

To minimise impacts to the Pink-tailed Legless Lizard, it is proposed to include a suite of controls within a project CEMP that would be adopted by the project EPC contractor and managed for the life of the project. These measures include but are not limited to the measures outlined by project phase in **Table 30.**

Table 30. Summary of mitigation measures – Pink tailed Legless Lizard

Phase	Mitigation Measure
Pre-construction	Prepare a detailed Fauna Management Plan to be incorporated into the project CEMP to outline measures for protection and mitigation (including those outlined within this document), to be prepared in conjunction with project ecologists. Areas outside of the project footprint assessed as being potential habitat for the pink tailed legless lizard to be identified with demarcation fencing to ensure no inadvertent access during construction. Rocks and suitable habitat areas within the access handle to be checked for the species by the project ecologist prior to works commencing, and any identified lizards to be relocated to suitable habitat Where feasible, rocks within the access handle with the potential to provide habitat that may be impacted by the project to be relocated prior to works commencing so that the habitat value is not lost.
Construction	Areas outside of the project footprint assessed as being potential habitat for the pink tailed legless lizard are not to be used for equipment laydown areas or for the parking of vehicles Laydown and vehicle parking areas to be established well clear of potential habitat for the pink tailed legless lizard.

3.3.1.2.4 Koala

To minimise impacts to Koala, it is proposed to include a suite of controls within a project CEMP that would be adopted by the project EPC contractor and managed for the life of the project. These measures include but are not limited to the measures outlined by project phase in **Table 31**.

Table 31. Summary of mitigation measures – Koala

Phase	Mitigation Measure
Pre-construction	Prepare a detailed Fauna Management Plan to be incorporated into the project CEMP to outline measures for protection and mitigation (including those outlined within this document), to be prepared in conjunction with project ecologists. Areas outside of the project footprint assessed as being potential habitat for the Koala to be identified with demarcation fencing to ensure no inadvertent access during construction.
Construction	Areas outside of the project footprint assessed as being potential habitat for the Koala are not to be used for equipment laydown areas or for the parking of vehicles Laydown and vehicle parking areas to be established well clear of potential habitat for the Koala.

3.3.2 MITIGATING INDIRECT IMPACTS ON NATIVE VEGETATION AND HABITAT

Potential impacts of the development beyond the Subject Land are identified in section 9.1.4 of the BAM and indirect impacts relevant to the Solar Farm are identified in section 4.2.4. Mitigation measures for these impacts are discussed below and summarised in **Table 32**.

3.3.2.1 Inadvertent impacts on adjacent habitat or vegetation

Removal of vegetation would be undertaken in accordance with best practice guidelines published by the RTA (2011) to avoid inadvertent impacts on adjacent habitat or vegetation.

3.3.2.2 Reduced viability of adjacent habitat due to edge effects

Edge effects have been managed through avoidance measures.

3.3.2.3 Reduced viability of adjacent habitat due to noise, dust and light spill

Construction activity will be restricted to daylight hours minimising the disturbance due to light spill. Any night lighting required during construction would be directed away from native vegetation, surrounding streets and neighbouring properties. Noise impacts would be temporary, limited to the construction period. Dust control measures will be in line with those outlined in the EIS.

3.3.2.4 Transport of weeds and pathogens from the site to adjacent vegetation

Prevention of the transport of weeds and pathogens from the site will be managed as a part of the CEMP, which may involve the use of vehicle wash stations or other weed control methods to reduce the risk of new incursions onto the Subject Land and reduce movement off the site, and annual control of new and existing weed infestations on the Subject Land. Weeds for control on the Subject Land will be those which are classified as Priority Weeds for the South East Local Land Services Region (NSW DPI, 2020), NSW High Threat Weeds (DPIE, 2018b) or Weeds of National Significance. Weed control will be based on best practice guidelines produced by NSW DPI and may include mechanical, biological, or chemical control methods.

3.3.2.5 Increased Risk of Starvation, Exposure and Loss of Shelter

Felled trees and logs will be relocated into secure offset areas nearby to supplement habitat and reduce this indirect impact. This impact is considered likely to be short term in duration, with local populations establishing a new but slightly lower equilibrium population size after the disturbance.

3.3.2.6 Chemical drift

Weed management will follow best practice guidelines to reduce the risk of chemical drift from weed spraying.

3.3.2.7 Increase in pest species populations

Monitoring of pest animal populations and strategic control will be conducted by a licenced contractor or site manager to reduce the risk of the activity leading to an increase in pest species numbers.

3.3.2.8 Increased Risk of Fire

Grass around the solar panels will be slashed or grazed regularly to reduce fuel loads and mitigate fire risk. During construction and operation, machinery will not be operated in long grass during the fire season and a Bushfire Safety plan will be developed as part of the CEMP.

Table 32. Avoidance and Mitigation Measures, Responsibility and Timing

Action	Impacts Mitigated	Type of Impact Addressed	Outcome	Timing	Responsibility	Performance Criteria	Method	Reporting
Pre-construction								
Planning the timing of site clearance to avoid the nesting season of threatened, migratory and resident species.	Displacement of resident fauna.	Direct	Harm to breeding wildlife minimised.	Prior to clearing operations	Project management.	No disruption to wildlife breeding	Project planning meetings.	Annual Environmental Management Report (AEMR).
Undertake pre-clearing surveys to determine the presence of species that may be breeding in trees or utilising tree hollows.	Displacement of resident fauna.	Direct	Harm to tree dwelling and hollow-dwelling wildlife minimised.	Prior to clearing operations	Environmental Manager.	No disruption to wildlife breeding	Project planning meetings.	AEMR.
Planning for relocation of habitat features, such as surface rocks, fallen logs and tree trunks.	Displacement of resident fauna. Creation of more habitat opportunities in adjacent areas.	Direct Indirect	Relocation of any bush rocks, logs and felled timber into adjacent habitat areas.	Prior to clearing operations	Project management.	Habitat features established in offset areas or existing on-site rehabilitation areas.	Project planning meetings.	AEMR.

Action	Impacts Mitigated	Type of Impact Addressed	Outcome	Timing	Responsibility	Performance Criteria	Method	Reporting
During Construction								
Protect native vegetation immediately adjoining the proposed clearance area.	Impacts on adjacent vegetation and habitat.	Indirect	No damage to trees earmarked for protection and retention.	Throughout construction phase.	Site Manager.	No damage to adjoining vegetation.	Clearly mark vegetation to prevent accidental damage.	AEMR.
Inspection of felled trees for the presence of fauna by trained ecologists or licensed wildlife handlers.	Displacement of resident fauna. Creation of more habitat opportunities in adjacent areas.	Direct	Harm to hollow-dwelling wildlife minimised. Injured wildlife cared for and recovered by WIRES. Displaced wildlife released into appropriate habitat nearby.	During clearing operations.	Environmental Manager.	All tree felling supervised. Habitat creation in adjacent areas maximised.	Experienced tree pusher supervised by experienced wildlife handler.	AEMR.
Relocate fallen timber for breeding habitat.	Displacement of resident fauna.	Direct	Felled timber to be relocated into adjacent habitat areas.	After clearing operations.	Site Manager.	All suitable timber relocated.	Fallen trees trimmed and trunks transported.	AEMR.
Relocate bush rocks.	Displacement of resident fauna.	Direct, Prescribed	Relocation of any bush rocks into adjacent	After clearing operations.	Environmental Manager	All surface rocks relocated.	Surface rock gathered and transported.	AEMR.

Action	Impacts Mitigated	Type of Impact Addressed	Outcome	Timing	Responsibility	Performance Criteria	Method	Reporting
Removal of rocks supervised by a trained reptile handler, or staff member with appropriate snake-handling training	Loss of rock habitat.		secure habitat areas.					
Dust suppression	Reduced photosynthesis in dust-covered vegetation.	Indirect	Watering of drill locations during installation of tracker posts and construction of roads.	During construction.	Site Manager	Negligible dust movement off site.	Spraying of water on roads and drill locations by water carts.	
Runoff prevention	Sedimentation in creeks	Indirect	Sediment control measures used on site below construction areas.	During construction	Site Manager	Negligible sediment runoff into streams on site.	Sediment barriers	
Post Construction								
Weed management.	Spread of Priority and High Threat Weeds, chemical drift	Indirect	Priority and high threat weeds controlled, chemical drift minimised.	Annual inspections and control as required.	Environmental Manager.	Selected High Threat Exotic and Priority Weeds maintained at negligible	Certified weed control contractor.	

Action	Impacts Mitigated	Type of Impact Addressed	Outcome	Timing	Responsibility	Performance Criteria	Method	Reporting
						levels, responsible chemical use.		
Pest animal management.	Increase in predation by feral predators; degradation of native vegetation by feral herbivores.	Indirect	Pest animals controlled, especially feral pigs, foxes, rabbits, wild dogs, feral cats and brown hares.	Annual inspections and control as required.	Environmental Manager.	All pest animal species maintained at negligible levels.	Baiting, destruction of harbour and exclusion (e.g. fencing). Experienced contractor.	
Site Closure								
Rehabilitation of roads and post hole locations	N/A	N/A	Safe landforms with no potential for livestock or wildlife injury.	Following decommissio n of Solar Farm.	Environmental Manager.	Land fit for designated alternative uses.	-	AEMR.

3.3.3 MITIGATING PRESCRIBED IMPACTS

The loss of rocky habitat, water quality impacts on the Temperate Grassland CEEC and impacts on threatened species associated with non-native vegetation are the only prescribed impacts attributable to Marulan Solar Farm (**Section 3.2.5**).

Owing to the limited options for access, rocky areas in the southern paddock along the access route from Munro Road cannot be avoided. The loss of rock outcrop would be mitigated by moving any loose surface rock or large embedded rock that requires removal to suitable adjacent woodland to provide potential habitat for the Pink-tailed Legless Lizard. The process of rock removal and placement would be supervised by a qualified ecologist.

One candidate threatened fauna species potentially associated with the rocky outcrops, the Pink-tailed Legless Lizard, has been assumed present on the Subject Land. The credit liability for loss of the assumed populations of this species has been assessed through species polygons calculated by BMS (2022). Because impacts on rock outcrop habitats (**Figure 19** and **Figure 20**) are prescribed impacts, compensation for the loss of the outcrops themselves is required, which may be either additional species credits or '*other actions that will directly benefit the species in the wild*' (DPIE, 2020a). The quantum of any additional species credits or other actions is to be determined by the 'decision maker', i.e. the approval authority. To assist the approval authority in determining the level of compensation for the loss of rock outcrops the following considerations and test of significance are provided:

- The proponent agrees to relocate all transportable surface rocks from the disturbance area to adjacent areas of woodland. (mitigation strategy, **Table 27**).
- Similar habitat is widespread and common in the wider region on ridges and hilltops, and higher quality habitat areas are to be avoided as part of the planned activity.

The Striped Legless Lizard is considered by BMS (2022) and the Biodiversity and Conservation Directorate (2022) as potentially able to utilise exotic grasslands dominated by *Phalaris aquatica* on the Subject Land within areas less likely to have been ploughed or had extensive soil disturbance. These areas have been mapped as occurring along the outer banks of the Narambulla Creek. A test of significance for the impacts of the solar farm on exotic grasslands is also provided below.

Potential impacts on water quality during construction via runoff will be managed through use of post-hole drilling for tracker stands to minimise soil disturbance. Risks to water quality will be managed as per the Water Cycle Management Study.

The threat of vehicle strikes along the proposed access route will be managed by use of signage and speed limits. Operating hours are to be restricted to between 7am and 6pm which will minimise exposure to owls during their active period. Clearing protocols as described in Section 4.3.1 will be employed to mitigate the risk of vehicle collisions with threatened birds during tree felling.

3.3.4 ADAPTIVE MANAGEMENT FOR UNCERTAIN BIODIVERSITY IMPACTS

With respect to section 9.3.1.2 of the BAM, it is considered that all potential impacts of the Solar Farm on threatened biodiversity have been identified. It is considered that a comprehensive set of mitigation measures has been developed and that they are feasible standard approaches that have a high probability of successful implementation. Overall, it is considered there are no uncertain impacts for which the risks of the activity are unpredictable. Accordingly, it is not considered necessary to develop an adaptive management strategy for uncertain impacts.

3.4 SERIOUS AND IRREVERSIBLE IMPACTS

As a critically endangered entity, *White Box - Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland* CEEC (Box-Gum Woodland) is considered at risk of Serious And Irreversible Impacts (SAII), and additional information must be considered by assessors when determining the impact of a development or activity (DPIE, 2019b).

The Threatened Biodiversity Data Collection (DPIE, 2021b) and SAII Guidance (DPIE, 2019b) have been consulted and no other candidate threatened entities on the Subject Land are species or communities at risk of SAII.

A total area of 3.65 ha of remnant native woodland, 0.45 ha of regenerating woodland, 1.52 ha of native plantings and 10 scattered trees proposed for removal on the Subject Land have been determined to be part of the Box-Gum Woodland CEEC, totalling 5.62 ha. Exotic pastures and poor-quality grasslands on the site are considered to have originally been Box Gum Woodland, however this is based solely on landscape position and the presence of several native grass species. The condition of the CEEC varies across the Subject Land and is generally in poor to moderate condition with VI scores ranging from 8.9 to 31.5 in different zones. The exotic dominated grassland (302.4 ha), poor condition grassland (20.43 ha) and Moderate-Poor condition woodland (1.2 ha) are in too low condition to require offsetting (VI 10.6, 8.9 and 10.9 respectively).

The area of CEEC on the Subject Land is located within the broad Southern Slopes priority management area for the Save our Species strategy due to its location within the overall range of the community in NSW. Based on site data and the literature however, this community on the Subject Land is not consistent with an important occurrence of Box Gum Woodland. Overstorey species are widely spaced and irregular, with few native groundcovers beneath remnant patches. The ground cover is in particularly poor condition being dominated by introduced pasture grasses and legumes, and native herbs and grasses have been almost eliminated through pasture improvement and the application of nitrogenous fertilisers. Native grasses and shrubs which remain consist of grazing tolerant species which have been retained due to their low palatability (e.g. *Austrostipa scabra*) or colonising characteristics (e.g. Sifton Bush, Common Couch). The value of the CEEC remnants resides almost entirely in the trees, which provide habitat for wildlife, including 4 Vulnerable species.

The NSW Threatened Species Scientific Committee (2020) indicates that less than 10% of the original cover of Box Gum Woodland CEEC remains. However, there are no accurate published estimates of the amount remaining or its precise distribution within its very wide former range on the NSW Tablelands and Slopes. Plant Community Types associated with the CEEC have been mapped through the State Vegetation Type Mapping (SVTM) program, which can be queried to provide estimates of the areas remaining within IBRA regions and subregions.

It is considered that only the woodland remnants of the CEEC on the Subject Land would be likely to respond to management (NPWS, 2005), and therefore losses from the proposed activity are in the order of 5.62 hectares rather than 331.6 ha. Planting within the exclusion zones around Lockyersleigh Creek are proposed as part of the Solar Farm, to improve the general vegetation condition within the Solar Farm boundary. Proposed supplementary planting in the southern woodland adjacent to the Solar Farm is also intended to improve the condition of the CEEC which will partially offset the clearing required as part of the activity.

Within the surrounding area, vegetation mapping available for Southeast NSW includes three classes within a 10,000 ha buffer which could be considered to fall within the definition of Box Gum Woodland, based on descriptions provided by Tozer et al. (2010). Vegetation classes which contain *Eucalyptus albens*, *E. melliodora* or *E. blakelyi* as dominant or subdominant species within the description are considered in this assessment to be consistent with the Box Gum Woodland CEEC.

Additional information to be considered in the assessment of the CEEC (BAM section 9.1.1) is given in **Table 33**.

Table 33. Assessment of the Box-Gum Woodland CEEC on the Subject Land as an SAII

Topic	Additional Information
Avoidance measures	Terrain Solar has designed the Solar Farm layout to minimise potential harm to the CEEC by moving the southern boundary of the footprint north, away from woodland areas. The location of the access route has been selected because it has previously been cleared and does not contain large hollow-bearing trees. Alternate access routes other than from the south (Munro Road) were not feasible.
Area of CEEC impacted	5.62 ha
Condition of the CEEC	The CEEC is considered to be in Poor to Moderate condition. VI score for each vegetation zone are: PCT 1330 Mod-Poor Woodland – 10.6 PCT 1330 Moderate – 31.5 PCT 1330 Plantings – 34.4 PCT 1330 Regen – 38.7
Exceedance of threshold	No threshold has been set for the CEEC in the TBDC (DPIE, 2021b) to assess SAII status.
Extent and condition of the community in the surrounds	The Subject Land is situated in a farming region in which properties have similar characteristics to each other. CEEC remnants on these properties are in similar condition to those on the Subject Land. Extant areas of the CEEC in the region were estimated using Southeast NSW (SCIVI) mapping as follows: Within 1000 ha around the Subject Land – 128.5 ha. Loss due to activity is 4.3%. Within 10,000 ha around the Subject Land – 1,946 ha. Loss due to activity is 0.27%.
Extent in IBRA sub-region	No specific information is available for the extent of the CEEC in the Bungonia sub-region. An analysis of Tozer vegetation classes indicates that approximately 19% of the total area contains woodland which may be included in the CEEC classification. Information from the Goulburn Information available in the Vegetation Information System for PCT 1330 indicates that 6 percent of the original cover remains across its extent. The condition is considered likely to be similar or greater on average to that in the Subject Land.
Extent in the reserve system	No accurate published information is available on the extent of the CEEC within the reserve system in the South Eastern Highlands Bioregion or the Bungonia Sub-region. Reference to the LLS TSR state-wide map indicates that only a small proportion of TSRs are located in this region which do not form connected corridors (LLS, 2022). Reserves within proximity to the Subject Land including Tarlo River National Park, Bungonia State Recreation Reserve and Cookbundoon Nature Reserve mostly protect vegetation associated with hilly country including Argyle Apple and Silvertop Stringybark. The Bungonia Reserve management plan states that Yellow Box is present in gullies with Cabbage Gum on the plateaus, which appears describe associations similar to those on the Subject Land. The Tarlo River National Park reserve protects Ribbon Gum riparian forest but it is unclear whether this is associated with Box Gum Woodland, although this is likely to occur in transition zones between riparian areas and hillslopes.

Topic	Additional Information
Other impacts	The principal impact of the proposed Solar Farm is the loss of 5.62 ha of Box-Gum Woodland CEEC. As part of the construction of solar panels, trenching will involve some soil disturbance and dams will be filled. The community is not groundwater dependent and is unlikely to be affected significantly by these changes outside of direct clearing. The direct drilling of posts supporting panels and rehabilitation of these areas post disturbance will reduce the risk of topsoil loss. The proposal would not impact abiotic factors of importance to the CEEC, e.g.: The CEEC is not considered to be ground-water dependent. In any event, the proposal would not affect sub-surface aquifers due to avoidance measures. Narambulla Creek, Osborn Creek and Lockyersleigh Creek on the Subject Land have all been mapped as High potential Groundwater Dependent Ecosystems by Department of Industry– Water (2020). The proposed activity would not lead to any change in existing practices on the surrounding farm lands supporting the CEEC. Changes to the CEEC caused by farming are mainly historical, e.g. thinning/clearing of the overstorey, removal of the shrub layer and loss of most of the ground layer diversity through pasture improvement. Invasion by weeds, pathogens and pests, which would normally be considered likely edge effects on intact ecosystems, has already occurred on a landscape-wide scale in the region, owing to historical agricultural land use. No other significant edge effects are likely to occur. Similarly, the continuance of existing farming practices would not lead to an increase in invasive flora or fauna, or increased use of farm chemicals. The proponent and the farming community would continue to manage remnants of the community by controlling Priority Weeds and feral animals. The activity is considered unlikely to result in increases in soil erosion and downstream sedimentation. Buffers placed around streams and sediment management measures are intended to prevent downstream movement of moisture and sediments. Planned targeted planting around streams as part of environmental improvement measures on the proposed Solar Farm will further reduce this risk of erosion through soil stabilisation.
Fragmentation	There are no identified wildlife corridors or migratory flight paths traversing the Subject Land (BMS, 2022). The native vegetation patches on the Subject Land form the edges of remnant woodland or scattered paddock trees within a matrix of exotic pasture. (**Figure 9**). Accordingly, the native vegetation that would be removed on the Subject Land does not constitute part of a vegetation corridor across the landscape.
Recovery measures	The Save Our Species Program has an extensive focus on protection of high quality Box-Gum Woodland remnants and on the recovery of others (DPIE, 2020c). There are nine Priority Management Sites in the South West Slopes Bioregion, most of which are in the Inland Slopes Sub-region. These sites are in the area between Cowra and the Victorian border. The CEEC remnants on the Subject Land are in far too degraded a condition to qualify for similar recovery actions from the Save Our Species program.

3.4.1.1 Evaluation

The data in **Table 34** allows an assessment to be made of the likelihood that the proposed activity would result in a significant increase in the risk of extinction of the Box-Gum Woodland CEEC at the local and IBRA sub-region or regional scales, using SCIVI mapping.

Table 34. Box-Gum Woodland CEEC Loss on the Subject Land as a Proportion of Local and Regional Areas.

Landscape scale	Area (ha)	Percentage loss
1000 ha buffer around Subject Land	128.5	4.3
10,000 ha buffer around Subject Land	1,946	0.27
Bungonia Subregion	82,637.27	0.007

The above losses indicate there would be a small, but insignificant, increase in the likelihood of extinction of the CEEC at the local level, but this loss is much smaller at the subregion and regional levels.

3.5 BIODIVERSITY OFFSETS

3.5.1 PREDICTED CREDITS FOR REMOVAL OF NATIVE VEGETATION

The Solar Farm would result in the loss of 4.46 ha of Box-Gum Woodland (PCT 1330), 0.94 ha of Natural Temperate Grassland (PCT 1110), as well as 0.19 ha of Stringybark open forest. The future VI score will be zero for all areas.

The BAM Credit Calculator valued the losses of:

- 4.46 ha of PCT 1330 at 92 Credits,
- 0.94 ha of PCT 1110 at 26 credits and,
- 0.19 ha of PCT 351 at 7 credits.

giving a total of 125 Ecosystem Credits.

3.5.1.1 Scattered Trees

Scattered Trees on the Subject Land meet Category B of the BAM (2020) definition for Scattered Trees, that is: *have a DBH of greater than or equal to 5 cm and are located more than 50 m away from any living tree that is greater than or equal to 5 cm DBH, and the land between the scattered trees is comprised of vegetation that are all ground cover species on the widely cultivated native species list, or exotic species or human-made surfaces or bare ground*. Scattered Trees recorded on the Subject Land are recorded in Appendix C.

Scattered trees on the Subject Land consist of a total of 16 large trees separated by more than 50 metres from one another within a matrix of exotic-dominated pasture. Exotic pasture on the Subject Land represents a score of less than 15 which is the minimum score to require offsetting. Species within this pasture include exotic annual and perennial species which have been sown along with fertilisers for pasture improvement.

Total Ecosystem Credits generated by Scattered Trees are 13 credits (**Appendix A**), which takes the total Ecosystem Credits generated by the activity to a total of 138 credits.

3.5.2 CANDIDATE SPECIES CREDITS

The impact of the Solar Farm on Species Credit Species is calculated as the loss of assumed habitat for the Pink-tailed Legless Lizard, Glossy Black-Cockatoo, Striped Legless Lizard, Barking Owl, Powerful Owl and Masked Owl. The credit liability is outlined in **Table 35** and the biodiversity credit summary report is available in **Appendix A**.

Table 35. Biodiversity Credits for Species Credit Species

IBRA sub-region	Threatened Species	Conservation Status	Biodiversity Risk Weighting	No. of species credits
Bungonia	Pink-tailed Legless Lizard	Vulnerable	2.00	26
Bungonia	Glossy Black-Cockatoo	Vulnerable	2.00	113
Bungonia	Striped Legless Lizard	Vulnerable	1.50	15
Bungonia	Barking Owl	Vulnerable	2.00	40
Bungonia	Powerful Owl	Vulnerable	2.00	57
Bungonia	Masked Owl	Vulnerable	2.00	40

3.5.3 VEGETATION CLEARANCE NOT REQUIRING OFFSETTING

Vegetation clearance not requiring offsetting includes:

- 1.2 ha of Moderate-Poor quality woodland, 20.43 ha of grassland derived from the Box-Gum Woodland CEEC and 302.4 ha of Exotic Pasture with a VI score of less than 15, which therefore does not require offsetting,
- 1.1 ha of Poor-quality grassland derived from the Stringybark open forest community with a VI score of less than 17

3.6 CONCLUSIONS AND RECOMMENDATIONS

The proposed Solar Farm will result in the generation of 138 Ecosystem Credits and 291 Species Credits for native vegetation removal as calculated by the BAM credit calculator. Terrain will satisfy the biodiversity credit requirements using offset mechanisms allowed by the NSW Biodiversity Offsets Scheme (i.e. contribution to the Biodiversity Trust Fund administered by the NSW Biodiversity Conservation Trust, purchase of existing credits on the market, funding of a biodiversity conservation action or retirement of biodiversity credits).

A referral to the Federal Government was made via the DAWE Business Portal for the Pink-tailed Legless Lizard, Striped Legless Lizard, the Koala and the Natural Temperate Grasslands CEEC. The results of this referral are that the proposed Solar Farm is not a controlled action. Reference number for the Referral is EPBC 2022/09218 (**Appendices D-F**).

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APPENDIX A

BIODIVERSITY CREDIT REPORTS

BAM Credit Summary Report

Proposal Details

Assessment Id
00028758/BAAS18048/21/00028759

Proposal Name
Marulan Solar Farm

BAM data last updated *
16/06/2022

Assessor Name
Sally Kirby

Report Created
17/08/2022

BAM Data version *
54

Assessor Number
BAAS21027

BAM Case Status
Finalised

Date Finalised
17/08/2022

Assessment Revision
5

Assessment Type
Major Projects

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

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

Zone	Vegetation zone name	TEC name	Current Vegetation integrity score	Change in Vegetation integrity (loss / gain)	Area (ha)	Sensitivity to loss (Justification)	Species sensitivity to gain class	BC Act Listing status	EPBC Act listing status	Biodiversity risk weighting	Potential SAII	Ecosystem credits
Brittle Gum - Broad-leaved Peppermint - Red Stringybark open forest in the north-western part (Yass to Orange) of the South Eastern Highlands Bioregion												
8	351_Dense	Not a TEC	78.7	78.7	0.19	PCT Cleared - 60%	High Sensitivity to Gain			1.75		7

9	351_Poor	Not a TEC	1.2	1.2	1.1	PCT Cleared - 60%	High Sensitivity to Gain			1.75		0
											Subtotal	**7**
River Tussock - Tall Sedge - Kangaroo Grass moist grasslands of the South Eastern Highlands Bioregion												
7	1110_Moderate	Not a TEC	49.4	49.4	0.94	PCT Cleared - 90%	Moderate Sensitivity to Gain			2.25		26
											Subtotal	**26**

Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion												
1	1330_Moderate	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla	31.5	31.5	2.4	PCT Cleared - 94%	High Sensitivity to Gain	Critically Endangered Ecological Community	Critically Endangered	2.50	True	48

2	1330_Mod_Poor	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla	10.9	10.9	1.2	PCT Cleared - 94%	High Sensitivity to Gain	Critically Endangered Ecological Community	Critically Endangered	2.50	True	0

3	1330_Poor	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla	8.9	8.9	20.4	PCT Cleared - 94%	High Sensitivity to Gain	Critically Endangered Ecological Community	Critically Endangered	2.50	True	0

4	1330_Pasture	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla	10.6	10.6	302.4	PCT Cleared - 94%	High Sensitivity to Gain	Critically Endangered Ecological Community	Critically Endangered	2.50	True	0

5	1330_Regen	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla	38.7	38.7	0.45	PCT Cleared - 94%	High Sensitivity to Gain	Critically Endangered Ecological Community	Critically Endangered	2.50	True	11

6	1330_Planting	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla	34.4	34.4	1.5	PCT Cleared - 94%	High Sensitivity to Gain	Critically Endangered Ecological Community	Critically Endangered	2.50	True	33
											Subtotal	**92**
											Total	**125**

Species credits for threatened species

Vegetation zone name	Habitat condition (Vegetation Integrity)	Change in habitat condition	Area (ha)/Count (no. individuals)	Sensitivity to loss (Justification)	Sensitivity to gain (Justification)	BC Act Listing status	EPBC Act listing status	Potential SAII	Species credits
Aprasia parapulchella / Pink-tailed Legless Lizard (Fauna)									
1330_Pasture	10.6	10.6	2.4			Vulnerable	Vulnerable	False	13
1330_Regen	38.7	38.7	0.23			Vulnerable	Vulnerable	False	4

351_Dense	78.7	78.7	0.19			Vulnerable	Vulnerable	False	7
1330_Mod_Poor	10.9	10.9	0.14			Vulnerable	Vulnerable	False	1
351_Poor	1.2	1.2	0.9			Vulnerable	Vulnerable	False	1
								Subtotal	**26**
Calyptorhynchus lathami / Glossy Black-Cockatoo (Fauna)									
1330_Moderate	31.5	31.5	0.75			Vulnerable	Not Listed	False	12
1330_Poor	8.9	8.9	2.6			Vulnerable	Not Listed	False	11
1330_Pasture	10.6	10.6	13			Vulnerable	Not Listed	False	69
1330_Regen	38.7	38.7	0.45			Vulnerable	Not Listed	False	9
351_Dense	78.7	78.7	0.19			Vulnerable	Not Listed	False	7
1330_Mod_Poor	10.9	10.9	0.77			Vulnerable	Not Listed	False	4
351_Poor	1.2	1.2	0.33			Vulnerable	Not Listed	False	1
								Subtotal	**113**
Delma impar / Striped Legless Lizard (Fauna)									
1330_Pasture	10.6	10.6	3.6			Vulnerable	Vulnerable	False	14
1110_Moderate	49.4	49.4	0.01			Vulnerable	Vulnerable	False	1
								Subtotal	**15**
Ninox connivens / Barking Owl (Fauna)									
1330_Pasture	10.6	10.6	6.4			Vulnerable	Not Listed	False	34
1330_Regen	38.7	38.7	0.21			Vulnerable	Not Listed	False	4
1330_Mod_Poor	10.9	10.9	0.37			Vulnerable	Not Listed	False	2
								Subtotal	**40**
Ninox strenua / Powerful Owl (Fauna)									
1330_Moderate	31.5	31.5	0.48			Vulnerable	Not Listed	False	8

1330_Poor	8.9	8.9	0.04			Vulnerable	Not Listed	False	1
1330_Pasture	10.6	10.6	8			Vulnerable	Not Listed	False	42
1330_Regen	38.7	38.7	0.21			Vulnerable	Not Listed	False	4
1330_Mod_Poor	10.9	10.9	0.37			Vulnerable	Not Listed	False	2
								Subtotal	**57**
Tyto novaehollandiae / Masked Owl (Fauna)									
1330_Pasture	10.6	10.6	6.4			Vulnerable	Not Listed	False	34
1330_Regen	38.7	38.7	0.21			Vulnerable	Not Listed	False	4
1330_Mod_Poor	10.9	10.9	0.37			Vulnerable	Not Listed	False	2
								Subtotal	**40**

BAM Credit Summary Report

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00028758/BAAS21027/22/00034363	Marulan Solar Farm Paddock Trees duplicate	16/06/2022
Assessor Name	Report Created	BAM Data version *
Sally Kirby	17/08/2022	54
Assessor Number	BAM Case Status	Date Finalised
BAAS21027	Finalised	17/08/2022
Assessment Revision	Assessment Type	BOS entry trigger
1	Scattered Trees	Major Project

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Scattered Trees Credit Requirement

Class	Contains hollows	Number of trees	Ecosystem credits
351-Brittle Gum - Broad-leaved Peppermint - Red Stringybark open forest in the north-western part (Yass to Orange) of the South Eastern Highlands Bioregion			
2	False	2.0	1
3	False	1.0	1
3	True	3.0	3
			5
1330-Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion			
3	False	4.0	3
3	True	1.0	1
2	True	1.0	1
3	False	4.0	3
			8
			13

Species credits for threatened species

Nil

APPENDIX B

PLANT SPECIES LIST

Plot number	Scientific Name	Exotic (* = introduced species)	Common Name	Family	BAM Growth Form Group	Cover	Abundance
BGW 1	*Eucalyptus tereticornis*		Forest Red Gum	Myrtaceae	Tree (TG)	35	2
	Lepidium africanum	*	Common Peppercress	Brassicaceae		5	1000
	Hordeum leporinum	*	Barley Grass	Poaceae		2	400
	Malva neglecta	*	Dwarf Mallow	Malvaceae		2	100
	Crassula sieberiana		Australian Stonecrop	Crassulaceae	Forb (FG)	1	400
	Eleusine tristachya	*	Goose Grass	Poaceae		1	200
	Paronychia brasiliana	*	Brazilian Whitlow	Caryophyllaceae		1	300
	Bromus brevis	*	Pampas Brome	Poaceae		0.3	50
	Chenopodium album	*	Fat Hen	Chenopodiaceae		0.2	50
	Lycium ferocissimum	*	African Boxthorn	Solanaceae		0.2	1
	Chenopodium spp.		Goosefoot, Crumbweed	Chenopodiaceae	Shrub (SG)	0.1	1
	Austrostipa scabra		Speargrass	Poaceae	Grass & grasslike (GG)	0.1	10
	Cynodon dactylon		Common Couch	Poaceae	Grass & grasslike (GG)	0.1	2
	Einadia nutans		Climbing Saltbush	Chenopodiaceae	Forb (FG)	0.1	4
	Einadia trigonos		Fishweed	Chenopodiaceae	Forb (FG)	0.1	3
	Bromus molliformis	*	Soft Brome	Poaceae		0.1	20
	Hirschfeldia incana	*	Buchan Weed	Brassicaceae		0.1	10
	Lolium rigidum	*	Wimmera Ryegrass	Poaceae		0.1	1
	Marrubium vulgare	*	White Horehound	Lamiaceae		0.1	1

Plot number	Scientific Name	Exotic (* = introduced species)	Common Name	Family	BAM Growth Form Group	Cover	Abundance
	Plantago coronopus	*	Buck's-horn Plaintain	Plantaginaceae		0.1	6
	Spergularia rubra	*	Sandspurry	Caryophyllaceae		0.1	20
BGW 2	*Austrostipa scabra*		Speargrass	Poaceae	Grass & grasslike (GG)	30	1500
	Eucalyptus melliodora		Yellow Box	Myrtaceae	Tree (TG)	20	1
	Eucalyptus tereticornis		Forest Red Gum	Myrtaceae	Tree (TG)	10	2
	Eleusine tristachya	*	Goose Grass	Poaceae		2	200
	Paronychia brasiliana	*	Chilean Whitlow Wort, Brazilian Whitlow	Caryophyllaceae		2	500
	Lolium rigidum	*	Wimmera Ryegrass	Poaceae		1	1
	Cassinia sifton		Sifton Bush	Asteraceae	Shrub (SG)	1	3
	Hypochaeris radicata	*	Catsear	Asteraceae		0.3	200
	Cynodon dactylon		Common Couch	Poaceae	Grass & grasslike (GG)	0.2	50
	Bromus molliformis	*	Soft Brome	Poaceae		0.2	50
	Lepidium africanum	*	Common Peppercress	Brassicaceae		0.1	10
	Hordeum leporinum	*	Barley Grass	Poaceae		0.1	1
	Bromus brevis	*	Pampas Brome	Poaceae		0.1	5
	Einadia nutans		Climbing Saltbush	Chenopodiaceae	Forb (FG)	0.1	20
	Einadia trigonos		Fishweed	Chenopodiaceae	Forb (FG)	0.1	3
	Hirschfeldia incana	*	Buchan Weed	Brassicaceae		0.1	20
	Spergularia rubra	*	Sandspurry	Caryophyllaceae		0.1	100

Plot number	Scientific Name	Exotic (* = introduced species)	Common Name	Family	BAM Growth Form Group	Cover	Abundance
	Baloskion tetraphyllum		Feather Rush	Restionaceae	Grass & grasslike (GG)	0.1	1
	Elymus scaber		Wheatgrass, Common Wheatgrass	Poaceae	Grass & grasslike (GG)	0.1	2
	Bromus diandrus	*	Great Brome	Poaceae		0.1	1
	Gamochaeta purpurea	*	Purple Cudweed	Asteraceae		0.1	3
	Nassella trichotoma	*	Serrated Tussock	Poaceae		0.1	2
	Plantago lanceolata	*	Lamb's Tongues	Plantaginaceae		0.1	40
	Vulpia muralis	*	A Fescue	Poaceae		0.1	30
BGW3	*Eucalyptus tereticornis*		Forest Red Gum	Myrtaceae	Tree (TG)	15	1
	Eucalyptus cinerea		Argyle Apple	Myrtaceae	Tree (TG)	15	2
	Eleusine tristachya	*	Goose Grass	Poaceae		1	400
	Paronychia brasiliana	*	Chilean Whitlow Wort, Brazilian Whitlow	Caryophyllaceae		1	500
	Lepidium africanum	*	Common Peppercress	Brassicaceae		1	300
	Austrostipa scabra		Speargrass	Poaceae	Grass & grasslike (GG)	0.5	100
	Hordeum leporinum	*	Barley Grass	Poaceae		0.5	200
	Hypochaeris radicata	*	Catsear	Asteraceae		0.2	50
	Plantago lanceolata	*	Lamb's Tongues	Plantaginaceae		0.2	50
	Malva neglecta	*	Dwarf Mallow	Malvaceae		0.2	30
	Onopordum acanthium	*	Scotch Thistle	Asteraceae		0.2	5
	Cynodon dactylon		Common Couch	Poaceae	Grass & grasslike (GG)	0.1	10

Plot number	Scientific Name	Exotic (* = introduced species)	Common Name	Family	BAM Growth Form Group	Cover	Abundance
	Bromus molliformis	*	Soft Brome	Poaceae		0.1	20
	Einadia nutans		Climbing Saltbush	Chenopodiaceae	Forb (FG)	0.1	2
	Einadia trigonos		Fishweed	Chenopodiaceae	Forb (FG)	0.1	1
	Hirschfeldia incana	*	Buchan Weed	Brassicaceae		0.1	10
	Spergularia rubra	*	Sandspurry	Caryophyllaceae		0.1	100
	Nassella trichotoma	*	Serrated Tussock	Poaceae		0.1	10
	Vulpia muralis	*	A Fescue	Poaceae		0.1	20
	Crassula sieberiana		Australian Stonecrop	Crassulaceae	Forb (FG)	0.1	20
	Chenopodium album	*	Fat Hen	Chenopodiaceae		0.1	1
	Juncus filicaulis		Thread Rush	Juncaceae	Grass & grasslike (GG)	0.1	3
	Oxalis spp.			Oxalidaceae	Forb (FG)	0.1	1
	Arctotheca calendula	*	Capeweed	Asteraceae		0.1	5
	Rumex acetosella	*	Sheep Sorrel	Polygonaceae		0.1	20
	Silybum marianum	*	Variegated Thistle	Asteraceae		0.1	1

Plot number	Scientific Name	Exotic (* = introduced species)	Common Name	Family	BAM Growth Form Group	Cover	Abundance
BGW 4	*Hordeum leporinum*	*	Barley Grass	Poaceae		40	500
	Eucalyptus melliodora		Yellow Box	Myrtaceae	Tree (TG)	15	1
	Marrubium vulgare	*	White Horehound	Lamiaceae		5	40
	Onopordum acanthium	*	Scotch Thistle	Asteraceae		2	20
	Hirschfeldia incana	*	Buchan Weed	Brassicaceae		1	100
	Urtica urens	*	Small Nettle	Urticaceae		1	50
	Vulpia muralis	*	A Fescue	Poaceae		0.2	10
	Chenopodium album	*	Fat Hen	Chenopodiaceae		0.2	50
	Dactylis glomerata	*	Cocksfoot	Poaceae		0.2	10
	Paronychia brasiliana	*	Chilean Whitlow Wort, Brazilian Whitlow	Caryophyllaceae		0.1	5
	Lepidium africanum	*	Common Peppercress	Brassicaceae		0.1	20
	Bidens subalternans	*	Greater Beggar's Ticks	Asteraceae		0.1	5
	Capsella bursa-pastoris	*	Shepherd's Purse	Brassicaceae		0.1	1
	Cirsium vulgare	*	Spear Thistle	Asteraceae		0.1	1
	Trifolium glomeratum	*	Clustered Clover	Fabaceae (Faboideae)		0.1	2
STR 1	*Bromus molliformis*	*	Soft Brome	Poaceae		20	5000
	Cassinia sifton		Sifton Bush	Asteraceae	Shrub (SG)	20	60
	Paronychia brasiliana	*	Chilean Whitlow Wort, Brazilian Whitlow	Caryophyllaceae		15	4000

Plot number	Scientific Name	Exotic (* = introduced species)	Common Name	Family	BAM Growth Form Group	Cover	Abundance
	Vulpia muralis	*	A Fescue	Poaceae		10	5000
	Cynodon dactylon		Common Couch	Poaceae	Grass & grasslike (GG)	2	200
	Crassula sieberiana		Australian Stonecrop	Crassulaceae	Forb (FG)	2	1000
	Austrostipa scabra		Speargrass	Poaceae	Grass & grasslike (GG)	1	200
	Hypochaeris radicata	*	Catsear	Asteraceae		1	200
	Hypochaeris glabra	*	Smooth Catsear	Asteraceae		1	500
	Eleusine tristachya	*	Goose Grass	Poaceae		0.5	50
	Chloris truncata		Windmill Grass	Poaceae	Grass & grasslike (GG)	0.2	100
	Lepidium africanum	*	Common Peppercress	Brassicaceae		0.1	3
	Nassella trichotoma	*	Serrated Tussock	Poaceae		0.1	2
	Juncus filicaulis		Thread Rush	Juncaceae	Grass & grasslike (GG)	0.1	3
	Oxalis spp.			Oxalidaceae	Forb (FG)	0.1	1
	Arctotheca calendula	*	Capeweed	Asteraceae		0.1	1
	Rumex acetosella	*	Sheep Sorrel	Polygonaceae		0.1	50
	Gamochaeta purpurea	*	Purple Cudweed	Asteraceae		0.1	50
	Rytidosperma caespitosum		Ringed Wallaby Grass	Poaceae	Grass & grasslike (GG)	0.1	1
	Festuca pratensis	*	Meadow Fescue	Poaceae		0.1	20
STR 2	*Paronychia brasiliana*	*	Chilean Whitlow Wort, Brazilian Whitlow	Caryophyllaceae		20	5000

Plot number	Scientific Name	Exotic (* = introduced species)	Common Name	Family	BAM Growth Form Group	Cover	Abundance
	Cassinia sifton		Sifton Bush	Asteraceae	Shrub (SG)	15	30
	Bromus molliformis	*	Soft Brome	Poaceae		10	3000
	Cynodon dactylon		Common Couch	Poaceae	Grass & grasslike (GG)	2	100
	Crassula sieberiana		Australian Stonecrop	Crassulaceae	Forb (FG)	2	500
	Austrostipa scabra		Speargrass	Poaceae	Grass & grasslike (GG)	2	500
	Rumex acetosella	*	Sheep Sorrel	Polygonaceae		2	500
	Vulpia muralis	*	A Fescue	Poaceae		1	500
	Eleusine tristachya	*	Goose Grass	Poaceae		1	300
	Festuca pratensis	*	Meadow Fescue	Poaceae		0.5	50
	Hypochaeris radicata	*	Catsear	Asteraceae		0.2	100
	Hypochaeris glabra	*	Smooth Catsear	Asteraceae		0.1	20
	Lepidium africanum	*	Common Peppercress	Brassicaceae		0.1	10
	Nassella trichotoma	*	Serrated Tussock	Poaceae		0.1	7
	Gamochaeta purpurea	*	Purple Cudweed	Asteraceae		0.1	50
	Hirschfeldia incana	*	Buchan Weed	Brassicaceae		0.1	50
	Aira elegantissima	*	Delicate Hairgrass	Poaceae		0.1	200
STR 3	*Bromus molliformis*	*	Soft Brome	Poaceae		30	5000
	Cassinia sifton		Sifton Bush	Asteraceae	Shrub (SG)	10	15
	Vulpia muralis	*	A Fescue	Poaceae		10	5000
	Crassula sieberiana		Australian Stonecrop	Crassulaceae	Forb (FG)	2	1000
	Hypochaeris radicata	*	Catsear	Asteraceae		2	1000

Plot number	Scientific Name	Exotic (* = introduced species)	Common Name	Family	BAM Growth Form Group	Cover	Abundance
	Austrostipa spp.			Poaceae	Grass & grasslike (GG)	2	50
	Paronychia brasiliana	*	Chilean Whitlow Wort, Brazilian Whitlow	Caryophyllaceae		1	500
	Holcus lanatus	*	Yorkshire Fog	Poaceae		1	200
	Cynodon dactylon		Common Couch	Poaceae	Grass & grasslike (GG)	0.5	20
	Rumex acetosella	*	Sheep Sorrel	Polygonaceae		0.5	300
	Austrostipa scabra		Speargrass	Poaceae	Grass & grasslike (GG)	0.2	50
	Gamochaeta purpurea	*	Purple Cudweed	Asteraceae		0.2	200
	Festuca pratensis	*	Meadow Fescue	Poaceae		0.1	20
	Hypochaeris glabra	*	Smooth Catsear	Asteraceae		0.1	20
	Nassella trichotoma	*	Serrated Tussock	Poaceae		0.1	25
	Bromus brevis	*	Pampas Brome	Poaceae		0.1	5
	Rumex brownii		Swamp Dock	Polygonaceae	Forb (FG)	0.1	1
STR 4	*Cassinia sifton*		Sifton Bush	Asteraceae	Shrub (SG)	15	50
	Paronychia brasiliana	*	Chilean Whitlow Wort, Brazilian Whitlow	Caryophyllaceae		15	2000
	Festuca pratensis	*	Meadow Fescue	Poaceae		10	1000
	Bromus molliformis	*	Soft Brome	Poaceae		5	1000
	Vulpia muralis	*	A Fescue	Poaceae		1	200
	Crassula sieberiana		Australian Stonecrop	Crassulaceae	Forb (FG)	1	500
	Cynodon dactylon		Common Couch	Poaceae	Grass & grasslike	1	100

Plot number	Scientific Name	Exotic (* = introduced species)	Common Name	Family	BAM Growth Form Group	Cover	Abundance
					(GG)		
	Hypochaeris radicata	*	Catsear	Asteraceae		0.2	50
	Austrostipa scabra		Speargrass	Poaceae	Grass & grasslike (GG)	0.2	100
	Bromus brevis	*	Pampas Brome	Poaceae		0.2	200
	Lepidium africanum	*	Common Peppercress	Brassicaceae		0.2	50
	Rumex acetosella	*	Sheep Sorrel	Polygonaceae		0.1	20
	Gamochaeta purpurea	*	Purple Cudweed	Asteraceae		0.1	10
	Nassella trichotoma	*	Serrated Tussock	Poaceae		0.1	3
	Hirschfeldia incana	*	Buchan Weed	Brassicaceae		0.1	3
	Cirsium vulgare	*	Spear Thistle	Asteraceae		0.1	2
	Trifolium glomeratum	*	Clustered Clover	Fabaceae (Faboideae)		0.1	2
	Plantago lanceolata	*	Lamb's Tongues	Plantaginaceae		0.1	1
	Spergularia rubra	*	Sandspurry	Caryophyllaceae		0.1	50
	Modiola caroliniana	*	Red-flowered Mallow	Malvaceae		0.1	1
CSF 9	*Paronychia brasiliana*	*	Chilean Whitlow Wort, Brazilian Whitlow	Caryophyllaceae		15	3000
	Cynodon dactylon		Common Couch	Poaceae	Grass & grasslike (GG)	10	500
	Eleusine tristachya	*	Goose Grass	Poaceae		10	2000
	Lepidium spp.	*		Brassicaceae	Forb (FG)	5	2000
	Vulpia muralis	*	A Fescue	Poaceae		2	1000
	Crassula sieberiana		Australian	Crassulaceae	Forb (FG)	2	2000

Plot number	Scientific Name	Exotic (* = introduced species)	Common Name	Family	BAM Growth Form Group	Cover	Abundance
			Stonecrop				
	Hypochaeris radicata	*	Catsear	Asteraceae		2	300
	Spergularia rubra	*	Sandspurry	Caryophyllaceae		2	500
	Hypochaeris glabra	*	Smooth Catsear	Asteraceae		2	500
	Austrostipa scabra		Speargrass	Poaceae	Grass & grasslike (GG)	1	200
	Rumex acetosella	*	Sheep Sorrel	Polygonaceae		0.3	200
	Bromus molliformis	*	Soft Brome	Poaceae		0.1	50
	Lepidium africanum	*	Common Peppercress	Brassicaceae		0.1	2
	Gamochaeta purpurea	*	Purple Cudweed	Asteraceae		0.1	20
	Nassella trichotoma	*	Serrated Tussock	Poaceae		0.1	3
	Hirschfeldia incana	*	Buchan Weed	Brassicaceae		0.1	5
	Arctotheca calendula	*	Capeweed	Asteraceae		0.1	1
	Rytidosperma caespitosum		Ringed Wallaby Grass	Poaceae	Grass & grasslike (GG)	0.1	3
	Plantago coronopus	*	Buck's-horn Plaintain	Plantaginaceae		0.1	20
	Panicum effusum		Hairy Panic	Poaceae	Grass & grasslike (GG)	0.1	1
	Wahlenbergia communis		Tufted Bluebell	Campanulaceae	Forb (FG)	0.1	1
	Chondrilla juncea	*	Skeleton Weed	Asteraceae		0.1	1
	Conyza spp.	*		Asteraceae		0.1	4
	Eragrostis curvula	*	African Lovegrass	Poaceae		0.1	1
UG 1	*Bromus molliformis*	*	Soft Brome	Poaceae		30	10000
	Vulpia muralis	*	A Fescue	Poaceae		10	10000

Plot number	Scientific Name	Exotic (* = introduced species)	Common Name	Family	BAM Growth Form Group	Cover	Abundance
	Rumex acetosella	*	Sheep Sorrel	Polygonaceae		5	2000
	Cynodon dactylon		Common Couch	Poaceae	Grass & grasslike (GG)	2	200
	Hypochaeris radicata	*	Catsear	Asteraceae		2	1000
	Festuca pratensis	*	Meadow Fescue	Poaceae		2	100
	Paronychia brasiliana	*	Chilean Whitlow Wort, Brazilian Whitlow	Caryophyllaceae		1	1000
	Austrostipa bigeniculata			Poaceae	Grass & grasslike (GG)	1	20
	Austrostipa scabra		Speargrass	Poaceae	Grass & grasslike (GG)	0.5	50
	Chondrilla juncea	*	Skeleton Weed	Asteraceae		0.1	2
	Juncus subsecundus		Finger Rush	Juncaceae	Grass & grasslike (GG)	0.1	2
	Rytidosperma spp.		Wallaby Grass	Poaceae	Grass & grasslike (GG)	0.1	5
	Alternanthera nana		Hairy Joyweed	Amaranthaceae	Forb (FG)	0.1	1
	Persicaria prostrata		Creeping Knotweed	Polygonaceae	Forb (FG)	0.1	1
UG 2	*Bromus molliformis*	*	Soft Brome	Poaceae		40	2000
	Vulpia muralis	*	A Fescue	Poaceae		10	2000
	Hypochaeris radicata	*	Catsear	Asteraceae		10	1000
	Paronychia brasiliana	*	Chilean Whitlow Wort, Brazilian Whitlow	Caryophyllaceae		5	500
	Eleusine tristachya	*	Goose Grass	Poaceae		5	500

Plot number	Scientific Name	Exotic (* = introduced species)	Common Name	Family	BAM Growth Form Group	Cover	Abundance
	Austrostipa scabra		Speargrass	Poaceae	Grass & grasslike (GG)	1	50
	Arctotheca calendula	*	Capeweed	Asteraceae		0.2	100
	Juncus subsecundus		Finger Rush	Juncaceae	Grass & grasslike (GG)	0.1	1
	Lepidium africanum	*	Common Peppercress	Brassicaceae		0.1	5
	Gamochaeta purpurea	*	Purple Cudweed	Asteraceae		0.1	20
	Nassella trichotoma	*	Serrated Tussock	Poaceae		0.1	5
	Hordeum leporinum	*	Barley Grass	Poaceae		0.1	50
EG 1	*Crassula sieberiana*		Australian Stonecrop	Crassulaceae	Forb (FG)	20	10000
	Dactylis glomerata	*	Cocksfoot	Poaceae		20	500
	Bromus molliformis	*	Soft Brome	Poaceae		2	1000
	Vulpia muralis	*	A Fescue	Poaceae		2	1000
	Hypochaeris radicata	*	Catsear	Asteraceae		2	500
	Lepidium africanum	*	Common Peppercress	Brassicaceae		2	200
	Rumex acetosella	*	Sheep Sorrel	Polygonaceae		2	1000
	Carthamus lanatus	*	Saffron Thistle	Asteraceae		2	300
	Nassella trichotoma	*	Serrated Tussock	Poaceae		1	50
	Hirschfeldia incana	*	Buchan Weed	Brassicaceae		1	200
	Hypochaeris glabra	*	Smooth Catsear	Asteraceae		0.2	200
	Gamochaeta purpurea	*	Purple Cudweed	Asteraceae		0.1	30
	Austrostipa bigeniculata			Poaceae	Grass & grasslike (GG)	0.1	5
	Plantago coronopus	*	Buck's-horn	Plantaginaceae		0.1	5

Plot number	Scientific Name	Exotic (* = introduced species)	Common Name	Family	BAM Growth Form Group	Cover	Abundance
			Plaintain				
	Cirsium vulgare	*	Spear Thistle	Asteraceae		0.1	3
	Modiola caroliniana	*	Red-flowered Mallow	Malvaceae		0.1	20
	Austrostipa spp.			Poaceae	Grass & grasslike (GG)	0.1	2
	Lolium perenne	*	Perennial Ryegrass	Poaceae		0.1	1
	Onopordum illyricum	*	Illyrian Thistle	Asteraceae		0.1	10
EG 2	*Dactylis glomerata*	*	Cocksfoot	Poaceae		40	1000
	Hypochaeris glabra	*	Smooth Catsear	Asteraceae		30	20000
	Eleusine tristachya	*	Goose Grass	Poaceae		10	2000
	Crassula sieberiana		Australian Stonecrop	Crassulaceae	Forb (FG)	5	5000
	Bromus molliformis	*	Soft Brome	Poaceae		5	5000
	Spergularia rubra	*	Sandspurry	Caryophyllaceae		2	500
	Vulpia muralis	*	A Fescue	Poaceae		1	2000
	Lepidium africanum	*	Common Peppercress	Brassicaceae		1	100
	Cynodon dactylon		Common Couch	Poaceae	Grass & grasslike (GG)	1	100
	Trifolium subterraneum	*	Subterranean Clover	Fabaceae (Faboideae)		1	100
	Rumex acetosella	*	Sheep Sorrel	Polygonaceae		0.5	500
	Modiola caroliniana	*	Red-flowered Mallow	Malvaceae		0.2	50
	Paronychia brasiliana	*	Chilean Whitlow	Caryophyllaceae		0.2	200

Plot number	Scientific Name	Exotic (* = introduced species)	Common Name	Family	BAM Growth Form Group	Cover	Abundance
			Wort, Brazilian Whitlow				
	Setaria pumila	*	Pale Pigeon Grass	Poaceae		0.2	10
	Carthamus lanatus	*	Saffron Thistle	Asteraceae		0.1	10
	Gamochaeta purpurea	*	Purple Cudweed	Asteraceae		0.1	20
	Cirsium vulgare	*	Spear Thistle	Asteraceae		0.1	1
	Austrostipa scabra		Speargrass	Poaceae	Grass & grasslike (GG)	0.1	2
	Phalaris aquatica	*	Phalaris	Poaceae		0.1	2
EG 3	*Dactylis glomerata*	*	Cocksfoot	Poaceae		40	1000
	Crassula sieberiana		Australian Stonecrop	Crassulaceae	Forb (FG)	10	5000
	Bromus molliformis	*	Soft Brome	Poaceae		10	5000
	Vulpia muralis	*	A Fescue	Poaceae		5	5000
	Hypochaeris glabra	*	Smooth Catsear	Asteraceae		2	500
	Hypochaeris radicata	*	Catsear	Asteraceae		2	500
	Hirschfeldia incana	*	Buchan Weed	Brassicaceae		2	1000
	Rumex acetosella	*	Sheep Sorrel	Polygonaceae		1	200
	Paronychia brasiliana	*	Chilean Whitlow Wort, Brazilian Whitlow	Caryophyllaceae		1	500
	Eragrostis curvula	*	African Lovegrass	Poaceae		1	20
	Carthamus lanatus	*	Saffron Thistle	Asteraceae		0.5	100
	Trifolium striatum	*	Knotted Clover	Fabaceae (Faboideae)		0.5	200
	Gamochaeta purpurea	*	Purple Cudweed	Asteraceae		0.2	100

Plot number	Scientific Name	Exotic (* = introduced species)	Common Name	Family	BAM Growth Form Group	Cover	Abundance
	Nassella trichotoma	*	Serrated Tussock	Poaceae		0.2	5
	Lepidium africanum	*	Common Peppercress	Brassicaceae		0.1	50
	Modiola caroliniana	*	Red-flowered Mallow	Malvaceae		0.1	6
	Austrostipa scabra		Speargrass	Poaceae	Grass & grasslike (GG)	0.1	2
	Onopordum illyricum	*	Illyrian Thistle	Asteraceae		0.1	10
	Conyza spp.	*		Asteraceae		0.1	1
EG 4	*Dactylis glomerata*	*	Cocksfoot	Poaceae		10	500
	Crassula sieberiana		Australian Stonecrop	Crassulaceae	Forb (FG)	10	10000
	Eleusine tristachya	*	Goose Grass	Poaceae		10	2000
	Vulpia muralis	*	A Fescue	Poaceae		5	5000
	Rumex acetosella	*	Sheep Sorrel	Polygonaceae		5	3000
	Trifolium striatum	*	Knotted Clover	Fabaceae (Faboideae)		5	1000
	Cynodon dactylon		Common Couch	Poaceae	Grass & grasslike (GG)	5	500
	Bromus molliformis	*	Soft Brome	Poaceae		3	2000
	Hypochaeris radicata	*	Catsear	Asteraceae		3	800
	Trifolium glomeratum	*	Clustered Clover	Fabaceae (Faboideae)		2	500
	Paronychia brasiliana	*	Chilean Whitlow Wort, Brazilian Whitlow	Caryophyllaceae		1	500
	Spergularia rubra	*	Sandspurry	Caryophyllaceae		1	200

Plot number	Scientific Name	Exotic (* = introduced species)	Common Name	Family	BAM Growth Form Group	Cover	Abundance
	Lolium rigidum	*	Wimmera Ryegrass	Poaceae		1	50
	Hirschfeldia incana	*	Buchan Weed	Brassicaceae		0.5	200
	Lepidium africanum	*	Common Peppercress	Brassicaceae		0.2	50
	Carthamus lanatus	*	Saffron Thistle	Asteraceae		0.1	10
	Gamochaeta purpurea	*	Purple Cudweed	Asteraceae		0.1	5
	Austrostipa scabra		Speargrass	Poaceae	Grass & grasslike (GG)	0.1	2
	Lolium perenne	*	Perennial Ryegrass	Poaceae		0.1	1
EG 5	*Dactylis glomerata*	*	Cocksfoot	Poaceae		40	500
	Crassula sieberiana		Australian Stonecrop	Crassulaceae	Forb (FG)	30	5000
	Hypochaeris glabra	*	Smooth Catsear	Asteraceae		3	1000
	Vulpia muralis	*	A Fescue	Poaceae		2	2000
	Rumex acetosella	*	Sheep Sorrel	Polygonaceae		2	1000
	Bromus molliformis	*	Soft Brome	Poaceae		2	1000
	Paronychia brasiliana	*	Chilean Whitlow Wort, Brazilian Whitlow	Caryophyllaceae		2	500
	Gamochaeta purpurea	*	Purple Cudweed	Asteraceae		1	400
	Austrostipa scabra		Speargrass	Poaceae	Grass & grasslike (GG)	0.5	50
	Hypochaeris radicata	*	Catsear	Asteraceae		0.2	100
	Juncus subsecundus		Finger Rush	Juncaceae	Grass & grasslike (GG)	0.2	1

Plot number	Scientific Name	Exotic (* = introduced species)	Common Name	Family	BAM Growth Form Group	Cover	Abundance
	Eleusine tristachya	*	Goose Grass	Poaceae		0.1	10
	Spergularia rubra	*	Sandspurry	Caryophyllaceae		0.1	5
	Lolium rigidum	*	Wimmera Ryegrass	Poaceae		0.1	1
	Hirschfeldia incana	*	Buchan Weed	Brassicaceae		0.1	20
	Lepidium africanum	*	Common Peppercress	Brassicaceae		0.1	3
	Lolium perenne	*	Perennial Ryegrass	Poaceae		0.1	1
	Eragrostis curvula	*	African Lovegrass	Poaceae		0.1	1
	Conyza spp.	*		Asteraceae		0.1	1
	Cirsium vulgare	*	Spear Thistle	Asteraceae		0.1	2
	Hordeum leporinum	*	Barley Grass	Poaceae		0.1	10
	Panicum effusum		Hairy Panic	Poaceae	Grass & grasslike (GG)	0.1	1
	Elymus scaber		Wheatgrass, Common Wheatgrass	Poaceae	Grass & grasslike (GG)	0.1	1
SW 1	*Eragrostis curvula*	*	African Lovegrass	Poaceae		30	1000
	Nassella trichotoma	*	Serrated Tussock	Poaceae		5	100
	Crassula sieberiana		Australian Stonecrop	Crassulaceae	Forb (FG)	3	3000
	Vulpia muralis	*	A Fescue	Poaceae		2	1000
	Rumex acetosella	*	Sheep Sorrel	Polygonaceae		1	500
	Paronychia brasiliana	*	Chilean Whitlow Wort, Brazilian Whitlow	Caryophyllaceae		1	500

Plot number	Scientific Name	Exotic (* = introduced species)	Common Name	Family	BAM Growth Form Group	Cover	Abundance
	Austrostipa scabra		Speargrass	Poaceae	Grass & grasslike (GG)	1	100
	Hypochaeris radicata	*	Catsear	Asteraceae		1	300
	Cynodon dactylon		Common Couch	Poaceae	Grass & grasslike (GG)	1	100
	Bromus molliformis	*	Soft Brome	Poaceae		0.1	50
	Gamochaeta purpurea	*	Purple Cudweed	Asteraceae		0.1	2
	Juncus subsecundus		Finger Rush	Juncaceae	Grass & grasslike (GG)	0.1	1
	Hordeum leporinum	*	Barley Grass	Poaceae		0.1	20
	Rytidosperma caespitosum		Ringed Wallaby Grass	Poaceae	Grass & grasslike (GG)	0.1	20
	Aira elegantissima	*	Delicate Hairgrass	Poaceae		0.1	50
SW 2	*Cynodon dactylon*		Common Couch	Poaceae	Grass & grasslike (GG)	30	2000
	Crassula sieberiana		Australian Stonecrop	Crassulaceae	Forb (FG)	5	5000
	Vulpia muralis	*	A Fescue	Poaceae		5	5000
	Hypochaeris glabra	*	Smooth Catsear	Asteraceae		3	1000
	Nassella trichotoma	*	Serrated Tussock	Poaceae		2	50
	Eragrostis curvula	*	African Lovegrass	Poaceae		1	200
	Rumex acetosella	*	Sheep Sorrel	Polygonaceae		1	1000
	Hypochaeris radicata	*	Catsear	Asteraceae		1	200
	Paronychia brasiliana	*	Chilean Whitlow Wort, Brazilian Whitlow	Caryophyllaceae		0.2	200

Plot number	Scientific Name	Exotic (* = introduced species)	Common Name	Family	BAM Growth Form Group	Cover	Abundance
	Austrostipa scabra		Speargrass	Poaceae	Grass & grasslike (GG)	0.2	50
	Rytidosperma caespitosum		Ringed Wallaby Grass	Poaceae	Grass & grasslike (GG)	0.2	100
	Bromus molliformis	*	Soft Brome	Poaceae		0.1	50
	Aira elegantissima	*	Delicate Hairgrass	Poaceae		0.1	20
	Elymus scaber		Wheatgrass, Common Wheatgrass	Poaceae	Grass & grasslike (GG)	0.1	10
	Austrostipa bigeniculata			Poaceae	Grass & grasslike (GG)	0.1	5
	Festuca pratensis	*	Meadow Fescue	Poaceae		0.1	5
	Juncus filicaulis		Thread Rush	Juncaceae	Grass & grasslike (GG)	0.1	10
	Wahlenbergia gracilis		Sprawling Bluebell	Campanulaceae	Forb (FG)	0.1	1
SW 3	*Nassella trichotoma*	*	Serrated Tussock	Poaceae		40	500
	Eragrostis curvula	*	African Lovegrass	Poaceae		8	300
	Crassula sieberiana		Australian Stonecrop	Crassulaceae	Forb (FG)	5	5000
	Vulpia muralis	*	A Fescue	Poaceae		2	1000
	Paronychia brasiliana	*	Chilean Whitlow Wort, Brazilian Whitlow	Caryophyllaceae		2	400
	Hypochaeris radicata	*	Catsear	Asteraceae		1	400
	Austrostipa scabra		Speargrass	Poaceae	Grass & grasslike (GG)	1	100

Plot number	Scientific Name	Exotic (* = introduced species)	Common Name	Family	BAM Growth Form Group	Cover	Abundance
	Cynodon dactylon		Common Couch	Poaceae	Grass & grasslike (GG)	0.5	50
	Rytidosperma caespitosum		Ringed Wallaby Grass	Poaceae	Grass & grasslike (GG)	0.5	100
	Rumex acetosella	*	Sheep Sorrel	Polygonaceae		0.2	100
	Bromus molliformis	*	Soft Brome	Poaceae		0.1	50
	Aira elegantissima	*	Delicate Hairgrass	Poaceae		0.1	5
	Elymus scaber		Wheatgrass, Common Wheatgrass	Poaceae	Grass & grasslike (GG)	0.1	1
	Festuca pratensis	*	Meadow Fescue	Poaceae		0.1	10
	Hordeum leporinum	*	Barley Grass	Poaceae		0.1	50
PL 1	*Bromus diandrus*	*	Great Brome	Poaceae		25	1000
	Vulpia muralis	*	A Fescue	Poaceae		10	1000
	Plantago lanceolata	*	Lamb's Tongues	Plantaginaceae		10	1000
	Digitaria diffusa		Open Summer-grass	Poaceae	Grass & grasslike (GG)	5	300
	Eucalyptus ovata		Swamp Gum	Myrtaceae	Tree (TG)	3	1
	Microlaena stipoides		Weeping Grass	Poaceae	Grass & grasslike (GG)	3	200
	Rumex acetosella	*	Sheep Sorrel	Polygonaceae		2	300
	Trifolium subterraneum	*	Subterranean Clover	Fabaceae (Faboideae)		2	200
	Eucalyptus pauciflora		White Sally	Myrtaceae	Tree (TG)	2	1
	Acacia spp. 1		Wattle	Fabaceae (Mimosoideae)	Shrub (SG)	2	1

Plot number	Scientific Name	Exotic (* = introduced species)	Common Name	Family	BAM Growth Form Group	Cover	Abundance
	Acacia spp. 2		Wattle	Fabaceae (Mimosoideae)	Shrub (SG)	2	1
	Dactylis glomerata	*	Cocksfoot	Poaceae		1	20
	Panicum effusum		Hairy Panic	Poaceae	Grass & grasslike (GG)	1	100
	Acacia melanoxylon		Blackwood	Fabaceae (Mimosoideae)	Tree (TG)	1	3
	Eucalyptus camphora		Mountain Swamp Gum	Myrtaceae	Tree (TG)	1	1
	Eucalyptus viminalis		Ribbon Gum	Myrtaceae	Tree (TG)	1	1
	Hypochaeris radicata	*	Catsear	Asteraceae		0.5	200
	Cirsium vulgare	*	Spear Thistle	Asteraceae		0.5	5
	Acacia dealbata		Silver Wattle	Fabaceae (Mimosoideae)	Tree (TG)	0.5	15
	Eucalyptus polyanthemos		Red Box	Myrtaceae	Tree (TG)	0.5	1
	Acacia rubida		Red-stemmed Wattle	Fabaceae (Mimosoideae)	Shrub (SG)	0.5	12
	Juncus gregiflorus		Green Rush	Juncaceae	Grass & grasslike (GG)	0.5	3
	Sporobolus africanus	*	Parramatta Grass	Poaceae		0.5	20
	Eragrostis curvula	*	African Lovegrass	Poaceae		0.2	20
	Holcus lanatus	*	Yorkshire Fog	Poaceae		0.2	2
	Acacia pravissima		Wedge-leaved Wattle	Fabaceae (Mimosoideae)	Shrub (SG)	0.2	2
	Bromus catharticus	*	Praire Grass	Poaceae		0.2	10
	Lactuca serriola	*	Prickly Lettuce	Asteraceae		0.2	2

Plot number	Scientific Name	Exotic (* = introduced species)	Common Name	Family	BAM Growth Form Group	Cover	Abundance
	Nassella trichotoma	*	Serrated Tussock	Poaceae		0.1	1
	Paronychia brasiliana	*	Chilean Whitlow Wort, Brazilian Whitlow	Caryophyllaceae		0.1	10
	Gamochaeta purpurea	*	Purple Cudweed	Asteraceae		0.1	100
	Conyza spp.	*		Asteraceae		0.1	5
	Austrostipa spp.			Poaceae	Grass & grasslike (GG)	0.1	3
	Cassinia sifton		Sifton Bush	Asteraceae	Shrub (SG)	0.1	1
	Lycium ferocissimum	*	African Boxthorn	Solanaceae		0.1	5
	Oxalis perennans		Grassland Wood-sorrel	Oxalidaceae	Forb (FG)	0.1	20
EG A	*Vulpia myuros*	*	Rat's Tail Fescue	Poaceae		40	2000
	Hordeum leporinum	*	Barley Grass	Poaceae		20	400
	Trifolium subterraneum	*	Subterranean Clover	Fabaceae (Faboideae)		15	300
	Bromus molliformis	*	Soft Brome	Poaceae		15	500
	Phalaris aquatica	*	Phalaris	Poaceae		2	10
	Eleusine tristachya	*	Goose Grass	Poaceae		1	50
	Rapistrum rugosum	*	Turnip Weed	Brassicaceae		0.5	50
	Hypochaeris glabra	*	Smooth Catsear	Asteraceae		0.3	30
	Paronychia brasiliana	*	Chilean Whitlow Wort, Brazilian Whitlow	Caryophyllaceae		0.2	100
	Austrostipa scabra		Speargrass	Poaceae	Grass & grasslike (GG)	0.2	5
	Cynodon dactylon		Common Couch	Poaceae	Grass & grasslike	0.2	20

Plot number	Scientific Name	Exotic (* = introduced species)	Common Name	Family	BAM Growth Form Group	Cover	Abundance
					(GG)		
	Hirschfeldia incana	*	Buchan Weed	Brassicaceae		0.2	100
	Lolium perenne	*	Perennial Ryegrass	Poaceae		0.2	20
	Plantago lanceolata	*	Lamb's Tongues	Plantaginaceae		0.1	2
	Rumex acetosella	*	Sheep Sorrel	Polygonaceae		0.1	10
	Bromus catharticus	*	Praire Grass	Poaceae		0.1	20
	Lactuca serriola	*	Prickly Lettuce	Asteraceae		0.1	2
	Oxalis perennans		Grassland Wood-sorrel	Oxalidaceae	Forb (FG)	0.1	10
	Juncus filicaulis		Thread Rush	Juncaceae	Grass & grasslike (GG)	0.1	3
	Lepidium africanum	*	Common Peppercress	Brassicaceae		0.1	5
	Carthamus lanatus	*	Saffron Thistle	Asteraceae		0.1	1
	Modiola caroliniana	*	Red-flowered Mallow	Malvaceae		0.1	10
	Alternanthera denticulata		Lesser Joyweed	Amaranthaceae	Forb (FG)	0.1	100
	Erodium crinitum		Blue Crowfoot	Geraniaceae	Forb (FG)	0.1	2
	Avena fatua	*	Wild Oats	Poaceae		0.1	1
	Erodium cicutarium	*	Common Crowfoot	Geraniaceae		0.1	1
	Festuca rubra	*	Red Fescue	Poaceae		0.1	5
EG B	*Vulpia muralis*	*	A Fescue	Poaceae		30	2000
	Bromus molliformis	*	Soft Brome	Poaceae		25	500
	Trifolium subterraneum	*	Subterranean	Fabaceae		15	300

Plot number	Scientific Name	Exotic (* = introduced species)	Common Name	Family	BAM Growth Form Group	Cover	Abundance
			Clover	(Faboideae)			
	Dactylis glomerata	*	Cocksfoot	Poaceae		15	100
	Phalaris aquatica	*	Phalaris	Poaceae		2	20
	Hordeum leporinum	*	Barley Grass	Poaceae		1	30
	Hypochaeris radicata	*	Catsear	Asteraceae		0.5	200
	Rumex acetosella	*	Sheep Sorrel	Polygonaceae		0.2	50
	Festuca pratensis	*	Meadow Fescue	Poaceae		0.2	2
	Rapistrum rugosum	*	Turnip Weed	Brassicaceae		0.1	10
	Paronychia brasiliana	*	Chilean Whitlow Wort, Brazilian Whitlow	Caryophyllaceae		0.1	5
	Hirschfeldia incana	*	Buchan Weed	Brassicaceae		0.1	200
	Plantago lanceolata	*	Lamb's Tongues	Plantaginaceae		0.1	4
	Lepidium africanum	*	Common Peppercress	Brassicaceae		0.1	1
	Modiola caroliniana	*	Red-flowered Mallow	Malvaceae		0.1	10
	Alternanthera denticulata		Lesser Joyweed	Amaranthaceae	Forb (FG)	0.1	100
	Trifolium glomeratum	*	Clustered Clover	Fabaceae (Faboideae)		0.1	100
	Plantago coronopus	*	Buck's-horn Plaintain	Plantaginaceae		0.1	10
	Cyperus eragrostis	*	Umbrella Sedge	Cyperaceae		0.1	2
	Medicago minima	*	Woolly Burr Medic	Fabaceae (Faboideae)		0.1	2
	Taraxacum officinale	*	Dandelion	Asteraceae		0.1	1

Plot number	Scientific Name	Exotic (* = introduced species)	Common Name	Family	BAM Growth Form Group	Cover	Abundance
UG 4	*Vulpia muralis*	*	A Fescue	Poaceae		20	3000
	Bromus molliformis	*	Soft Brome	Poaceae		15	300
	Trifolium subterraneum	*	Subterranean Clover	Fabaceae (Faboideae)		10	300
	Paronychia brasiliana	*	Chilean Whitlow Wort, Brazilian Whitlow	Caryophyllaceae		10	2000
	Hypochaeris radicata	*	Catsear	Asteraceae		5	500
	Gamochaeta calviceps	*	Cudweed	Asteraceae		5	5000
	Medicago minima	*	Woolly Burr Medic	Fabaceae (Faboideae)		3	300
	Nassella trichotoma	*	Serrated Tussock	Poaceae		2.5	25
	Cynodon dactylon		Common Couch	Poaceae	Grass & grasslike (GG)	2	100
	Panicum effusum		Hairy Panic	Poaceae	Grass & grasslike (GG)	1	50
	Sporobolus creber		Slender Rat's Tail Grass	Poaceae	Grass & grasslike (GG)	1	100
	Rumex acetosella	*	Sheep Sorrel	Polygonaceae		0.5	400
	Eleusine tristachya	*	Goose Grass	Poaceae		0.5	100
	Austrostipa scabra		Speargrass	Poaceae	Grass & grasslike (GG)	0.5	20
	Juncus gregiflorus		Green Rush	Juncaceae	Grass & grasslike (GG)	0.5	7
	Microlaena stipoides		Weeping Grass	Poaceae	Grass & grasslike (GG)	0.2	6
	Eragrostis curvula	*	African Lovegrass	Poaceae		0.2	10
	Crassula sieberiana		Australian	Crassulaceae	Forb (FG)	0.2	1000

Plot number	Scientific Name	Exotic (* = introduced species)	Common Name	Family	BAM Growth Form Group	Cover	Abundance
			Stonecrop				
	Setaria pumila	*	Pale Pigeon Grass	Poaceae		0.2	20
	Hordeum leporinum	*	Barley Grass	Poaceae		0.1	5
	Lepidium africanum	*	Common Peppercress	Brassicaceae		0.1	3
	Plantago coronopus	*	Buck's-horn Plaintain	Plantaginaceae		0.1	1
	Gamochaeta purpurea	*	Purple Cudweed	Asteraceae		0.1	1
	Wahlenbergia gracilis		Sprawling Bluebell	Campanulaceae	Forb (FG)	0.1	20
	Chloris truncata		Windmill Grass	Poaceae	Grass & grasslike (GG)	0.1	1
	Schoenus apogon		Fluke Bogrush	Cyperaceae	Grass & grasslike (GG)	0.1	10
	Cotula australis		Common Cotula	Asteraceae	Forb (FG)	0.1	5
	Juncus bufonius	*	Toad Rush	Juncaceae		0.1	10
	Soliva sessilis	*	Bindyi	Asteraceae		0.1	10
SWMP 1	*Carex appressa*		Tall Sedge	Cyperaceae	Grass & grasslike (GG)	30	100
	Poa labillardierei subsp. labillardierei		Tussock	Poaceae	Grass & grasslike (GG)	30	100
	Hypochaeris radicata	*	Catsear	Asteraceae		5	1000
	Paspalum dilatatum	*	Paspalum	Poaceae		5	20
	Rubus fruticosus agg.		Blackberry	Rosaceae		3	2
	Phalaris aquatica	*	Phalaris	Poaceae		2	30
	Geranium retrorsum		Cranesbill	Geraniaceae	Forb (FG)	2	200

Plot number	Scientific Name	Exotic (* = introduced species)	Common Name	Family	BAM Growth Form Group	Cover	Abundance
			Geranium				
	Vulpia muralis	*	A Fescue	Poaceae		1	300
	Rumex acetosella	*	Sheep Sorrel	Polygonaceae		1	300
	Juncus subglaucus		-	Juncaceae	Grass & grasslike (GG)	1	50
	Plantago lanceolata	*	Lamb's Tongues	Plantaginaceae		0.5	100
	Rumex brownii		Swamp Dock	Polygonaceae	Forb (FG)	0.3	200
	Bromus catharticus	*	Praire Grass	Poaceae		0.2	6
	Paronychia brasiliana	*	Chilean Whitlow Wort, Brazilian Whitlow	Caryophyllaceae		0.1	20
	Gamochaeta calviceps	*	Cudweed	Asteraceae		0.1	10
	Medicago minima	*	Woolly Burr Medic	Fabaceae (Faboideae)		0.1	10
	Panicum effusum		Hairy Panic	Poaceae	Grass & grasslike (GG)	0.1	20
	Gamochaeta purpurea	*	Purple Cudweed	Asteraceae		0.1	100
	Modiola caroliniana	*	Red-flowered Mallow	Malvaceae		0.1	2
	Trifolium glomeratum	*	Clustered Clover	Fabaceae (Faboideae)		0.1	20
	Taraxacum officinale	*	Dandelion	Asteraceae		0.1	20
	Oxalis perennans		Grassland Wood-sorrel	Oxalidaceae	Forb (FG)	0.1	50
	Carthamus lanatus	*	Saffron Thistle	Asteraceae		0.1	5
	Cirsium vulgare	*	Spear Thistle	Asteraceae		0.1	5
	Holcus lanatus	*	Yorkshire Fog	Poaceae		0.1	10

Plot number	Scientific Name	Exotic (* = introduced species)	Common Name	Family	BAM Growth Form Group	Cover	Abundance
	Lolium rigidum	*	Wimmera Ryegrass	Poaceae		0.1	10
	Asperula conferta		Common Woodruff	Rubiaceae	Forb (FG)	0.1	10
	Haloragis heterophylla		Variable Raspwort	Haloragaceae	Forb (FG)	0.1	50
	Wahlenbergia gracilenta		Annual Bluebell	Campanulaceae	Forb (FG)	0.1	30
	Festuca arundinacea	*	Tall Fescue	Poaceae		0.1	2
	Sonchus oleraceus	*	Common Sowthistle	Asteraceae		0.1	1
SWMP 2	*Poa labillardierei subsp. labillardierei*		Tussock	Poaceae	Grass & grasslike (GG)	25	200
	Rubus fruticosus agg.		Blackberry	Rosaceae		15	5
	Geranium retrorsum		Cranesbill Geranium	Geraniaceae	Forb (FG)	15	500
	Phalaris aquatica	*	Phalaris	Poaceae		10	30
	Vulpia muralis	*	A Fescue	Poaceae		10	5000
	Paspalum dilatatum	*	Paspalum	Poaceae		7	200
	Plantago lanceolata	*	Lamb's Tongues	Plantaginaceae		7	2000
	Rosa rubiginosa	*	Sweet Briar	Rosaceae		3	4
	Holcus lanatus	*	Yorkshire Fog	Poaceae		2	30
	Rumex acetosella	*	Sheep Sorrel	Polygonaceae		1	500
	Hypochaeris radicata	*	Catsear	Asteraceae		0.5	100
	Carex appressa		Tall Sedge	Cyperaceae	Grass & grasslike (GG)	0.2	5
	Cirsium vulgare	*	Spear Thistle	Asteraceae		0.2	20
	Trifolium subterraneum	*	Subterranean	Fabaceae		0.2	20

Plot number	Scientific Name	Exotic (* = introduced species)	Common Name	Family	BAM Growth Form Group	Cover	Abundance
			Clover	(Faboideae)			
	Juncus gregiflorus		Green Rush	Juncaceae	Grass & grasslike (GG)	0.2	5
	Cassinia sifton		Sifton Bush	Asteraceae	Shrub (SG)	0.2	20
	Eleusine spp.	*		Poaceae		0.2	20
	Paronychia brasiliana	*	Chilean Whitlow Wort, Brazilian Whitlow	Caryophyllaceae		0.1	2
	Medicago minima	*	Woolly Burr Medic	Fabaceae (Faboideae)		0.1	10
	Panicum effusum		Hairy Panic	Poaceae	Grass & grasslike (GG)	0.1	10
	Gamochaeta purpurea	*	Purple Cudweed	Asteraceae		0.1	50
	Carthamus lanatus	*	Saffron Thistle	Asteraceae		0.1	100
	Asperula conferta		Common Woodruff	Rubiaceae	Forb (FG)	0.1	20
	Haloragis heterophylla		Variable Raspwort	Haloragaceae	Forb (FG)	0.1	50
	Bromus molliformis	*	Soft Brome	Poaceae		0.1	5
	Nassella trichotoma	*	Serrated Tussock	Poaceae		0.1	2
	Lepidium africanum	*	Common Peppercress	Brassicaceae		0.1	1
	Sporobolus africanus	*	Parramatta Grass	Poaceae		0.1	2
	Conyza spp.	*		Asteraceae		0.1	30
SWMP 3	*Poa labillardierei subsp. labillardierei*		Tussock	Poaceae	Grass & grasslike (GG)	35	150
	Carex appressa		Tall Sedge	Cyperaceae	Grass & grasslike (GG)	25	100

Plot number	Scientific Name	Exotic (* = introduced species)	Common Name	Family	BAM Growth Form Group	Cover	Abundance
	Plantago lanceolata	*	Lamb's Tongues	Plantaginaceae		15	500
	Phalaris aquatica	*	Phalaris	Poaceae		10	30
	Paspalum dilatatum	*	Paspalum	Poaceae		5	50
	Juncus subglaucus		-	Juncaceae	Grass & grasslike (GG)	2	150
	Rosa rubiginosa	*	Sweet Briar	Rosaceae		0.5	2
	Holcus lanatus	*	Yorkshire Fog	Poaceae		0.5	10
	Hypochaeris radicata	*	Catsear	Asteraceae		0.5	100
	Rumex brownii		Swamp Dock	Polygonaceae	Forb (FG)	0.5	100
	Rumex acetosella	*	Sheep Sorrel	Polygonaceae		0.3	100
	Cassinia sifton		Sifton Bush	Asteraceae	Shrub (SG)	0.2	10
	Rubus fruticosus agg.		Blackberry	Rosaceae		0.1	1
	Geranium retrorsum		Cranesbill Geranium	Geraniaceae	Forb (FG)	0.1	2
	Cirsium vulgare	*	Spear Thistle	Asteraceae		0.1	30
	Paronychia brasiliana	*	Chilean Whitlow Wort, Brazilian Whitlow	Caryophyllaceae		0.1	2
	Gamochaeta purpurea	*	Purple Cudweed	Asteraceae		0.1	50
	Bromus molliformis	*	Soft Brome	Poaceae		0.1	2
	Trifolium glomeratum	*	Clustered Clover	Fabaceae (Faboideae)		0.1	5
	Sonchus oleraceus	*	Common Sowthistle	Asteraceae		0.1	10
	Eleusine tristachya	*	Goose Grass	Poaceae		0.1	5
UG 3	*Bromus molliformis*	*	Soft Brome	Poaceae		30	500
	Vulpia muralis	*	A Fescue	Poaceae		30	5000

Plot number	Scientific Name	Exotic (* = introduced species)	Common Name	Family	BAM Growth Form Group	Cover	Abundance
	Trifolium subterraneum	*	Subterranean Clover	Fabaceae (Faboideae)		15	500
	Austrostipa scabra		Speargrass	Poaceae	Grass & grasslike (GG)	10	100
	Dactylis glomerata	*	Cocksfoot	Poaceae		10	50
	Rumex acetosella	*	Sheep Sorrel	Polygonaceae		5	1000
	Hordeum leporinum	*	Barley Grass	Poaceae		2	70
	Paronychia brasiliana	*	Chilean Whitlow Wort, Brazilian Whitlow	Caryophyllaceae		1	200
	Hypochaeris radicata	*	Catsear	Asteraceae		0.5	100
	Phalaris aquatica	*	Phalaris	Poaceae		0.2	5
	Erodium crinitum		Blue Crowfoot	Geraniaceae	Forb (FG)	0.2	50
	Plantago lanceolata	*	Lamb's Tongues	Plantaginaceae		0.1	5
	Eleusine tristachya	*	Goose Grass	Poaceae		0.1	20
	Juncus gregiflorus		Green Rush	Juncaceae	Grass & grasslike (GG)	0.1	1
	Lepidium africanum	*	Common Peppercress	Brassicaceae		0.1	50
	Gamochaeta calviceps	*	Cudweed	Asteraceae		0.1	20
	Modiola caroliniana	*	Red-flowered Mallow	Malvaceae		0.1	5
	Oxalis perennans		Grassland Wood-sorrel	Oxalidaceae	Forb (FG)	0.1	2
	Festuca arundinacea	*	Tall Fescue	Poaceae		0.1	2
	Schoenus apogon		Fluke Bogrush	Cyperaceae	Grass & grasslike (GG)	0.1	1

Plot number	Scientific Name	Exotic (* = introduced species)	Common Name	Family	BAM Growth Form Group	Cover	Abundance
	Hirschfeldia incana	*	Buchan Weed	Brassicaceae		0.1	20
	Lactuca serriola	*	Prickly Lettuce	Asteraceae		0.1	20
	Verbena spp.			Verbenaceae	Forb (FG)	0.1	2
	Brassica spp.	*	Brassica	Brassicaceae		0.1	1
CinereaDense	*Cassinia sifton*		Sifton Bush	Asteraceae	Shrub (SG)	20	60
	Microlaena stipoides		Weeping Grass	Poaceae	Grass & grasslike (GG)	20	300
	Eucalyptus macrorhyncha		Red Stringybark	Myrtaceae	Tree (TG)	15	20
	Eucalyptus cinerea		Argyle Apple	Myrtaceae	Tree (TG)	10	15
	Lomandra filiformis		Wattle Matt-rush	Lomandraceae	Grass & grasslike (GG)	3	300
	Hypochaeris glabra	*	Smooth Catsear	Asteraceae		2	500
	Eucalyptus tereticornis		Forest Red Gum	Myrtaceae	Tree (TG)	2	3
	Vulpia muralis	*	A Fescue	Poaceae		1	50
	Aristida ramosa		Purple Wiregrass	Poaceae	Grass & grasslike (GG)	1	50
	Austrostipa mollis		Soft Speargrass	Poaceae	Grass & grasslike (GG)	0.5	20
	Gonocarpus tetragynus		Poverty Raspwort	Haloragaceae	Forb (FG)	0.5	200
	Rumex acetosella	*	Sheep Sorrel	Polygonaceae		0.2	100
	Panicum effusum		Hairy Panic	Poaceae	Grass & grasslike (GG)	0.2	30
	Lissanthe strigosa		Peach Heath	Ericaceae	Shrub (SG)	0.2	50
	Austrostipa scabra		Speargrass	Poaceae	Grass & grasslike (GG)	0.1	10
	Dactylis glomerata	*	Cocksfoot	Poaceae		0.1	1

Plot number	Scientific Name	Exotic (* = introduced species)	Common Name	Family	BAM Growth Form Group	Cover	Abundance
	Paronychia brasiliana	*	Chilean Whitlow Wort, Brazilian Whitlow	Caryophyllaceae		0.1	20
	Hypochaeris radicata	*	Catsear	Asteraceae		0.1	20
	Lepidium africanum	*	Common Peppercress	Brassicaceae		0.1	1
	Gamochaeta calviceps	*	Cudweed	Asteraceae		0.1	50
	Oxalis perennans		Grassland Wood-sorrel	Oxalidaceae	Forb (FG)	0.1	5
	Schoenus apogon		Fluke Bogrush	Cyperaceae	Grass & grasslike (GG)	0.1	10
	Gamochaeta purpurea	*	Purple Cudweed	Asteraceae		0.1	15
	Sonchus oleraceus	*	Common Sowthistle	Asteraceae		0.1	3
	Asperula conferta		Common Woodruff	Rubiaceae	Forb (FG)	0.1	30
	Conyza spp.	*		Asteraceae		0.1	5
	Lolium rigidum	*	Wimmera Ryegrass	Poaceae		0.1	5
	Cynodon dactylon		Common Couch	Poaceae	Grass & grasslike (GG)	0.1	10
	Plantago coronopus	*	Buck's-horn Plaintain	Plantaginaceae		0.1	2
	Cotula australis		Common Cotula	Asteraceae	Forb (FG)	0.1	10
	Juncus bufonius	*	Toad Rush	Juncaceae		0.1	1
	Juncus filicaulis		Thread Rush	Juncaceae	Grass & grasslike (GG)	0.1	30
	Lycium ferocissimum	*	African Boxthorn	Solanaceae		0.1	1

Plot number	Scientific Name	Exotic (* = introduced species)	Common Name	Family	BAM Growth Form Group	Cover	Abundance
	Aira elegantissima	*	Delicate Hairgrass	Poaceae		0.1	2
	Wahlenbergia communis		Tufted Bluebell	Campanulaceae	Forb (FG)	0.1	10
	Dillwynia spp.			Fabaceae (Faboideae)	Shrub (SG)	0.1	1
	Carex inversa		Knob Sedge	Cyperaceae	Grass & grasslike (GG)	0.1	20
	Eragrostis lacunaria		Purple Lovegrass	Poaceae	Grass & grasslike (GG)	0.1	5
	Paspalidium spp.			Poaceae	Grass & grasslike (GG)	0.1	1
	Themeda triandra		Kangaroo Grass	Poaceae	Grass & grasslike (GG)	0.1	3
	Chrysocephalum apiculatum		Common Everlasting	Asteraceae	Forb (FG)	0.1	1
	Cymbonotus lawsonianus		Bear's Ear	Asteraceae	Forb (FG)	0.1	1
	Euchiton sphaericus		Star Cudweed	Asteraceae	Forb (FG)	0.1	3
	Goodenia hederacea		Ivy Goodenia	Goodeniaceae	Forb (FG)	0.1	50
	Solenogyne spp.			Asteraceae	Forb (FG)	0.1	5
	Veronica plebeia		Trailing Speedwell	Plantaginaceae	Forb (FG)	0.1	2
	Wahlenbergia stricta		Tall Bluebell	Campanulaceae	Forb (FG)	0.1	1
	Cheilanthes sieberi		Rock Fern	Pteridaceae	Fern (EG)	0.1	2
STR 5	*Vulpia muralis*	*	A Fescue	Poaceae		15	1000
	Eucalyptus amplifolia		Cabbage Gum	Myrtaceae	Tree (TG)	15	7
	Digitaria diffusa		Open Summer-grass	Poaceae	Grass & grasslike (GG)	10	100

Plot number	Scientific Name	Exotic (* = introduced species)	Common Name	Family	BAM Growth Form Group	Cover	Abundance
	Rumex acetosella	*	Sheep Sorrel	Polygonaceae		5	500
	Panicum effusum		Hairy Panic	Poaceae	Grass & grasslike (GG)	5	300
	Hypochaeris glabra	*	Smooth Catsear	Asteraceae		2	1000
	Gamochaeta calviceps	*	Cudweed	Asteraceae		1	2000
	Bromus molliformis	*	Soft Brome	Poaceae		1	300
	Cynodon dactylon		Common Couch	Poaceae	Grass & grasslike (GG)	0.5	50
	Eragrostis brownii		Brown's Lovegrass	Poaceae	Grass & grasslike (GG)	0.5	50
	Austrostipa scabra		Speargrass	Poaceae	Grass & grasslike (GG)	0.2	20
	Crassula sieberiana		Australian Stonecrop	Crassulaceae	Forb (FG)	0.2	5000
	Cassinia sifton		Sifton Bush	Asteraceae	Shrub (SG)	0.1	15
	Paronychia brasiliana	*	Chilean Whitlow Wort, Brazilian Whitlow	Caryophyllaceae		0.1	5
	Lepidium africanum	*	Common Peppercress	Brassicaceae		0.1	3
	Oxalis perennans		Grassland Wood-sorrel	Oxalidaceae	Forb (FG)	0.1	1
	Gamochaeta purpurea	*	Purple Cudweed	Asteraceae		0.1	2
	Conyza spp.	*		Asteraceae		0.1	10
	Plantago coronopus	*	Buck's-horn Plaintain	Plantaginaceae		0.1	1
	Juncus bufonius	*	Toad Rush	Juncaceae		0.1	100
	Juncus filicaulis		Thread Rush	Juncaceae	Grass & grasslike	0.1	10

Plot number	Scientific Name	Exotic (* = introduced species)	Common Name	Family	BAM Growth Form Group	Cover	Abundance
					(GG)		
	Aira elegantissima	*	Delicate Hairgrass	Poaceae		0.1	20
	Euchiton sphaericus		Star Cudweed	Asteraceae	Forb (FG)	0.1	2
	Wahlenbergia stricta		Tall Bluebell	Campanulaceae	Forb (FG)	0.1	10
	Cheilanthes sieberi		Rock Fern	Pteridaceae	Fern (EG)	0.1	2
	Trifolium subterraneum	*	Subterranean Clover	Fabaceae (Faboideae)		0.1	20
	Holcus lanatus	*	Yorkshire Fog	Poaceae		0.1	2
	Medicago minima	*	Woolly Burr Medic	Fabaceae (Faboideae)		0.1	5
	Sporobolus africanus	*	Parramatta Grass	Poaceae		0.1	1
	Isolepis hookeriana		Grassy Club-sedge	Cyperaceae	Grass & grasslike (GG)	0.1	1
	Hypericum gramineum		Small St John's Wort	Clusiaceae	Forb (FG)	0.1	3
	Pseudognaphalium luteoalbum		Jersey Cudweed	Asteraceae	Forb (FG)	0.1	1
	Vittadinia spp.		Fuzzweed	Asteraceae	Forb (FG)	0.1	1
	Facelis retusa	*	Annual Trampweed	Asteraceae		0.1	50
	Juncus capitatus	*	Dwarf Rush	Juncaceae		0.1	500
CinereaDNG	*Eragrostis leptostachya*		Paddock Lovegrass	Poaceae	Grass & grasslike (GG)	45	1000
	Cassinia sifton		Sifton Bush	Asteraceae	Shrub (SG)	5	20
	Microlaena stipoides		Weeping Grass	Poaceae	Grass & grasslike (GG)	5	100

Plot number	Scientific Name	Exotic (* = introduced species)	Common Name	Family	BAM Growth Form Group	Cover	Abundance
	Austrostipa mollis		Soft Speargrass	Poaceae	Grass & grasslike (GG)	2	200
	Digitaria diffusa		Open Summer-grass	Poaceae	Grass & grasslike (GG)	1	50
	Sporobolus creber		Slender Rat's Tail Grass	Poaceae	Grass & grasslike (GG)	1	100
	Eragrostis parviflora		Weeping Lovegrass	Poaceae	Grass & grasslike (GG)	1	200
	Bromus molliformis	*	Soft Brome	Poaceae		0.5	200
	Euchiton sphaericus		Star Cudweed	Asteraceae	Forb (FG)	0.5	500
	Paspalum dilatatum	*	Paspalum	Poaceae		0.5	5
	Hypochaeris radicata	*	Catsear	Asteraceae		0.5	300
	Cyperus eragrostis	*	Umbrella Sedge	Cyperaceae		0.2	20
	Bothriochloa macra		Red Grass	Poaceae	Grass & grasslike (GG)	0.2	50
	Gamochaeta calviceps	*	Cudweed	Asteraceae		0.2	200
	Conyza bonariensis	*	Flaxleaf Fleabane	Asteraceae		0.2	300
	Vulpia muralis	*	A Fescue	Poaceae		0.1	100
	Schoenus apogon		Fluke Bogrush	Cyperaceae	Grass & grasslike (GG)	0.1	50
	Themeda triandra		Kangaroo Grass	Poaceae	Grass & grasslike (GG)	0.1	10
	Eleusine tristachya	*	Goose Grass	Poaceae		0.1	10
	Wahlenbergia gracilis		Sprawling Bluebell	Campanulaceae	Forb (FG)	0.1	100
	Chloris truncata		Windmill Grass	Poaceae	Grass & grasslike (GG)	0.1	10

Plot number	Scientific Name	Exotic (* = introduced species)	Common Name	Family	BAM Growth Form Group	Cover	Abundance
	Juncus subsecundus		Finger Rush	Juncaceae	Grass & grasslike (GG)	0.1	1
	Centaurium erythraea	*	Common Centaury	Gentianaceae		0.1	2
	Trifolium arvense	*	Haresfoot Clover	Fabaceae (Faboideae)		0.1	1

APPENDIX C

SCATTERED TREES

Easting	Northing	Species	Status	DBH (Diameter at Breast Height)	Hollows	Hollow size and height	Notes
767973	6154506	Eucalyptus amplifolia	Living	82	Non hollow-bearing		Scratches
767961	6154475	Eucalyptus amplifolia	Living	122	Non hollow-bearing		
766377	6154488	Eucalyptus melliodora	Stag	83	Hollow-bearing	15 cm 7m above ground	
766564	6154434	Eucalyptus melliodora	Living	117	Non hollow-bearing		
766662	6154309	Eucalyptus melliodora	Living	103	Non hollow-bearing		
766673	6154337	Eucalyptus melliodora	Living	105	Non hollow-bearing		
766728	6154411	Eucalyptus melliodora	Living	82	Non hollow-bearing		
766733	6154409	Eucalyptus amplifolia	Living	136	Non hollow-bearing		
766702	6154461	Eucalyptus amplifolia	Living	87	Non hollow-bearing		
765800	6154809	Eucalyptus melliodora	Stag	101	Hollow-bearing	7cm 6m above ground, 15cm 7 m above ground	
765852	6154783	Eucalyptus cinerea	Living	38	Non hollow-bearing		
765796	6155024	Eucalyptus amplifolia	Living	143	Hollow-bearing	5cm 5m above ground X 2	
765856	6154788	Eucalyptus cinerea	Living	30	Non hollow-bearing		
766376	6154600	Eucalyptus macrorhyncha	Stag	83	Hollow-bearing	7cm 8m above ground	
766337	6154626	Eucalyptus macrorhyncha	Living	56	Non hollow-bearing		
766347	6154561	Eucalyptus macrorhyncha	Living	73	Hollow-bearing	10cm 7m above ground	

APPENDIX D

BMS FAUNA SURVEY REPORT

Draft

Terrain Solar
Marulan Solar Farm

Baseline Fauna Survey Report

for

Premise

March 2022

Document History

Report	Version	Prepared By	Checked By	Submission Method	Date
Fauna	Issue 1	Andrew Lothian	Nicholas Tong	Email	17 Feb 2022
Fauna	Issue 2	Andrew Lothian	Nicholas Tong	Email	25 Feb 2022
Fauna	Issue 3	Andrew Lothian	Nicholas Tong	Email	1 March 2022
Fauna	Issue 4	Andrew Lothian	Nicholas Tong	Email	21 March 2022

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Figures, Plates and Tables

Executive Summary

Biodiversity Monitoring Services were commissioned by Premise to prepare a Baseline Fauna Survey Report, including a baseline fauna survey, for the proposed solar farm. The development footprint for the solar farm is approximately 375.5 ha.

Fauna field surveys were undertaken in December 2021-February 2022. The surveys included targeted surveys and habitat assessments for threatened fauna species listed under the NSW *Biodiversity Conservation Act, 2016* and the Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999* with potential to occur in the study area at the time of the survey. Survey techniques included diurnal bird survey, call playback, spotlighting, PIR cameras, Koala Spot Assessment Technique (SAT) surveys, ultrasonic bat detection, frog searches, evidence searches (e.g. for scats, tree scratches, nests and potential hollows) and habitat assessment. Due to access issues with wet ground and abundant grass growth, some survey techniques are incomplete and do not meet the survey requirements to suggest absence of species from site.

Mapping of the study area shows large areas of exotic grassland interspersed with patches of derived native grassland. Remnant native woodland patches occur along the southern boundary. Two-three creek systems cross site, the majority of which have been excluded from the direct footprint. Suitable habitat for several threatened species occurs, with resources such as paddock and hollow-bearing trees, logs, rock outcropping, various-sized water bodies (farm dams as well as flooded creeks) and flowering eucalypt feed trees present.

Eighty-one (81) species of vertebrate fauna were recorded during the 2021-2022 surveys, comprising 49 bird (plus one exotic), 16 mammal (plus 4 exotic), nine amphibian and two reptile. Based on the survey results, the following Species Credit Species remain relevant to the study area:

- Pink-tailed Legless Lizard (*Aprasia parapulchella*) (habitat present, surveys not conducted due to project timing);
- Striped Legless Lizard (*Delma impar*) (habitat present, surveys not conducted due to project timing);
- Glossy Black-Cockatoo (*Calyptorhynchus lathami*) (habitat present, surveys not conducted due to project timing);
- Barking Owl (*Ninox connivens*) (habitat present, surveys not yet conducted due to access);
- Powerful Owl (*Ninox strenua*) (habitat present, surveys not conducted due to project timing); and
- Masked Owl (*Tyto tenebricosa*) (habitat present, surveys not conducted due to project timing).

Introduction

1.1 BACKGROUND

Biodiversity Monitoring Services were commissioned by Premise to prepare a Baseline Fauna Survey Report, including a baseline fauna survey, for the proposed solar farm. The development footprint for the solar farm is approximately 375.5 ha.

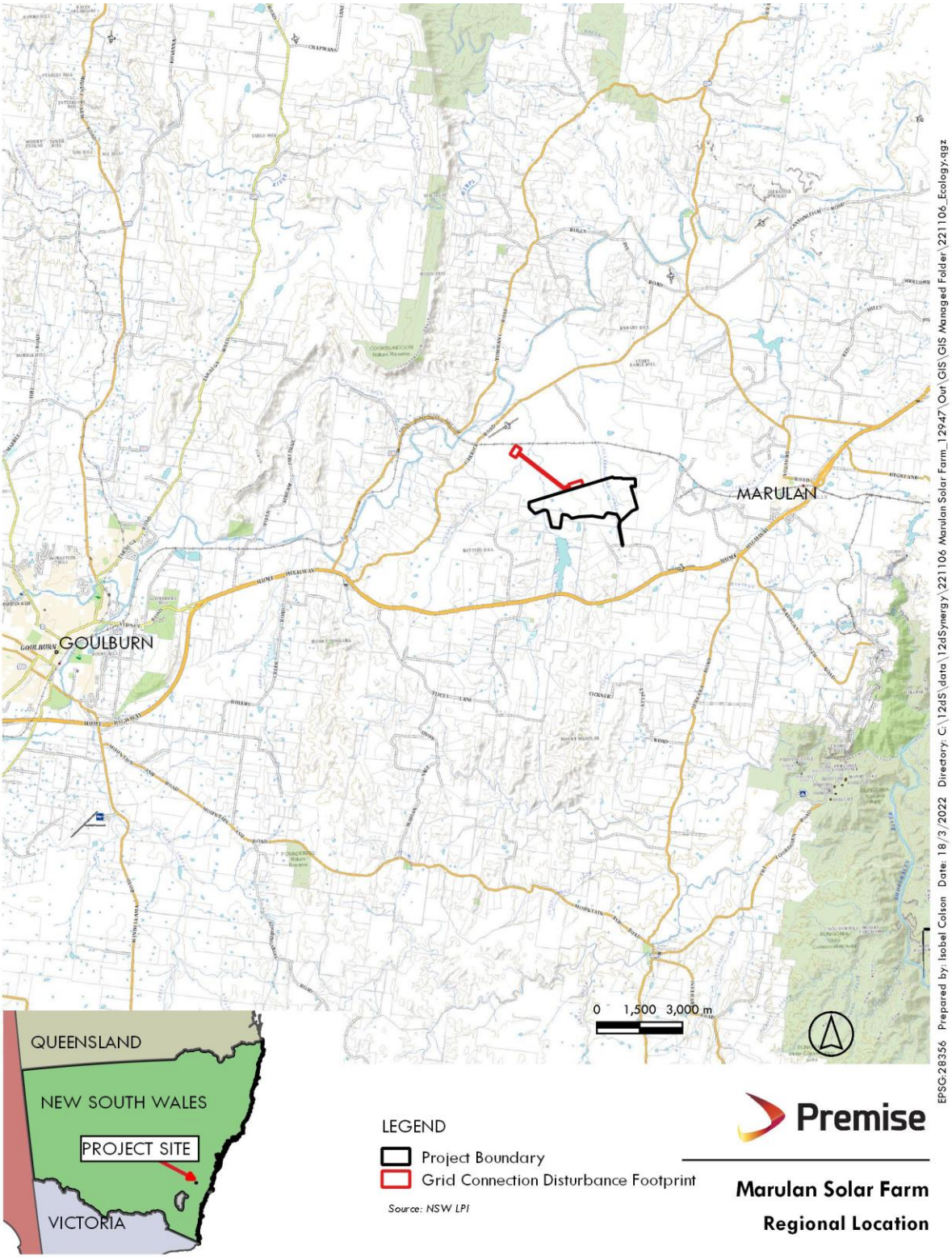

Figure 1-1: Regional Location

1.2 PURPOSE

Targeted surveys and habitat assessment were undertaken within the development footprint (the study area) (**Figure 1-2**), in addition to the areas immediately adjacent the footprint (the survey areas), collecting data on threatened fauna species and fauna habitat to inform this report.

Biodiversity Monitoring Services (BMS) has undertaken the following:

- conducted a desktop review of potential species and confirm which would require targeted surveys in accordance with the Biodiversity Assessment Method (BAM) (DPIE, 2020a);
- conducted field surveys within the study area for fauna species that can be surveyed in the timeframe given (by February 2022), in accordance with relevant State and Commonwealth guidelines (i.e. timing and duration of surveys, methods to locate species and methods to identify potential habitat);
- conducted targeted surveys for threatened fauna listed under the *Biodiversity Conservation Act, 2016* (BC Act) and the *Environment Protection and Biodiversity Conservation Act, 1999* (EPBC Act) that could potentially occur within the study area, in accordance with relevant State and Commonwealth guidelines;
- described habitat features for threatened fauna species that could potentially occur within the study area;
- mapped and described suitable habitat for threatened fauna species; and
- prepared a Baseline Fauna Survey Report documenting the survey methods and results.

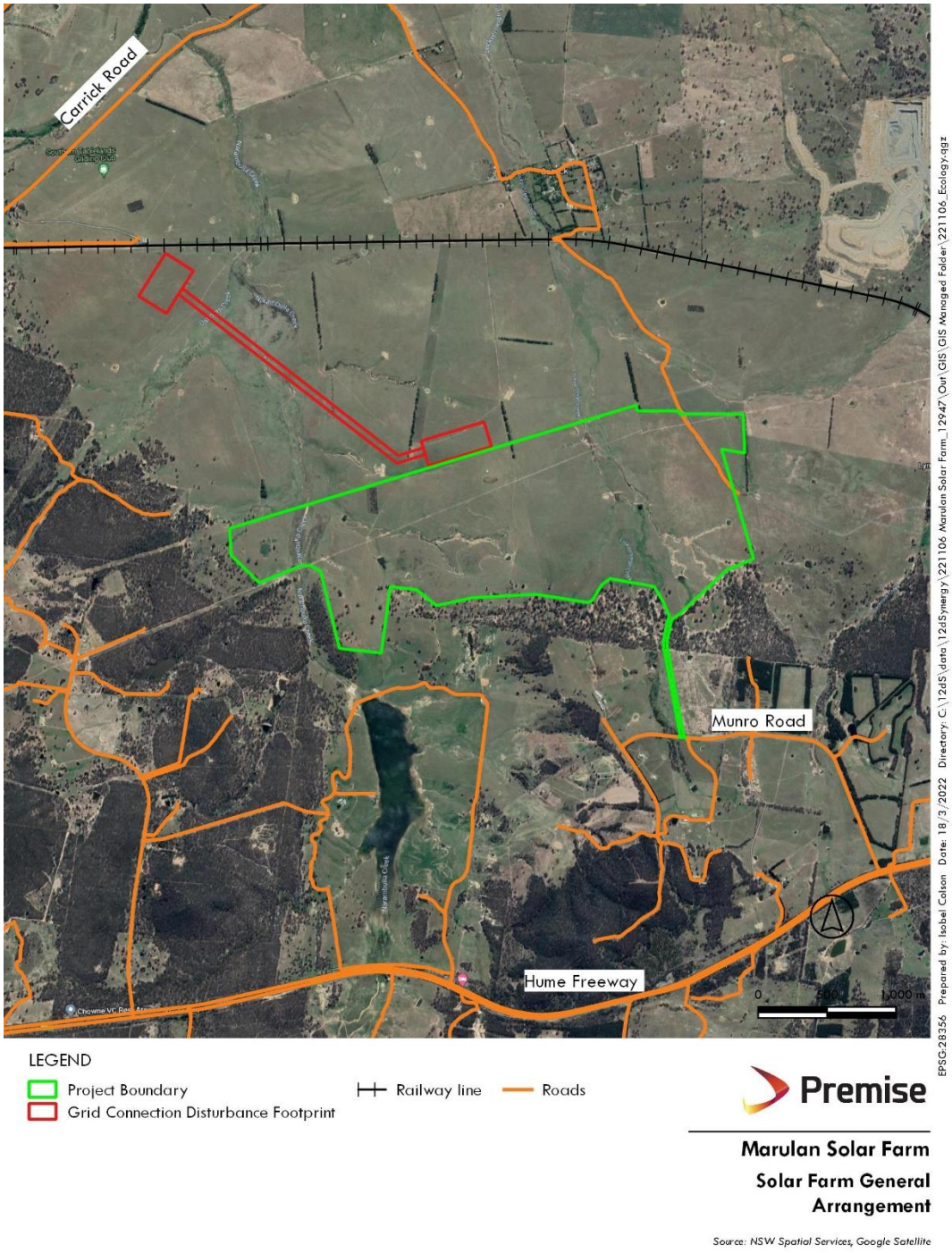

Figure 1-2: Proposed solar farm layout, including solar array footprint, access roads, substation footprint and electricity easement footprint

1.3 EXISTING ENVIRONMENT

In terms of the broader context, the study area sits amongst a landscape dominated by grazing land with scattered paddock trees, bordering on remnant patches of native forest.

Detailed floristic descriptions are provided in the Premise report. Initial mapping of the study area (**Figure 1-2**) shows large areas of exotic grassland. This zone contains smaller patches of native grassland, particularly around the banks of historical contour drains. Most trees are included in mapped PCT patches (of various condition levels), with only a few isolated paddock trees (**Figure 1-2**). Paddock tree species include *Eucalyptus amplifolia, E. tereticornis*, *E. melliodora*, *E. macrorhyncha* and *E. cinerea* trees (some living, some dead). These areas still retain habitat features that could be utilised by threatened fauna species.

A major creekline runs north through the western part of the study area, containing floodout swamp vegetation. Two other systems of eroded channels contain lower order creeklines (up to fourth order), and run through the site from south to north and east to west.

The majority of forest patches on site are best associated with PCT1330, with a small area of PCT351 in the southwest corner, and large areas of PCT1110 around the creeklines.

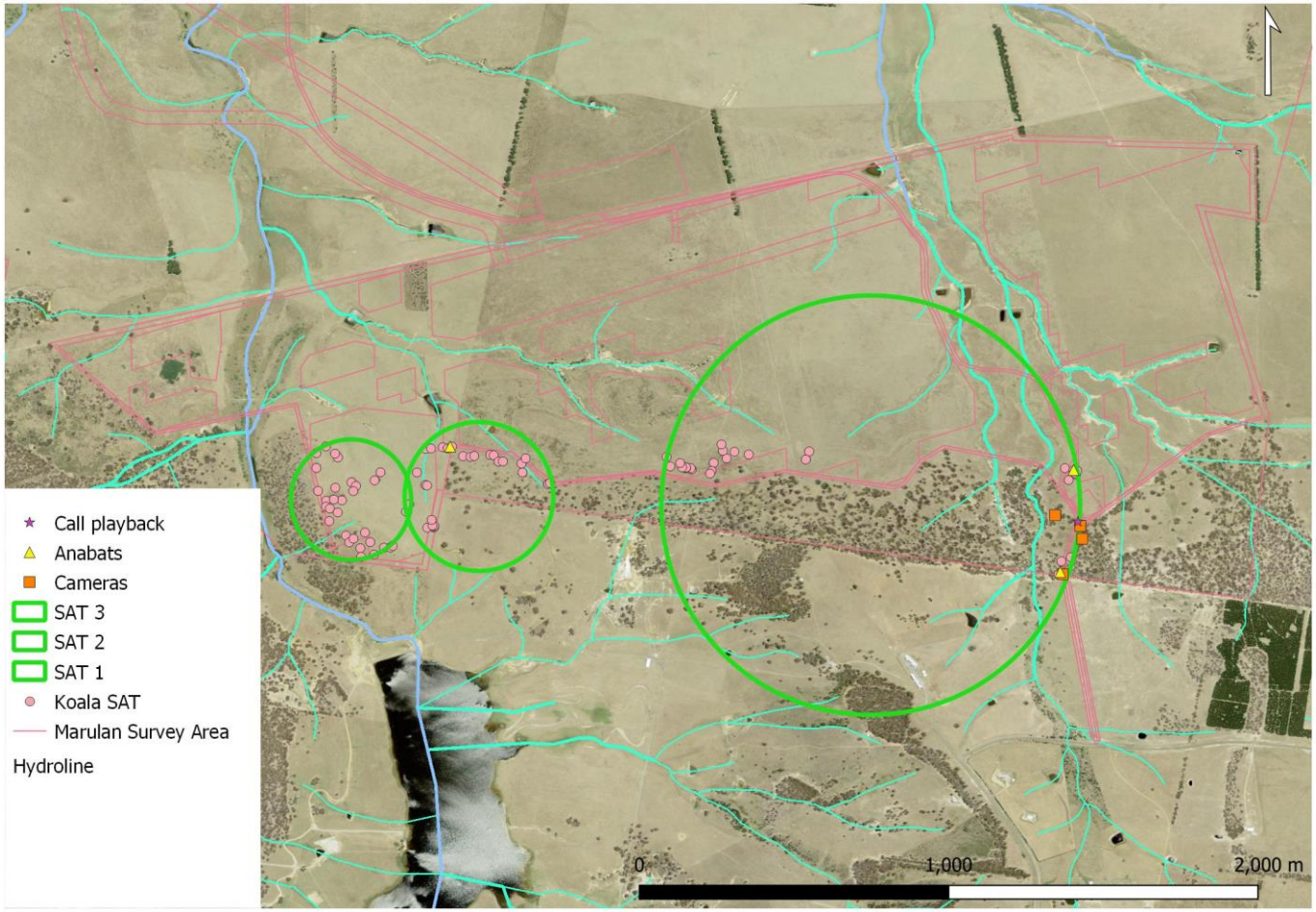

Figure 1-3: SAT, Camera and Call Playback Locations

Methods

A combination of desktop and database searches, habitat assessment and physical surveys were used to determine the potential presence of fauna in the study area.

2.1 DATABASE AND LITERATURE SEARCH

Threatened fauna previously recorded in the wider locality are summarised in **Table 2-1**.

Table 2-1: ***Threatened fauna previously recorded in the wider locality***

Scientific Name	Common Name	Conservation Status		Biodiversity Credit Class	BioNet Database[3]
		BC Act[1]	EPBC Act[2]		
Birds					
Hirundapus caudacutus	White-throated Needletail	-	V	Ecosystem	✓
Haliaeetus leucogaster	White-bellied Sea-Eagle	V	-	Species/Ecosystem	✓
Hieraaetus morphnoides	Little Eagle	V	-	Species/Ecosystem	✓
Lophoictinia isura	Square-tailed Kite	V	-	Species/Ecosystem	✓
Calyptorhynchus lathami	Glossy Black-Cockatoo	V	-	Species/Ecosystem	✓
Callocephalon fimbriatum	Gang-gang Cockatoo	V	-	Species/Ecosystem	✓
Glossopsitta pusilla	Little Lorikeet	V	-	Ecosystem	✓
Lathamus discolour	Swift Parrot	E	CE	Species/Ecosystem	✓
Pyrrholaemus sagittatus	Speckled Warbler	V	-	Ecosystem	✓
Melithreptus gularis gularis	Black-chinned Honeyeater	V	-	Ecosystem	✓
Daphoenositta chrysoptera	Varied Sittella	V	-	Ecosystem	✓
Artamus cyanopterus	Dusky Woodswallow	V	-	Ecosystem	✓
Melanodryas cucullate cucullata	Hooded Robin (south-eastern form)	V	-	Ecosystem	✓
Petroica boodang	Scarlet Robin	V	-	Ecosystem	✓
Petroica phoenicea	Flame Robin	V	-	Ecosystem	✓
Stagonopleura guttata	Diamond Firetail	V	-	Ecosystem	✓
Mammals					
Phascolarctos cinereus	Koala	V	E	Species/Ecosystem	✓
Petaurus norfolcensis	Squirrel Glider	V	-	Species	✓

Scientific Name	Common Name	Conservation Status		Biodiversity Credit Class	BioNet Database[3]
		BC Act[1]	EPBC Act[2]		
Petauroides volans	Greater Glider	-	V	Species	✓
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	Species/Ecosystem	✓
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V	-	Ecosystem	✓
Mormopterus norfolkensis	Eastern Coastal Free-tailed Bat	V	-	Ecosystem	✓
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	Species	✓
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V	-	Ecosystem	✓
Myotis macropus	Southern Myotis	V	-	Ecosystem	✓
Miniopterus orianae oceanensis	Large Bent-winged Bat	V	-	Species/Ecosystem	✓
Reptiles					
Delma impar	Striped Legless Lizard	V	V	Species	Known from around Goulburn

1 Conservation status under the BC Act (current as at February 2022). CE = Critically Endangered, E = Endangered, V = Vulnerable.

2 Conservation status under the EPBC Act (current as at February 2022). CE = Critically Endangered, E= Endangered, V = Vulnerable.

3 Office of the Environment and Heritage (2019b)

2.2 FIELD SURVEYS

2.2.1 SURVEY TIMING

The study area was visited between the 13th and 15th December 2021 to deploy cameras and conduct target bird surveys, spotlighting, call playback, Koala SAT survey and habitat assessment. The study area was visited again between the 10th and 14th January 2022 to check and rebait cameras, and for further target fauna survey. This second lot of surveys included aural-visual frog searches, diurnal bird survey and target microbat survey. A third visit was conducted on 10th February 2022 to collect cameras and conduct diurnal bird survey. This third visit coincided with a site inspection by DPE in relation to categorisation of Striped Legless Lizard habitat. A fourth visit was conducted between the 22nd and 24th February 2022 to complete spotlighting surveys for arboreal mammals in areas cameras could not be deployed due to lack of access across wet boggy ground, deep grass and access issues with neighbours. Some species could not be surveyed for due to project timing.

On all occasions, the study area was surveyed by Andrew Lothian using National Parks and Wildlife Service Scientific Licence No. SL101725 and Department of Primary Industry's Animal Research Authority No. CSB 16/559. Rachel Moore assisted with spotlighting in February.

2.2.2 SURVEY TECHNIQUES

The methodology follows that specified in the draft working guidelines produced by the Department of Environment and Conservation (DEC) (2004). Although these guidelines are in draft form and still subject to review, they provide an important direction on survey methodology, including suggested survey effort. A summary of the survey effort in each survey period is given in **Table 2-2** and methodologies for each fauna type are summarised in **Table 2-3**.

Areas of habitat for most target species are discretely located and if access was improved, surveys could have been completed over the entire potential habitat. Visibility was good as trees were either absent or scattered, but due to the large amount of rainfall over the spring-summer period, access to the treed habitat along the southern boundary was limited due to boggy ground preventing vehicular access for camera deployment. This, combined with frequent wet weather meant nocturnal surveys were completed via spotlighting in late February.

2.2.2.1 Habitat Assessment

To assess the suitability of the habitat in the study area for each of the potential target Species Credit Species, assessment of habitat attributes was conducted (**Table 2-5**). All surveys involved assessment of habitat characteristics that would make the impact footprint suitable for threatened species, particularly those that could not be surveyed for in the time constraints.

Notes were made on the following attributes:

- Presence of paddock trees (live or dead)
- Presence of existing nests
- Presence and size of hollows
- Presence of feed/prey species
- Presence of rocky streams
- Presence of fallen timber

- Proximity to dams/watercourses
- Proximity to clifflines, caves, rocky overhangs, culverts, mine shafts (considering OEH, 2018b).

For Regent Honeyeater (*Anthochaera phyrgia*) and Swift Parrot (*Lathamus discolor*), consultation of mapping in BAAS portal (15 February 2022) confirmed mapped important areas for the species were not present.

Table 2-2: Total fauna survey effort

Survey technique	No. surveys (Dec 2021)	No. surveys (Jan 2022)	No. surveys (Feb 2022)
Diurnal Bird Survey	3 days (while traversing site)	4 afternoons, 1 morning (while traversing site)	1 morning, 1 afternoon (while traversing site)
Call Playback	1	-	-
Hand Spotlighting	1	-	3
Vehicle Spotlighting Transects	-	-	-
Passive Infrared (PIR) Cameras	4	4	4
SAT survey	3	-	-
Anabat	1 detector night, 1 location	7 detector nights, 2 locations	-
Frog Searches	2 hours	3 hours/night over 4 nights 3 hours per afternoon (4 days) also spent searching for basking locations and assessing habitat	-

Table 2-3: Methods used to target threatened species

Scientific Name	Common Name	Conservation Status		Biodiversity Credit Class[3]	Targeted survey methodology
		BC Act[1]	EPBC Act[2]		
Amphibians					
Litoria aurea	Green and Golden Bell Frog	E	V	Species	Habitat assessment. Aural-visual survey. Basking site inspection.
Litoria booroolongensis	Booroolong Frog	E	E	Species	Habitat assessment. Not targeted due to lack of suitable breeding habitat.
Reptiles					
Aprasia parapulchella	Pink-tailed Legless Lizard	V	V	Species	Habitat assessment. Artificial habitat (tiles) not deployed due to project timing.
Delma impar	Striped Legless Lizard	V	V	Species	Habitat assessment. Artificial habitat (tiles) not deployed due to project timing.
Birds					
Lophoictinia isura	Square-tailed Kite	V	-	Species/Ecosystem	Bird survey, nest tree survey.
Haliaeetus leucogaster	White-bellied Sea-Eagle	V	-	Species/Ecosystem	Bird survey, nest tree survey.
Hieraaetus morphnoides	Little Eagle	V	-	Species/Ecosystem	Habitat assessment. Not targeted due to lack of suitable breeding habitat (no medium-large raptor nests observed).
Burhinus grallarius	Bush Stone-curlew	E	-	Species	Habitat assessment. Little-no fallen logs. Presence of foxes. Habitat degraded.
Calyptorhynchus lathami	Glossy Black-Cockatoo	V	E	Species/Ecosystem	Little-no foraging habitat present, breeding habitat constraint present, but not surveyed for due to project timing.
Callocephalon fimbriatum	Gang-gang Cockatoo	V	-	Species/Ecosystem	Bird survey, hollow-bearing tree survey.

Scientific Name	Common Name	Conservation Status		Biodiversity Credit Class[3]	Targeted survey methodology
		BC Act[1]	EPBC Act[2]		
Anthochaera phrygia	Regent Honeyeater	CE	CE	Species/Ecosystem	Important area mapping consultation. Study area not in important area. Potential feed species present (E. bridgesiana, E. blakelyi/tereticornis, E. melliodora, Cassinia spp. and Acacia spp.; Higgins et. al. 2001), but no nearby records in Bionet.
Lathamus discolor	Swift Parrot	E	CE	Species/Ecosystem	Important area mapping consultation. Study area not in important area.
Ninox connivens	Barking Owl	V	-	Species/Ecosystem	Survey not finished, and not over whole area due to access issue. Only 1 night spotlight and call playback along southern access road.
Ninox strenua	Powerful Owl	V	-	Species/Ecosystem	Habitat exists (hollows), not targeted due to project timing.
Tyto novaehollandiae	Masked Owl	V	-	Species/Ecosystem	Habitat exists (hollows), not targeted due to project timing.
Mammals					
Phascolarctos cinereus	Koala	V	E	Species/Ecosystem	SAT survey, spotlight, scat/scratching search, PIR camera, habitat assessment/feed tree identification.
Petauroides volans	Greater Glider	-	V	Species	Spotlight.
Petaurus norfolcensis	Squirrel Glider	V	-	Species	Spotlight, PIR camera.

Scientific Name	Common Name	Conservation Status		Biodiversity Credit Class[3]	Targeted survey methodology
		BC Act[1]	EPBC Act[2]		
Cercartetus nanus	Eastern Pygmy-possum	V	-	Species	Habitat assessment. Not targeted due to lack of suitably conditioned habitat. Lack of coarse woody debris and presence of foxes.
Petrogale penicillata	Brush-tailed Rock Wallaby	E	V	Species	Habitat assessment. Not targeted due to lack of suitable rock habitat, and lack of habitat connectivity with known populations.
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	Species/Ecosystem	Habitat assessment. No breeding camps located.
Miniopterus orianae oceanensis	Large Bent-winged Bat	V	-	Species/Ecosystem	Habitat assessment. No cave/adit/cliff habitat within 2km.
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	Species	Habitat assessment. No cave/adit/cliff habitat within 2km.
Myotis macropus	Southern Myotis	V	-	Species	Habitat assessment. Acoustic detection at suitable locations.

Note: Species highlighted blue are those surveyed by Biodiversity Monitoring Services. Those highlighted orange only have partially completed survey effort.

[1] Conservation status under the BC Act (current as at February 2022). E = Endangered, V = Vulnerable.

[2] Conservation status under the EPBC Act (current as at February 2022). E= Endangered, V = Vulnerable.

[3] Biodiversity credit class under the *Threatened Biodiversity Data Collection* (DPIE, 2021a) (current as at January 2022).

Bird Surveys

DEC (2004) recommends a total of three 60-minute surveys to sample approximately 90 percent (%) of the species present in an area. As areas were being visited for various different surveys being conducted, at least three birds surveys were conducted across three summer visits (nine days). Bird surveys and habitat assessment were conducted whilst traversing the whole site, rather than at discrete locations, with the focus being treed and creekline areas (**Figure 1-3**). A mix of morning and afternoon survey periods were used to account for temporal changes in species' use of the study area. These surveys aimed to pick up any of the threatened species associated with the Plant Community Types (PCTs) in the Interim Biogeographic Regionalisation for Australia subregions (**Table 2-4**).

The only diurnal bird species that could be surveyed in the summer inspections were the Square-tailed Kite (*Lophoictinia isura*), White-bellied Sea Eagle (*Haliaeetus leucogaster*) and Gang-gang Cockatoo (*Callocephalon fimbriatum*). Little Eagle (*Hieraaetus morphnoides*), Glossy Black-Cockatoo (*Calyptorhynchus lathami*) and three owl species cannot be surveyed for until later in the year (beyond project timing). Barking Owl (*Ninox connivens*) could have been surveyed for in December, but nocturnal access to large areas of site was not possible. Habitat assessment focused on characteristics of the habitat that would be suitable for the species concerned (raptor nests, hollow-bearing trees and Allocasuarina/Casuarina feed species).

Areas of fallen timber were searched during daylight hours in an attempt to flush Bush Stone-curlew (*Burhinus grallarius*) that could be resting among the logs, but little-no fallen log habitat existed in the survey footprint, only in the timbered areas adjacent the footprint.

PIR Camera Surveys

Cameras can be used to survey for arboreal mammals such as Squirrel Gliders (*Petaurus norfolcensis*) and Koala (*Phascolarctos cinereus*), with a lower likelihood of picking up Greater Glider (*Petauroides volans*) and Eastern Pygmy-possum (*Cercartetus nanus*). Baited PIR cameras are set over head height, facing a branch or tree trunk where a honey-based bait has been placed. Cameras must remain in place for a minimum of four weeks with cameras checked and baits replaced after two weeks. Access to site around wet weather meant cameras were in place for four weeks before being rebaited, and another four weeks in the second bout. For smaller sites, a minimum of four cameras are to be placed in the first hectare of habitat, then an additional two cameras for every hectare of potential habitat thereafter. An attempt

must be made to space cameras evenly across the site. However, where potential habitat is disconnected by gaps of 50 metres (m) or more, each habitat patch should have a minimum of four cameras for the first hectare, and two cameras for every hectare thereafter. Malfunctioning cameras must be replaced and additional cameras and time must be invested to address the lost survey effort. Where sites are over 10 hectares (ha), the Department of Planning and Environment (DPE) are to be contacted for a modified camera survey approach. Due to a lack of vehicle access to large parts of the site (particularly the treed areas along the southern boundary) BMS only deployed four cameras along the proposed southern access road in December 2021. This means camera survey effort could only be considered complete in this region, but not in other treed parts of the study area. Camera survey effort is supplemented with spotlighting along access road.

2.2.2.2 Koala Spot Assessment Technique (SAT) Survey

Appendix C of the *Koala Habitat Protection Guideline: Implementing State Environmental Planning Policy (Koala Habitat Protection) 2019* (the Koala Habitat Protection Guideline) (DPIE, 2020c) stipulates survey requirements for determining and categorising Koala habitat and use. Though due to be superseded in 2022 by BAM survey guidelines (still not released), these guidelines remain best practice at time of survey. Koala presence must be determined through surveys of the development footprint by either:

1. scat SAT survey (Phillips and Callaghan, 2011), OR
2. use of detection dogs,

AND

1. spotlighting, OR
2. call playback, OR
3. passive acoustic recording.

Surveys must not be conducted within three days of heavy rainfall, or on wet or windy nights. Koala presence was assessed via a combination of SAT survey and spotlighting. This combination suits the nature of the site, where Koalas would likely be at low density and the habitat is open and relatively flat. A total of three SAT surveys were conducted across the main treed areas of the study area (**Figure 1-3; Figure 2-1**). Spotlighting transects (at least 200 m long) were walked along the southern boundary of the site (where trees are to be disturbed). Walking spotlight transects were repeated over two nights. To date, only one spotlighting transect has been conducted along the treed portion of the southern access road on one night in December 2021.

Due to the large spacing between areas of native forest and paddock trees in the landscape surveyed, the linear arrangement of the treed portions of the study area, and the requirement to assess 30 trees per SAT plot, the radial area searched is large and sometimes disjunct. Also, trees were chosen at random as per Woosnam-Merchez *et al.,* 2012, rather than the non-random method used in Phillips and Callaghan, 2011.

2.2.2.3 Call Playback

Nocturnal birds and mammals were surveyed for by call playback over one night in December 2021. Calls of Squirrel Glider (*Petaurus norfolcensis*), Barking Owl (*Ninox connivens*) and Bush Stone-curlew (*Burhinus grallarius*) were played from a megaphone where the southern access road meets the project footprint (**Figure 1-3**). At this location, an initial listening period of

10 minutes was undertaken, followed by a quick spotlight of the immediate area. Each call was played for a period of 5 minutes, followed by a 10-minute listening period (except Bush Stone-curlew which used a 30-second/5-minute play/listen cycle). Surveys were conducted within two hours of sunset.

Further survey effort is required to complete the access road area, and other treed portions of the study area. These were not conducted due to nocturnal access issues.

2.2.2.4 Spotlighting

Nocturnal birds and mammals were surveyed for by spotlighting over one night (1.75 person hour) in December 2021, after the completion of call playbacks. This involved traversing the southern access road (**Figure 1-3**) with a hand-held 30-Watt (W) spotlight, searching all trees within 50 m of the proposed road. Each walked transect covered at least 200 m (**Table 2-2**). Another three nights spotlighting were conducted in February 2022 (6 person hours per night). This consisted of two nights along treed portions of the southern boundary on the western half of site, and one night around southern access road and eastern side of site. Vehicle spotlighting was not conducted as the paddocks were too wet and boggy to drive across, and the grass was too high to allow headlights to work. Survey effort is summarised in **Table 2-2**.

Table 2-4: BioNet Report – South Eastern Highlands – fauna Species Credit Species, filtered for PCT 351/1110/1330

Scientific Name	Common Name	Conservation Status		Biodiversity Credit Class[3]	Survey Months for Each Species											
		BC Act[1]	EPBC Act[2]		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Amphibians																
Litoria aurea	Green and Golden Bell Frog	E	V	Species	Yes	Yes	Yes	-	-	-	-	-	-	-	Yes	Yes
Litoria booroolongensis	Booroolong Frog	E	E	Species	-	-	-	-	-	-	-	-	-	Yes	Yes	Yes
Reptiles																
Aprasia parapulchella	Pink-tailed Legless Lizard	V	V	Species	-	-	-	-	-	-	-	-	Yes	Yes	Yes	-
Delma impar	Striped Legless Lizard	V	V	Species	-	-	-	-	-	-	-	-	Yes	Yes	Yes	Yes
Birds																
Lophoictinia isura	Square-tailed Kite	V	-	Species/Ecosystem	Yes	-	-	-	-	-	-	-	Yes	Yes	Yes	Yes
Haliaeetus leucogaster	White-bellied Sea-Eagle	V	-	Species/Ecosystem	-	-	-	-	-	-	Yes	Yes	Yes	Yes	Yes	Yes
Hieraaetus morphnoides	Little Eagle	V	-	Species/Ecosystem	-	-	-	-	-	-	-	Yes	Yes	Yes	-	-
Burhinus grallarius	Bush Stone-curlew	E	-	Species	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Calyptorhynchus lathami	Glossy Black-Cockatoo	V	E	Species/Ecosystem	-	-	-	Yes	Yes	Yes	Yes	Yes	-	-	-	-

Scientific Name	Common Name	Conservation Status		Biodiversity Credit Class[3]	Survey Months for Each Species											
		BC Act[1]	EPBC Act[2]		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Callocephalon fimbriatum	Gang-gang Cockatoo	V	-	Species/Ecosystem	Yes	-	-	-	-	-	-	-	-	Yes	Yes	Yes
Anthochaera phrygia	Regent Honeyeater	CE	CE	Species/Ecosystem	-	-	-	-	-	-	-	-	-	-	-	-
Lathamus discolor	Swift Parrot	E	CE	Species/Ecosystem	-	-	-	-	-	-	-	-	-	-	-	-
Ninox connivens	Barking Owl	V	-	Species/Ecosystem	-	-	-	-	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Ninox strenua	Powerful Owl	V	-	Species/Ecosystem	-	-	-	-	Yes	Yes	Yes	Yes	-	-	-	-
Tyto novaehollandiae	Masked Owl	V	-	Species/Ecosystem	-	-	-	-	Yes	Yes	Yes	Yes	-	-	-	-
Mammals																
Phascolarctos cinereus	Koala	V	E	Species/Ecosystem	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Petauroides volans	Greater Glider	-	V	Species	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Petaurus norfolcensis	Squirrel Glider	V	-	Species	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cercartetus nanus	Eastern Pygmy-possum	V	-	Species	Yes	Yes	Yes	-	-	-	-	-	-	Yes	Yes	Yes
Petrogale penicillata	Brush-tailed Rock Wallaby	E	V	Species	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Scientific Name	Common Name	Conservation Status		Biodiversity Credit Class[3]	Survey Months for Each Species											
		BC Act[1]	EPBC Act[2]		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	Species/Ecosystem	-	-	-	-	-	-	-	-	-	Yes	Yes	Yes
Miniopterus orianae oceanensis	Large Bent-winged Bat	V	-	Species/Ecosystem	Yes	Yes	-	-	-	-	-	-	-	-	-	Yes
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	Species	Yes	-	-	-	-	-	-	-	-	-	Yes	Yes
Myotis macropus	Southern Myotis	V	-	Species	Yes	Yes	Yes	-	-	-	-	-	-	Yes	Yes	Yes

Note: Species highlighted are those surveyed by Biodiversity Monitoring Services.

1 Conservation status under the BC Act (current as at February 2022). CE = Critically Endangered, E = Endangered, V = Vulnerable.

2 Conservation status under the EPBC Act (current as at February 2022). CE = Critically Endangered, E= Endangered, V = Vulnerable.

3 Biodiversity credit class under the *Threatened Biodiversity Data Collection* (DPIE, 2021a) (current as at January 2022).

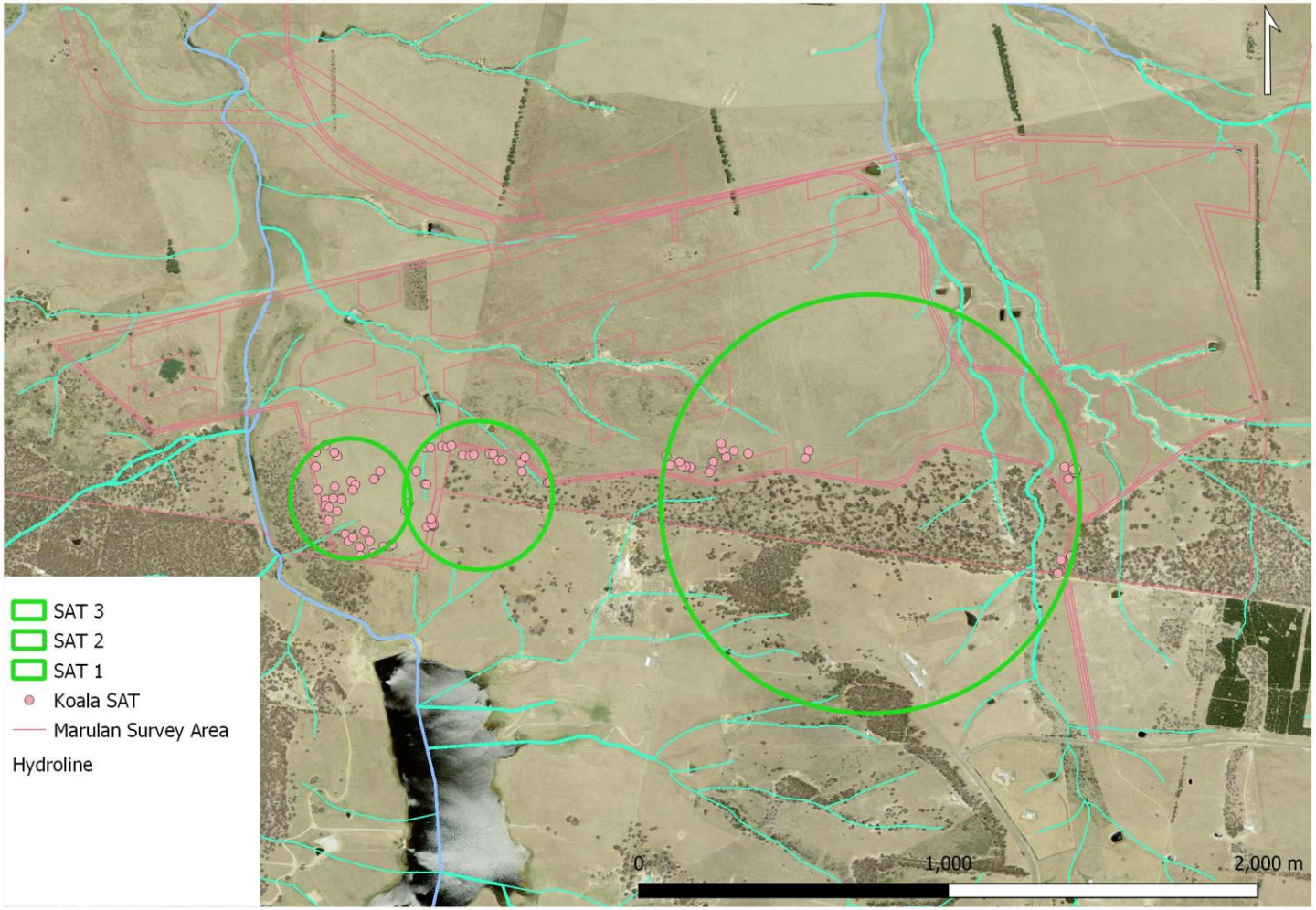

Figure 2-1: Koala SAT plots

Table 2-5: Survey of threatened fauna habitat constraints

Common Name	Conservation Status		Biodiversity Credit Class[3]	Habitat Constraints identified in the *Threatened Biodiversity Data Collection* (OEH, 2019a)	Field Assessment of Habitat Constraints
	BC Act[1]	EPBC Act[2]			
Green and Golden Bell Frog	E	V	Species	*Within 1km of semi-permanent/ephemeral wet areas, swamps or waterbodies.*	Ephemeral creeklines, swamps and farm dams with emergent vegetation present in or within 1km of study area.
Booroolong Frog	E	E	Species	*None*	N/A, but no rocky bottom streams present on site which is preferred by species.
Pink-tailed Legless Lizard	V	V	Species	*Rocky areas or within 50 m of rocky areas.*	Visual observation of rocky areas present in the study area.
Striped Legless Lizard	V	V	Species	*None*	N/A but potential habitat and local records. Site visit by DPE confirm some marginal habitat, but much of study area may be considered degraded.
Square-tailed Kite	V	-	Species/Ecosystem	*Breeding constraint: Other (Nest trees).*	Survey for nest trees that could provide breeding habitat.
White-bellied Sea-Eagle	V	-	Species/Ecosystem	*Breeding constraint: Other (Living or dead mature trees within suitable vegetation within 1 km of a rivers, lakes, large dams or creeks, wetlands and coastlines).*	Survey for living or dead mature trees that could provide breeding habitat within 1 km of large waterbodies and major watercourses.
Little Eagle	V	-	Species/Ecosystem	*Breeding constraint: Other (Nest trees – live (occasionally dead) large old trees within vegetation).*	Survey for live and dead nest trees and large trees with vegetation that could provide breeding habitat.
Bush Stone-curlew	E	-	Species	*Fallen/standing dead timber including logs.*	Fallen/standing dead timber, including logs, present adjacent study area but not within.
Glossy Black-Cockatoo	V	-	Species/Ecosystem	*Breeding constraint: Hollow-bearing trees (Living or dead tree with hollows greater than 15 cm diameter and greater than 5 m above ground.* *Foraging constraint: Other (Presence of Allocasuarina and Casuarina species)*	Eucalypt trees with hollows greater than 15 cm diameter, more than 5m above ground, present that could provide breeding habitat. Survey for Allocasuarina and Casuarina species that could provide foraging habitat – little-none present.

Common Name	Conservation Status		Biodiversity Credit Class[3]	Habitat Constraints identified in the *Threatened Biodiversity Data Collection* (OEH, 2019a)	Field Assessment of Habitat Constraints
	BC Act[1]	EPBC Act[2]			
Gang-gang Cockatoo	V	-	Species/Ecosystem	*Breeding constraint: Hollow-bearing trees (Eucalypt tree species with hollows greater than 9 cm diameter).*	Survey for Eucalypt trees with hollows greater than 9 cm diameter, that could provide breeding habitat.
Regent Honeyeater	CE	CE	Species/Ecosystem	*Breeding constraint: Other (As per mapped important areas).*	OEH important area mapping – not present.
Swift Parrot	E	CE	Species/Ecosystem	*Breeding constraint: Other (As per mapped important areas).*	OEH important area mapping – not present.
Barking Owl	V	-	Species/Ecosystem	*Breeding constraint: Hollow-bearing tree (Living or dead trees with hollows greater than 20 cm diameter and greater than 4m above the ground).*	Survey for living and dead hollow-bearing trees (greater than 20 cm diameter and greater than 4 m above the ground).
Powerful Owl	V	-	Species/Ecosystem	*Breeding constraint: Hollow-bearing tree (Living or dead trees with hollow greater than 20cm diameter).*	Survey for living and dead hollow-bearing trees (greater than 20 cm diameter).
Masked Owl	V	-	Species/Ecosystem	*Breeding constraint: Hollow-bearing tree (Living or dead trees with hollows greater than 20 cm diameter).*	Survey for living and dead hollow-bearing trees (greater than 20 cm diameter).
Koala	V	E	Species/Ecosystem	*Breeding constraint: Other (Areas identified via survey as important habitat (see comments).*	Important habitat defined by density of Koalas and quality of habitat determined by on site survey. Survey for paddock trees that could provide breeding habitat. Survey for scats and scratches on trees. Combine SAT survey with spotlighting.
Greater Glider	-	V	Species	*Hollow-bearing trees.*	Survey for all trees with hollows.
Squirrel Glider	V	-	Species	*None*	N/A
Eastern Pygmy-possum	V	-	Species	*None*	N/A
Brush-tailed Rock Wallaby	E	V	Species	*Land within 1km of rocky escarpments, gorges, steep slopes, boulder piles, rock outcrops or clifflines*	Survey for rocky escarpments, gorges, steep slopes, boulder piles, rock outcrops or clifflines within 1km of study area.

Common Name	Conservation Status		Biodiversity Credit Class[3]	Habitat Constraints identified in the *Threatened Biodiversity Data Collection* (OEH, 2019a)	Field Assessment of Habitat Constraints
	BC Act[1]	EPBC Act[2]			
Grey-headed Flying-fox	V	V	Species/Ecosystem	*Breeding constraint: Other (Breeding camps).*	Survey for breeding camps.
Large Bent-winged Bat	V	-	Species/Ecosystem	*Breeding constraint: Caves (Cave, tunnel, mine, culvert or other structure known or suspected to be used for breeding).*	Survey for caves that could provide breeding habitat.
Large-eared Pied Bat	V	V	Species	*Cliffs, or within 2km of rocky areas containing caves, overhangs, escarpments, outcrops or crevices, or within 2km of old mines or tunnels.*	Survey for cliffs or rocky areas containing caves, overhangs, escarpments, outcrops or crevices, or old mines and tunnels within 2km of study area.
Southern Myotis	V	-	Species	*Hollow-bearing trees within 200 m of riparian zone or water body >3 m diameter. Other (bridges, caves or artificial structures) within 200 m of riparian zone or water body >3 m diameter.*	Survey for hollow bearing trees and roost structures within 200m of riparian zone or water bodies >3m diameter.

Note: Species highlighted are those surveyed by Biodiversity Monitoring Services.

1 Conservation status under the BC Act (current as at February 2022). CE = Critically Endangered, E = Endangered, V = Vulnerable.

2 Conservation status under the EPBC Act (current as at February 2022). CE = Critically Endangered, E= Endangered, V = Vulnerable.

3 Biodiversity credit class under the *Threatened Biodiversity Data Collection* (DPIE, 2021a) (current as at January 2022).

2.2.2.5 Searches

Whilst conducting habitat assessment of the study area, additional signs of animal use were noted. This involved searches for scats and characteristic markings on tree trunks, feed species, raptor nests/perches, owl pellets and potential hollows.

2.2.2.6 Reptile Searches

To address the legless lizard species', grids of 50 tiles (spaced at 5-10 m) would need to be distributed around site in accordance with Commonwealth guidelines for Striped Legless Lizard (DSEWPC, 2011; DoE, 2021). As tiles must be deployed in June, the species could not be surveyed for in the desired project timeframe. Habitat assessment has been relied upon in an attempt to demonstrate avoid and minimise impact on the species'.

2.2.2.7 Frog Searches

Areas of suitable habitat were searched via aural-visual search. Suitable habitat for Green and Golden Bell Frog (*Litoria aurea*) was defined as waterbodies containing emergent vegetation, ephemeral creeks, swampy areas and flooded paddocks/contour channels. Fifteen farm dams exist within or near the development footprint, most containing emergent vegetation. Four of these are excluded from the development footprint. Due to the paucity of local records, a reduced survey effort was used to cover the large amount of potential habitat on or within 1 km of the development footprint. Suitable habitat was searched in late afternoon for potential basking sites, and to locate the best areas of habitat. Aural-visual surveys were conducted over four nights in January, within 4 hours of sunset. Waterbodies on the eastern half of the footprint were searched on nights 1 and 3, while those on the western half were searched on nights 2 and 4. Large amounts of rain had been received in the lead up to the surveys (**Table 3-1**), and some nights were sampled immediately after thunderstorms, with conditions humid and warm-mild. Frog activity and calling were high over all nights. Booroolong Frog (*Litoria booroolongensis*) prefer rocky bottom streams, which are absent from site. Though not targeted as the habitat would be considered wrong, the were by default surveyed for whilst looking for Green and Golden Bell Frog.

2.2.2.8 Bat Surveys

Areas of suitable Large-eared Pied Bat (*Chalinolobus dwyeri*) and Large Bent-winged Bat (*Miniopterus orianae oceanensis*) constraint habitat (cliffs, rocky outcrops, mine adits etc.) were searched for on site and via desktop study of aerial imagery. No suitable habitat was found in or near the study area, so no survey for these species would be required.

Southern Myotis were surveyed for via ultrasonic detection of water bodies with pools longer than 3 m with associated native forest vegetation and hollow-bearing trees within 200 m. This was restricted to two farm dams near the southern boundary of the project area. Overall, eight detector nights were conducted over three locations in December 2021 and January 2022.

2.2.3 TARGETED SURVEYS

Habitat assessment was conducted for all potential Ecosystem and Species Credit Species. After ruling out several species by desktop assessment, having seen the site in December, assessment focused on mapping habitat constraints for remaining species. Habitat assessment ruled out survey requirement for Booroolong Frog, Little Eagle, Bush Stone-curlew, Eastern Pygmy-possum, Brush-tailed Rock-wallaby, Grey-headed Flying-fox, Large Bent-winged Bat and Large-eared Pied Bat.

Access and project timing constraints mean target surveys have been completed for some species over the entire study area, while others have only been partially completed. Green and Golden Bell Frog, Square-tailed Kite, White-bellied Sea Eagle, Gang-Gang Cockatoo, Koala, Greater Glider, Squirrel Glider and Southern Myotis have been completed for the entire site. Barking Owl has only been partially completed in the vicinity of the southern access road only, but would require another night there, and two nights spotlighting and call playback over other treed parts of the study area.

Pink-tailed and Striped Legless Lizard, Glossy Black-Cockatoo, Powerful Owl, Masked Owl have had no surveys conducted and would need survey later in the year to avoid assumed credit liabilities, and likely modification of the project footprint to demonstrate avoid and minimise of impacts on threatened species.

2.2.4 WEATHER DURING THE TRAPPING SURVEY

Data from weather station at Goulburn Airport, NSW (Australian Bureau of Meteorology 2022) is given in **Table 3-1**.

Table 2-6: Weather records from Goulburn during 2021-2022 surveys

Date	Minimum temperature (°C)	Maximum temperature (°C)	Rainfall (mm)
09/12/2021	11.3	21.0	7.8
10/12/2021	9.9	13.2	37.0
11/12/2021	6.4	19.6	33.6
12/12/2021	4.8	20.9	0.2
13/12/2021	5.8	26.3	0
14/12/2021	6.3	27.8	0
15/12/2021	8.3	31.1	0
07/01/2022	16.1	25.2	30.6
08/01/2022	14.8	28.2	61.4
09/01/2022	16.0	23.5	0
10/01/2022	17.3	30.9	0.2
11/01/2022	18.9	25.6	0
12/01/2022	16.5	22.6	0
13/01/2022	15.0	24.7	0.2
14/01/2022	16.3	27.1	0.4
08/02/2022	7.9	24.0	0.4
09/02/2022	7.3	27.7	0
10/02/2022	9.2	30.4	0
20/02/2022	8.4	29.0	0
21/02/2022	15.9	28.8	0
22/02/2022	14.4	18.6	0
23/02/2022	14.5	24.8	1.2
24/02/2022	16.9	26.6	3.0

Maximum temperatures were about 2°C below long term average in December and January. Minimum temperatures were equal to the long-term average for December, but January minimums were 2°C above long term average. Rainfall in December was twice the long term average, while January rainfall was over three times the long term average. Though survey work was timed to avoid wet days (as per Koala survey guidelines), some surveys needed to be conducted soon after large rainfall events (frogs). The large amount of rain led to excessive amounts of exotic grass growth, and saturating of paddocks, meaning our ability to get survey equipment to all of the study area was hindered. The large grass growth had little impact on Koala SAT surveys, as grass was generally sparse around the base of large trees in paddocks,

or they were situated in areas of lower native ground cover along the southern boundary. Though overnight conditions were still mild in January, the previous wet weather had frogs calling in abundance. Some rain was experienced during spotlighting in late February, but both eastern (southern access) and western (southern boundary-southwest paddock) had one clear night spotlighting. Rain as not so heavy as to prevent spotlighting, but could have impacted animal activity.

Results

3.1 FAUNA HABITAT

General habitat features in the study area that apply to a number of the potential credit species include:

- Live paddock trees with up to approximately 150 cm DBH
- Dead paddock trees (stags)
- Flowering eucalypts (*Eucalyptus albens*, *Eucalyptus melliodora* [Yellow Box]) and *E. blakelyi*, but few flowering shrubs
- Koala use tree species (*Eucalyptus amplifolia/tereticornis/blakelyi, E. melliodora, E. bridgesiana, E. pauciflora* and *E. macrorhyncha* are all considered important species in the Central and Southern Tablelands Koala Management Area under Appendix A of the Koala Habitat Protection Guideline [DPIE, 2020c]); *Eucalyptus tereticornis* is listed as a feed tree species under Schedule 2 of the Koala Habitat Protection 2020 SEPP which applies to RU1, RU2 and RU3 zoned lands in Goulburn Mulwaree LGA.
- Trees with hollows ranging from 5 cm – 30 cm in diameter, greater than 4 m above the ground
- Small raptor nests (but no medium-large nests)
- 4 farm dams within footprint, 11 farm dams proximal but outside footprint, two eroded ephemeral creekline systems, and one large swampy creekline. The creeklines have been excluded from the footprint for the most part, but a road crossing of the swampy creekline will be required. One large water bodies exists south of the study area (suitable for White-bellied Sea-eagle foraging). Most dams and creeklines contain emergent vegetation that form suitable habitat for frogs.
- Small areas of embedded rocks, surrounded by a mix of native and exotic grasses
- Areas of native spear grass, kangaroo grass, wallaby grass and red grass, along with scattered serrated tussock and *Phalaris*.

The study area is located largely on what would have been woodland vegetation cleared for grazing. The site consists predominantly of improved pasture exotics, with scattered native grass patches around contour drains/banks, creeklines and woodland edges. In general, the habitats of the study area were discretely located, some within areas of native forest, and some among native or exotic pasture. For some species, habitats were low quality and lacking

in sufficient features such as flowing rocky streams, caves and connected shrubby vegetation areas to provide cover from predator species. Coarse woody debris and fallen logs were generally absent. Mistletoe was not noted from any of the 90 SAT trees. However, regardless of the prevalence of exotic species in the understorey, habitat constraints for some Species Credit Species still exist. Presence of habitat features are summarised by survey area in **Table 4-1**. Descriptions of habitat areas are described and discussed further below. Habitat trees recorded in the study area are provided in **Table 4-2**.

3.2 THREATENED FAUNA SPECIES

Appendix B lists all fauna species observed in the study area during the three 2021-2022 survey periods. Threatened species observed are highlighted in Appendix B.

Based on the survey results (**Table 4-3**), the following Species Credit Species remain relevant to the study area:

- Pink-tailed Legless Lizard (*Aprasia parapulchella*) (habitat present, surveys not conducted due to project timing);
- Striped Legless Lizard (*Delma impar*) (habitat present, surveys not conducted due to project timing);
- Glossy Black-Cockatoo (*Calyptorhynchus lathami*) (habitat present, surveys not conducted due to project timing);
- Barking Owl (*Ninox connivens*) (habitat present, surveys not yet conducted due to access);
- Powerful Owl (*Ninox strenua*) (habitat present, surveys not conducted due to project timing); and
- Masked Owl (*Tyto tenebricosa*) (habitat present, surveys not conducted due to project timing).

Table 3-1: Habitat features in and around study area

Habitat feature	Study Area
Live paddock tree	Yes
Dead paddock tree	Yes
Native forest	Yes
Native ground cover/grassland areas	Yes
Fallen timber	No
Mistletoe	No
Flowering eucalypts	Yes
Casuarina/Allocasuarina	Very few (young planted)
Koala feed species	Yes
Hollows (cockatoo)	Yes
Hollows (Superb Parrot)	Yes
Hollows (owls)	Yes
Hollows (gliders)	Yes
Raptor nest	Small only
Dam	*15 small farm, 1 large lake
Creekline	2 ephemeral eroded channel systems w emergent vegetation, 1 wide swampy creekline
Embedded rocks	1 hillside in southwest study area, some in paddock south of southern access road
Clifflines, rocky outcropping, escarpments etc.	No

*Not in actual footprint, but nearby in survey area

Table 3-2: Habitat trees in the study area

ID (Premise, 2020)	Tree species	Easting	Northing	Corresponding BMS tree ID	Hollow-bearing	DBH (cm)	Hollow size (cm) w height above ground			Species				
							<5	5-20	>20	GB Cockatoo	B Owl	P Owl	M Owl	Comments
T8	*Eucalyptus tereticornis*	767650	6154429	K1.10	Yes	117		5m		N	N	N	N	
T7	*Eucalyptus tereticornis*	767522	6154461	K1.20	Yes	71	9m	8m	3m	Y	N	Y	Y	Galah nesting hollow
N/A	*Eucalyptus bridgesiana*	768837	6154406	K1.24	Yes	114	5m			N	N	N	N	
N/A	*Eucalyptus bridgesiana*	768826	6154407	K1.25	Yes	66		2m		N	N	N	N	Bat crack
N/A	*Eucalyptus bridgesiana*	768798	6154417	K1.26	Yes	142	2m			N	N	N	N	
N/A	*Eucalyptus bridgesiana?*	768809	6154370	K1.27	Yes	106	10m			N	N	N	N	
N/A	*Eucalyptus macrorhyncha*	768776	6154053	K1.29	Yes	95	10m	10m		Y	N	N	N	
N/A	*Eucalyptus macrorhyncha*	766379	6154546	K2.04	Yes	76	6m			N	N	N	N	
N/A	*Stag*	766377	6154488	K2.05	Yes	83		7m		N	N	N	N	
N/A	*Eucalyptus macrorhyncha*	766380	6154398	K2.06	Yes	92			5m	N	Y	Y	Y	

ID (Premise, 2020)	Tree species	Easting	Northing	Corresponding BMS tree ID	Hollow-bearing	DBH (cm)	Hollow size (cm) w height above ground			Species				
							<5	5-20	>20	GB Cockatoo	B Owl	P Owl	M Owl	Comments
N/A	*Stag*	766416	6154328	K2.09	Yes	60		8m		Y	N	N	N	Bat crack
N/A	*Eucalyptus macrorhyncha*	766441	6154312	K2.11	Yes	109		10m		Y	N	N	N	
N/A	*Eucalyptus macrorhyncha*	766489	6154208	K2.14	Yes	101	8m			N	N	N	N	Bark chewed around hollow entrance
N/A	*Stag*	766512	6154136	K2.18	Yes	57	8m	7m		Y	N	N	N	Cockatoo nest
N/A	*Stag*	766554	6154144	K2.19	Yes	94	10m	6m	6m	N	Y	Y	Y	Bird egg / Owl
N/A	*Stag*	766587	6154170	K2.20	Yes	61	4m	4m	7m	N	Y	Y	Y	Bats
N/A	*Stag*	766608	6154170	K2.21	Yes	43	6m	6m		N	N	N	N	Bats
N/A N/A	*Eucalyptus melliodora*	766494	6154394	K2.27	Yes	117	6m			N	N	N	N	
N/A	*Stag*	766436	6154409	K2.30	Yes	40	8m	8m		Y	N	N	N	
N/A	*Stag*	766729	6154244	K3.01	Yes	70		6m		N	N	N	N	
N/A	*Eucalyptus tereticornis*	766733	6154552	K3.12	Yes	137	6m	6m		N	N	N	N	
N/A	*Eucalyptus tereticornis*	766750	6154553	K3.13	Yes	132	3m	5m		N	N	N	N	

ID (Premise, 2020)	Tree species	Easting	Northing	Corresponding BMS tree ID	Hollow-bearing	DBH (cm)	Hollow size (cm) w height above ground			Species				
							<5	5-20	>20	GB Cockatoo	B Owl	P Owl	M Owl	Comments
N/A	*Eucalyptus tereticornis*	766788	6154557	K3.14	Yes	90	3m			N	N	N	N	
N/A	*Eucalyptus tereticornis*	766853	6154520	K3.17	Yes	130	5m	3m		N	N	N	N	
N/A	*Eucalyptus tereticornis*	767041	6154486	K3.24	Yes	64	4m			N	N	N	N	Bat cracks
N/A	*Stag*	767906	6154406		Yes	-			4m	N	Y	Y	Y	
N/A	*Stag*	768876	6154217		Yes	-			4m	N	Y	Y	Y	
N/A	*Stag*	769170	6154433		Yes	-			4m	N	Y	Y	Y	
N/A	*Stag*	766332	6154524		Yes	-			4m	N	Y	Y	Y	

Note: Additional trees have been mapped in the study area during SAT surveys, but they do not contain hollows so are not included here. Some trees are outside the development footprint, but may have constraints requiring buffers which will enter footprint.

Table 3-3: Fauna species survey results

1 Conservation status under the BC Act (current as at February 2022). E = Endangered, V = Vulnerable.

2 Conservation status under the EPBC Act (current as at February 2022). E= Endangered, V = Vulnerable.

3 Biodiversity credit class under the *Threatened Biodiversity Data Collection* (DPIE, 2021a) (current as at January 2022).

Table 4-3: Fauna species survey results

Scientific Name	Common Name	Conservation Status		Biodiversity Credit Class[3]	Survey Result
		BC Act[1]	EPBC Act[2]		
Amphibians					
Litoria aurea	Green and Golden Bell Frog	E	V	Species	Not recorded, despite targeted surveys. No local records in Bionet. Much of the potential habitat has been excluded from direct impact.
Litoria booroolongensis	Booroolong Frog	E	E	Species	The species is unlikely to utilise the study area due to lack of sufficient habitat (rocky-bottomed streams). No targeted surveys are required.
Reptiles					
Aprasia parapulchella	Pink-tailed Legless Lizard	V	V	Species	Habitat constraints (**Table 2-5**) are present. Targeted surveys not undertaken within timing specified by OEH (2020a).
Delma impar	Striped Legless Lizard	V	V	Species	Grassland (native or exotic) present. Surface rocks present in some patches. Targeted surveys not undertaken within timing specified by OEH (2020a).
Birds					
Lophoictinia isura	Square-tailed Kite	V	-	Species/Ecosystem	Habitat constraints (potential nest trees) (**Table 2-5**) not present. Not recorded, despite targeted surveys.
Haliaeetus leucogaster	White-bellied Sea-Eagle	V	-	Species/Ecosystem	Habitat constraints (rivers, lakes, large dams or creeks, wetlands and coastlines) (**Table 2-5**) are

Scientific Name	Common Name	Conservation Status		Biodiversity Credit Class[3]	Survey Result
		BC Act[1]	EPBC Act[2]		
					present to south of study area. No large nests observed. Not recorded, despite targeted surveys.
Hieraaetus morphnoides	Little Eagle	V	-	Species/Ecosystem	Habitat constraints (potential nest trees) (**Table 2-5**) not present. No targeted surveys are required.
Burhinus grallarius	Bush Stone-curlew	E	-	Species	Habitat constraints (dead timber) (**Table 2-5**) not present. No targeted surveys are required.
Calyptorhynchus lathami	Glossy Black-Cockatoo	V	-	Species/ Ecosystem	Breeding habitat constraints (suitable hollow-bearing trees) (**Table 2-5**) are present. Very little foraging constraint present in study area, consisting of young planted Casuarina. Local records exist in Bionet. Targeted surveys not undertaken within timing specified by OEH (2020a).
Callocephalon fimbriatum	Gang-gang Cockatoo	V	-	Species/ Ecosystem	Habitat constraints (suitable hollow-bearing trees) (**Table 2-5**) are present. Not recorded, despite targeted surveys.
Ninox connivens	Barking Owl	V	-	Species/ Ecosystem	Habitat constraints (suitable hollow-bearing trees) (**Table 2-5**) are present. Targeted surveys not undertaken within timing specified by OEH (2020a).
Ninox strenua	Powerful Owl	V	-	Species/ Ecosystem	Habitat constraints (suitable hollow-bearing trees) (**Table 2-5**) are present. Targeted surveys

Scientific Name	Common Name	Conservation Status		Biodiversity Credit Class[3]	Survey Result
		BC Act[1]	EPBC Act[2]		
					not undertaken within timing specified by OEH (2020a).
Tyto novaehollandiae	Masked Owl	V	-	Species/ Ecosystem	Habitat constraints (suitable hollow-bearing trees) (**Table 2-5**) are present. Targeted surveys not undertaken within timing specified by OEH (2020a).
Mammals					
Phascolarctos cinereus	Koala	V	E	Species/ Ecosystem	Habitat constraints (feed trees) (**Table 2-5**) are present. Local records exist in Bionet. Not recorded, despite targeted surveys.
Petauroides volans	Greater Glider	-	V	Species	Habitat constraints (suitable hollow-bearing trees) (**Table 2-5**) are present. Local records exist in Bionet. Not recorded, despite targeted surveys.
Petaurus norfolcensis	Squirrel Glider	V	-	Species	Local records exist in Bionet. Though potential Squirrel Glider were recorded on cameras near southern access road, definitive Sugar Glider with similar sized tails were also recorded at the same locations. The abundance of definitive Sugar Glider images (white tail tip present) on camera near southern access road suggests Squirrel Glider are absent from this area. Some other treed portions of site would be too isolated to be occupied. Less accessible treed portions of study

Scientific Name	Common Name	Conservation Status		Biodiversity Credit Class[3]	Survey Result
		BC Act[1]	EPBC Act[2]		
					area were surveyed by spotlight. Not recorded, despite targeted surveys.
Cercartetus nanus	Eastern Pygmy-possum	V	-	Species	The species is unlikely to utilise the study area due to degraded nature of habitat (well-spaced eucalypts with little to no shrub layer and little to no coarse woody debris) and presence of foxes. No local records in Bionet. No targeted surveys are required.
Petrogale penicillata	Brush-tailed Rock Wallaby	E	V	Species	Habitat constraints (steep rocky slopes) (**Table 2-5**) are not present. The site is disconnected from any known non-extinct populations. Foxes are present. No targeted surveys are required.
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	Species/ Ecosystem	Habitat constraints (camps) (**Table 2-5**) are not present. No targeted surveys are required.
Miniopterus orianae oceanensis	Large Bent-winged Bat	V	-	Species/ Ecosystem	Habitat constraints (caves/adits) (**Table 2-5**) are not present in or around the development footprint. No target surveys are required.
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	Species	Habitat constraints (caves/cliffs/escarpments) (**Table 2-5**) are not present in or around the development footprint. No target surveys are required.
Myotis macropus	Southern Myotis	V	-	Species	Habitat constraints (hollow-bearing trees within 200 m of water) (**Table 2-5**) are present in two

Scientific Name	Common Name	Conservation Status		Biodiversity Credit Class[3]	Survey Result
		BC Act[1]	EPBC Act[2]		
					locations. Local records exist in Bionet. Not recorded, despite targeted surveys (ultrasonic call detection).

3.3 THREATENED FROGS

Green and Golden Bell frog (*Litoria aurea*) is classified as a Species Credit Species in the TBDC (DPIE, 2021a). The species can be surveyed for from November to March. Aural-visual surveys were conducted along the edge of suitable habitat in January, within a week of about 90 mm of rain. As this species utilises any waterbody with emergent vegetation, almost all dams and creeks in the study area form potential breeding habitat. Plague Minnow (*Gambusia holbrooki*) were absent from all but one area of the swampy creek (at the location of the powerline crossing). This area exhibited much lower frog activity compared to other potential habitat. Due to the lack of local records in Bionet, a retracted survey period was considered sufficient to determine the species presence in the study area. All potential habitat was visited over two nights by walking from dam to dam and along creeklines with a spotlight. Examples of investigated habitat are provided in **Plate 4-1**. The species was not found despite target survey.

Booroolong Frog (*Litoria booroolongensis*) is classified as a Species Credit Species in the Threatened Biodiversity Data Collection (DPIE, 2021a). The specified survey period for this species is October to December when adult males can be heard calling to attract a mate. This species prefers permanent rocky-bottomed streams with fringing vegetation. Whilst the larger swampy creek likely remains wet through drier times, the wide sandy bottom and lack of fast flowing water renders the habitat unsuitable for this species occupation. Due to lack of sufficient habitat in the study area, the Booroolong Frog is unlikely to utilise the study area. Whilst surveying for Green and Golden Bell Frog, no Booroolong Frog were seen or heard.

Plate 3-1: Water bodies containing emergent vegetation in study area.

3.4 THREATENED REPTILES

Pink-tailed Legless Lizard (*Aprasia parapulchella*), and Striped Legless Lizard (*Delma impar*) are classified as Species Credit Species in the Threatened Biodiversity Data Collection (DPIE, 2021a). The specified survey period is September through November (and December for *Delma*), when the species can be found under weathered rocks and logs feeding in ant nests (*Aprasia*), or on spiders, crickets, cockroaches and moth larvae (*Delma*; DPIE, 2021a). Like most reptiles, they travel deeper underground to avoid the cooler surface temperatures in winter. Deployment of artificial habitat to survey for these species would have needed to

begin in June 2021. As the survey window was missed, habitat assessment will be relied upon to determine the species polygons on site.

Known habitat for the Pink-tailed Legless Lizard is areas of sloping open woodland with a mostly native grassland ground layer (OEH, 2021a). Box-gum woodland, *Themeda australis* (Kangaroo Grass) and soils of volcanic origin are known associations (Wong *et al*, 2011). Habitat is well drained with scattered embedded rocks under which the species feeds and shelters. The lizard feeds on the larvae and eggs of ants and termites that nest under these rocks (OEH, 2021a). Leaf litter is low or absent and tree and shrub layers are often sparse. Though known habitat can contain exotic annual species, the presence of exotic rosette herbs and pasture grasses tend to be negatively associated with the species presence (Wong *et al*, 2011).

Four parts of the study area likely contain most of the habitat features required for this species; the hill in the southwest paddock, the area where the southern access road enters the site, areas around the eroded creekline systems, and along the southern boundary woodland interface. The dominance of exotic species in the ground layer could be used to define the boundary of the species polygon. Mapped exotic-dominated grassland (**Figure 1-3**) has been assessed as highly modified and not representative of derived native grassland (FloraSearch, 2019). The Pink-tailed Legless Lizard is therefore considered as highly unlikely to occur in the exotic grassland, and potential habitat is limited to native groundcover in the native woodland and grassland areas, and within 50 m of rock outcrops. The best areas of embedded rock occur on the southwest hill and along the southern access road. Desktop review (ALA, 2021) shows the closest record to be near Taralga, and the site is on DPIE (2021) and DoE (2021) mapping as being known or likely to occur.

Striped Legless Lizard is more of a grassland specialist, but is not restricted to native grassland. Many studies have found the species present (and reproducing) in areas with grazing history, and areas dominated by exotic grasses such as *Phalaris aquatica* (DoE, 2020). Though scattered throughout the improved pasture areas of the study area, few areas demonstrate dominance of this exotic grass. While desktop review (ALA, 2021) shows the nearest records to be Goulburn, Canberra and Yass, the site is on DPIE (2021) and DoE (2021) mapping as being predicted or likely to occur. Historical survey effort is low in NSW. The species may use cracking clay soils and surface rocks for shelter, but also grass tussocks, spider burrows and fallen timber. As the study area contains extensive areas of suitable habitat features for this

species (including *Phalaris*), no geographic or habitat constraints occur within the BAM-C, and no surveys have previously been conducted, the Striped Legless Lizard is possible to occur on-site.

Though the development footprint is approximately 375.5 ha, the amount of quality habitat for the species is likely to be only a fraction of this. In order to refine the habitat mapping, and facilitate measures to avoid and minimise impacts on this species, an onsite meeting with DPE staff and Threatened Species Officer was conducted. Some scattered patches of *Austrostipa bigeniculata, Themeda australis, Poa spp., Nassella trichotoma, Phalaris aquatica* and *Hypocharis radicata* do occur on the Subject Land. Though preferred grass species are present, the history of the site must be taken into account, as the species prefers historically native grassland, and along the ecotone where they transition into associated woodland PCTs (*pers. comm*. Rob Armstrong DPE). Areas that have been recently cultivated (ploughed or fertilised) are unlikely to form sufficient habitat (paddock south of forest patch on southern access road), though reinvasion of these areas is possible if no recent cultivation activity has been conducted. Much of the Subject Land which would have once been open woodland. Potentially suitable habitat for the Striped Legless Lizard has undergone pasture improvement, cropping and heavy grazing with an almost complete conversion of the groundlayer to exotic annual grass species which are not suitable refugia for the species. In places where native tussock grasses persist, they are either of insufficient density and therefore not a suitable refuge, or are associated with previously dense forest habitat which would historically not have supported the species. In agricultural landscapes, the species is most often associated with *Phalaris aquatica* where it has replaced native habitat because it provides sufficient shelter in the absence of native tussock grasses or shaded rocky habitat (pers comm, Rob Armstrong, DPE). Suitable *Phalaris aquatica* habitat has been mapped as occurring just above the floodzone of Narambulla Creek. These areas are considered the only suitable remnant habitat on the Subject Land for the Striped Legless Lizard (**Figure 4-2**).

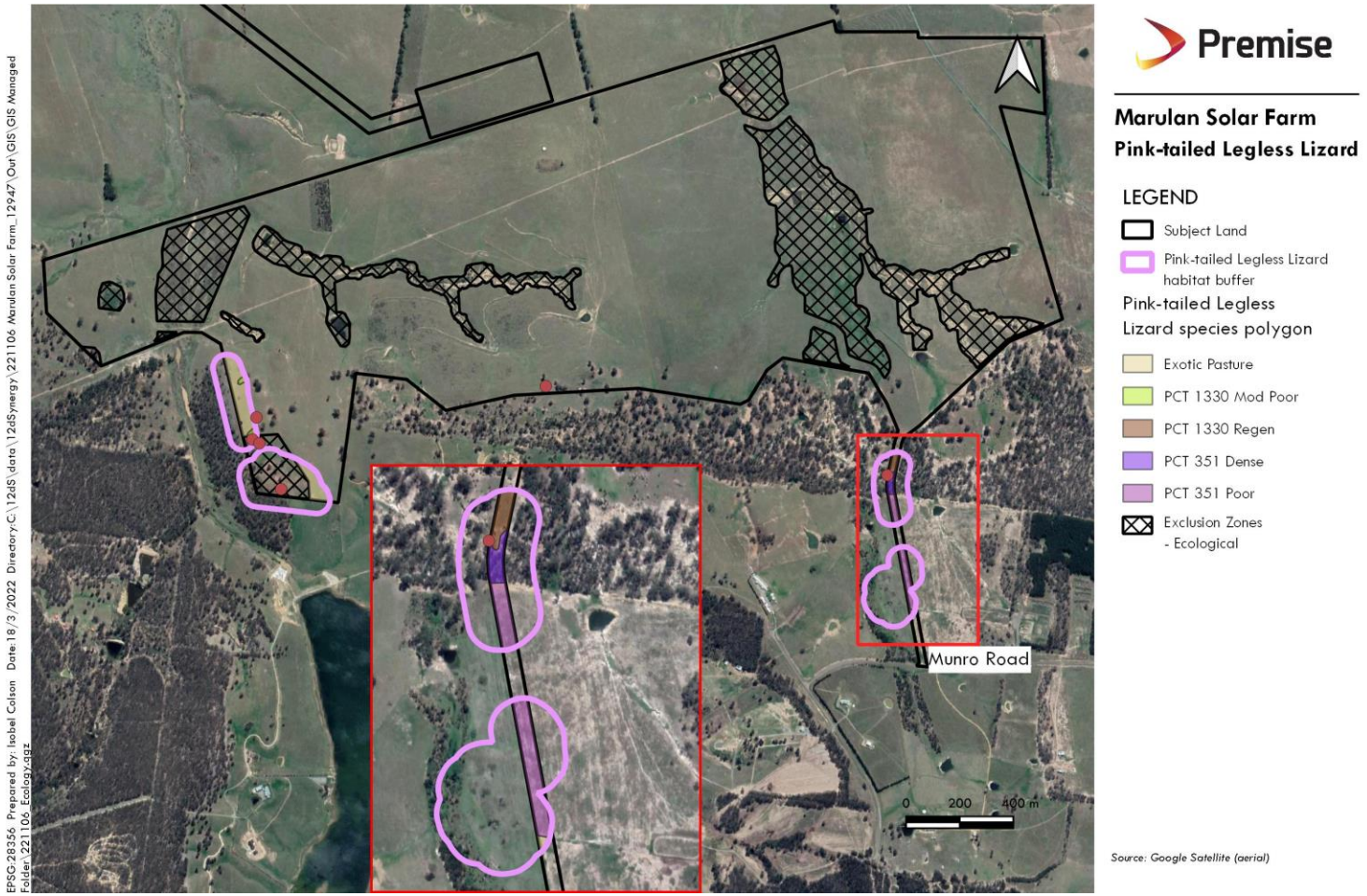

Figure 3-1: Pink-tailed Legless Lizard Species Polygon

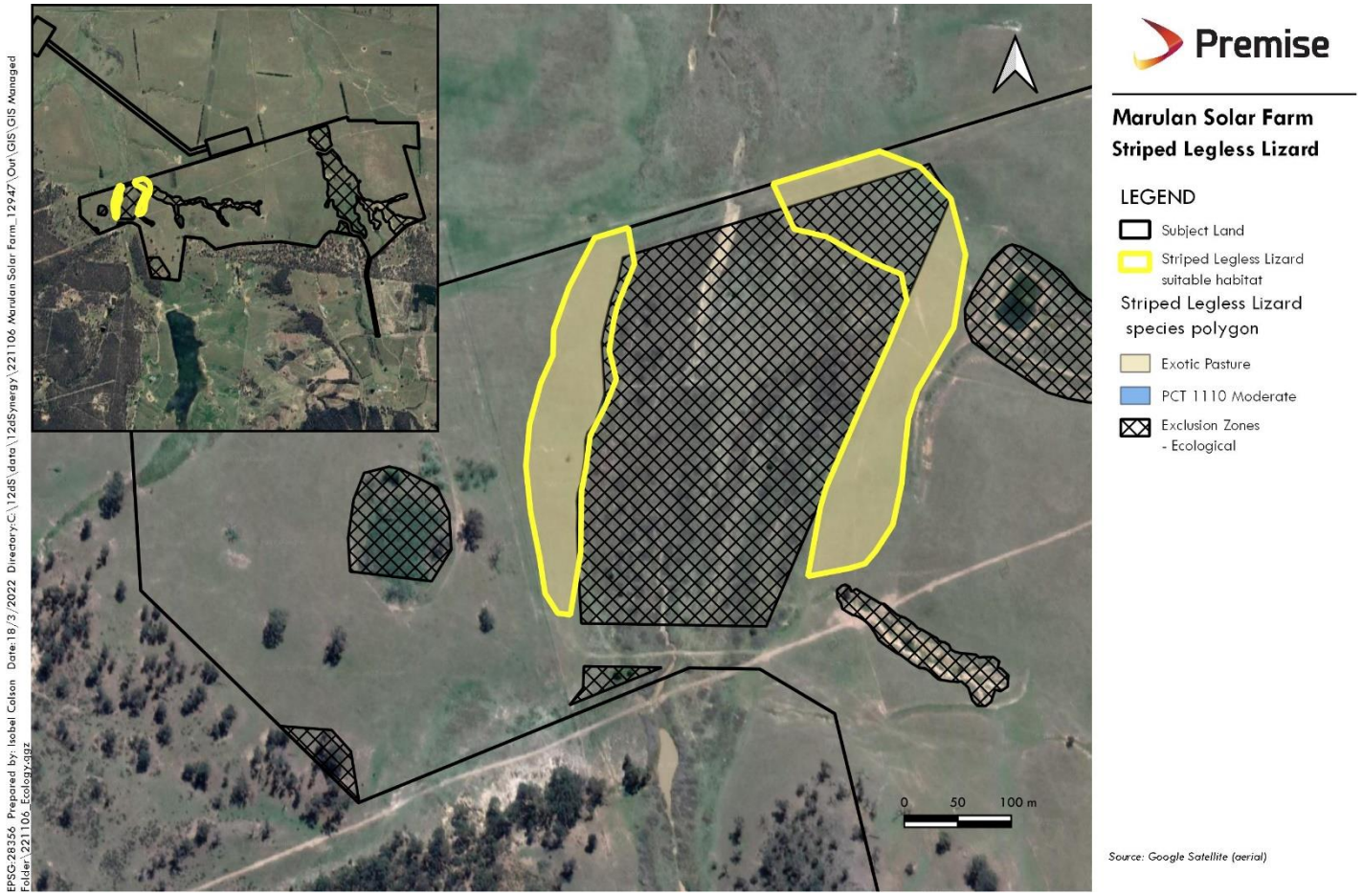

Figure 3-2: Striped Legless Lizard Species Polygon

Plate 3-2: **Potions of the study area containing habitat potentially suitable for legless lizards.**

3.5 THREATENED BIRDS

Square-tailed Kite (*Lophoictinia isura*) must be surveyed for between September and January (DPIE, 2021a). They are a spring-summer breeding migrant to the south-eastern parts of Australia, nesting in trees along or near watercourses from July to February (Marchant and Higgins, 1993). The presence of nest trees was specifically targeted as it is a recognised habitat constraint (DPIE, 2021a). A number of smaller stick nests were observed around treed portions of the study area. All would be considered too small to be kite nests. The study area was surveyed for three days in December 2021, and four afternoons and one morning in January 2022. No individuals were observed during any visits to site.

White-bellied Sea-Eagle (*Haliaeetus leucogaster*) must be surveyed for between July and December when the species occupy large stick nests in emergent eucalypts proximal to water bodies (Marchant and Higgins, 1993; OEH, 2020a). It is likely that this large water body (south of study area; **Figure 1-3**) is an important feeding ground for the species in the local area. No large raptor nests were observed across the study area. The study area was surveyed for three days in December 2021. No individuals were observed during any visits to site.

Little Eagle (*Hieraaetus morphnoides*) must be surveyed for between August and October when the species occupy large stick nests in tall trees among remnant patches of woodland (Marchant and Higgins, 1993; OEH, 2020a). The presence of nest trees was specifically targeted as it is a recognised habitat constraint (OEH, 2020a). The study area contained paddock trees (both living and dead) and native forest vegetation, rendering the study area conducive to Little Eagle occupation. No individuals were observed during any visits to site, though all visits were out of the breeding period for the species. The species can be ruled out by habitat constraint, as no large stick nests were observed in any of the trees on site.

Bush Stone-curlew (*Burhinus grallarius*) can be surveyed year round (DPIE, 2021a) by spotlighting, call playback and diurnal flushing of habitat containing fallen logs. Inspection of the study area in December 2021 showed there is little-no coarse woody debris/hollow logs on site. The species was not sighted during the nine diurnal visits or heard during the five nocturnal visits between December 2021 and January 2022. Foxes were frequently spotlighted in the study area, reducing the likelihood of the species presence considerably. The degraded habitat and lack of sign suggests the species can be considered absent from the study area without further targeted survey.

Swift Parrot (*Lathamus discolor*) and Regent Honeyeater (*Anthochaera phrygia*) are included as Ecosystem Credit Species. As such, no surveys are required. They are only considered Species Credit Species if the study area lies in an area of mapped 'important habitat' (DPIE, 2021a). The study area is not an important mapped area for Regent Honeyeater (according to the Biodiversity Accredited Assessor System [BAAS] portal map; DPIE 2021).

Glossy Black-Cockatoo (*Calyptorhynchus lathami*) must be surveyed for between April and August (DPIE, 2021a). They are highly specialised, feeding on the seeds of *Casuarina* and *Allocasuarina* species (Higgins, 1999). Whilst the study area does contain some hollows that could be suitable nesting sites for the species, no Glossy Black-Cockatoos surveys were carried out during the required breeding period. None were observed during any of the nine days survey between December 2021 and February 2022. This is likely due to the paucity of feed species on-site, which only occur as a handful of *Casuarina* saplings around the excluded creeklines. As the species is known from the local area, and was not surveyed for, Species Credit habitat would be assumed by drawing a 200 m buffer around all hollow bearing trees (living or dead with hollows greater than 15 cm diameter, greater than 8m above ground; **Figure 4-3**). Six trees mapped in the study area fit this description.

Gang-gang Cockatoo (*Callocephalon fimbriatum*) must be surveyed between October and January (DPIE, 2021a). This species is an altitudinal migrant, moving from taller mountain forests in summer to lower elevation open woodlands in winter (Higgins, 1999). The study area contains a number of hollow-bearing trees with hollows greater than 9 cm in diameter, though only two mapped trees had them at a height of greater than 9 m. One other cockatoo species (Galah [*Eolophus roseicapilla*], was observed utilising the trees in the study area for roosts during surveys. As hollows existed and the study area is in the southern highlands, Gang-gang Cockatoo were surveyed for over three days in December 2021, and four afternoons and one morning in January 2022. No individuals were observed during any visits to site.

Barking Owl (*Ninox connivens*), Powerful Owl (*Ninox strenua*) and Masked Owl (*Tyto novaehollandiae*) can all be surveyed for between May and August (DPIE, 2021a). Barking Owl survey period is extended to December, but nocturnal access to treed portion of site was

limited so survey effort was not able to be completed in the required timeframe. Only one nights spotlighting and call playback were conducted in the vicinity of the southern access road in December 2021 (**Figure 4-4**). As survey were not completed within the required timeframes, habitat assessment was relied on to map Species Credit Habitat. Eight living/dead/paddock trees with hollows greater than 20 cm diameter were mapped (**Figures 4-4** to **4-6**), seven of which were over 4 m above ground and suitable for Barking Owl. Species Credit habitat is mapped as a 100m radius around potential nest trees, noting that some may be outside the development footprint, but are within the influence of disturbance.

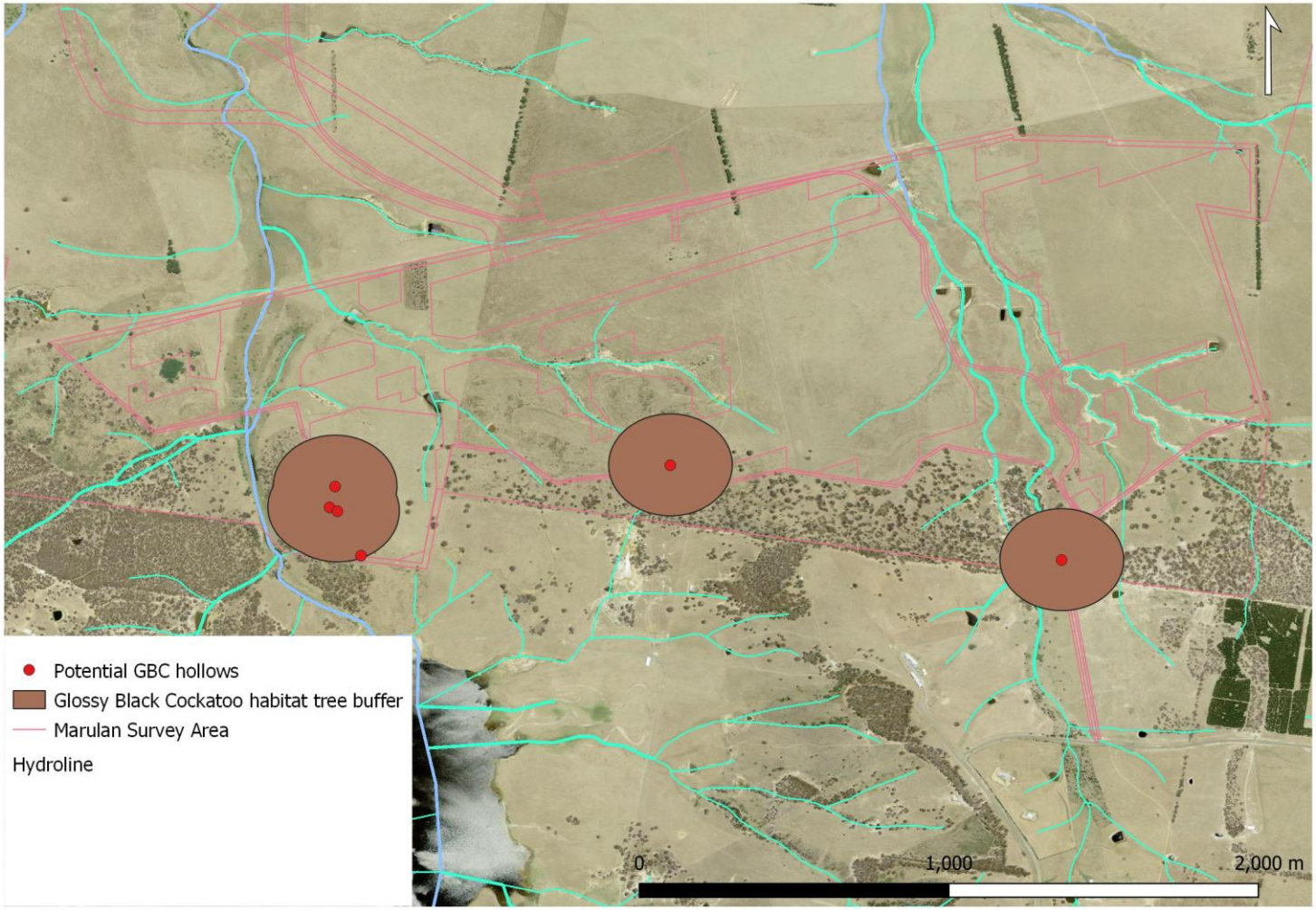

Figure 3-3: Glossy Black-Cockatoo Species Polygon

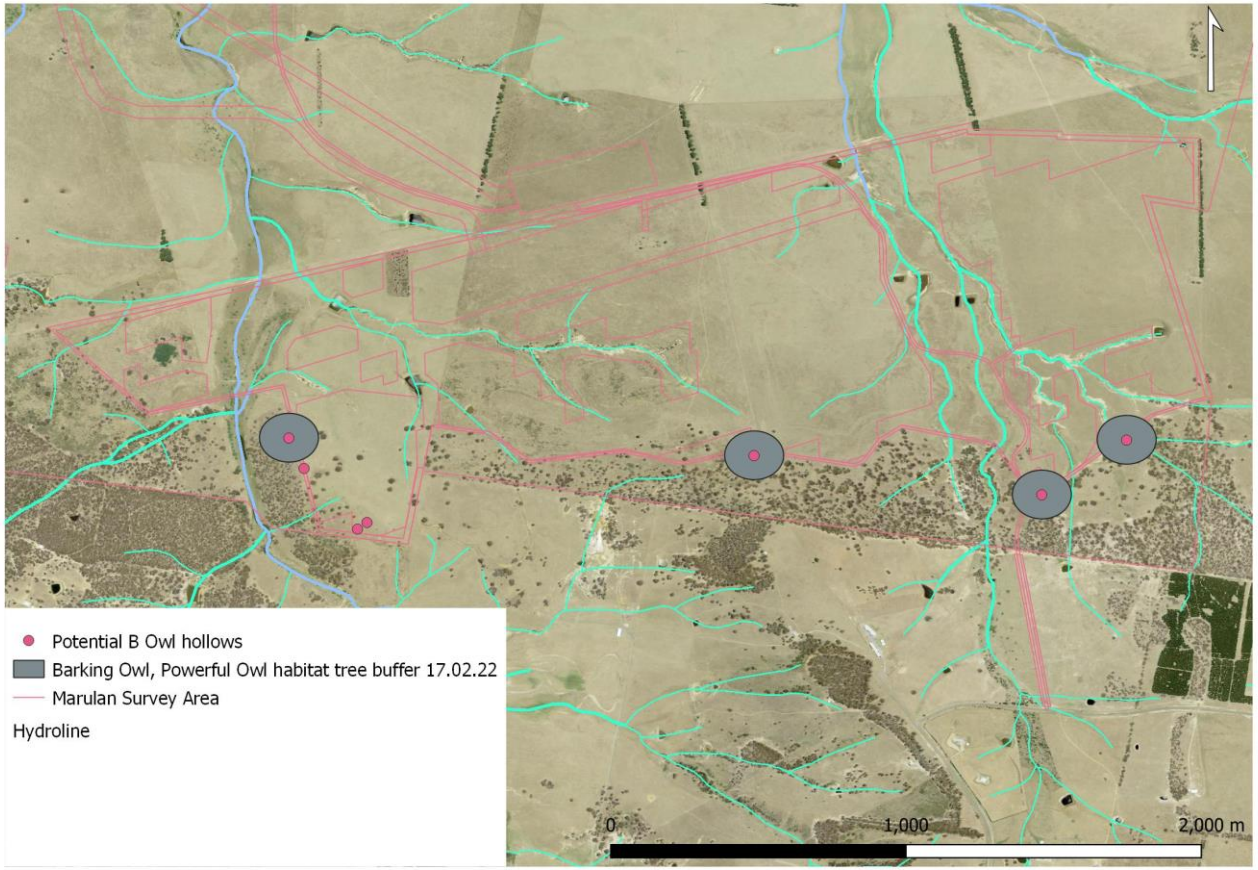

Figure 3-4: Barking Owl Species Polygon

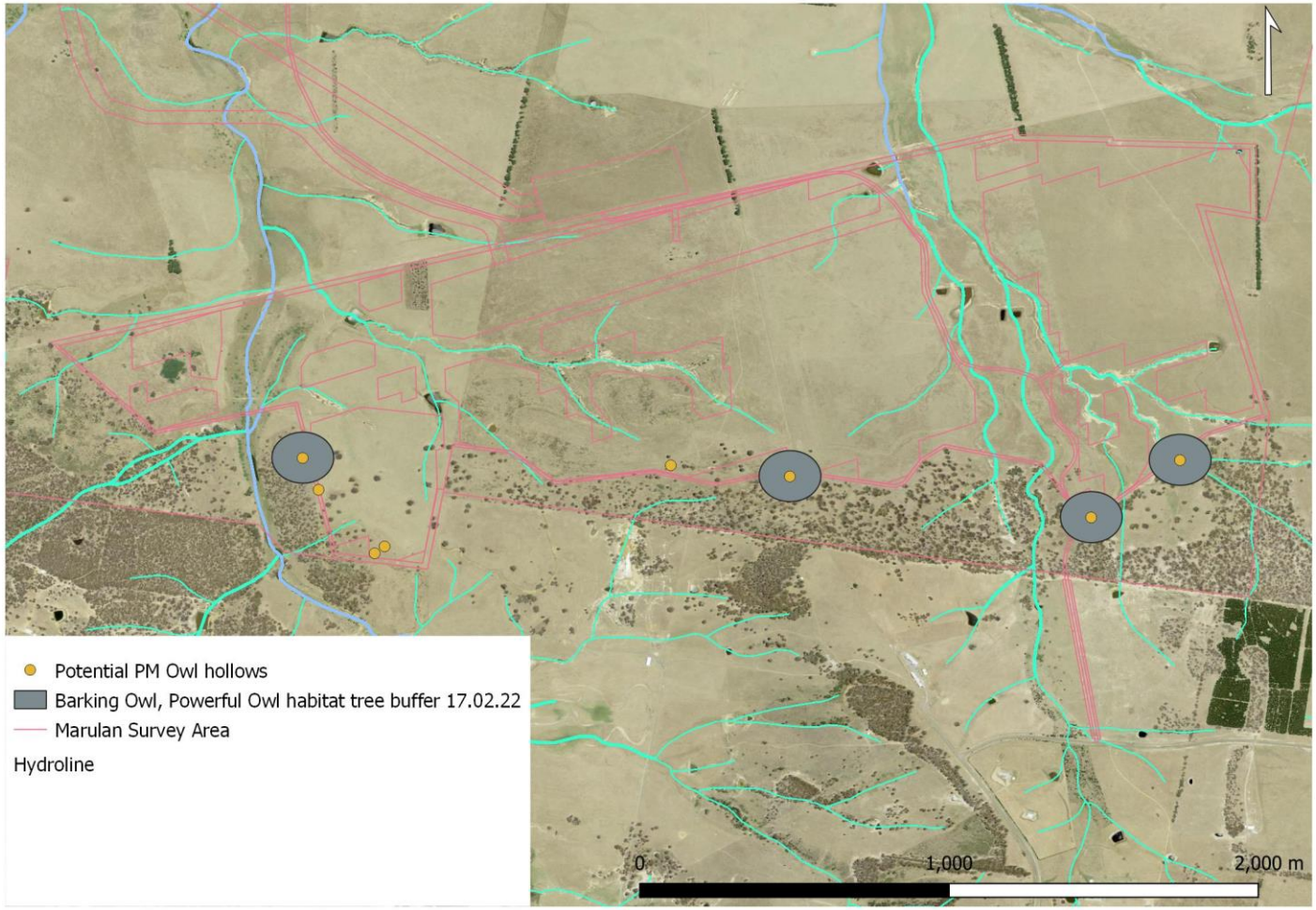

Figure 3-5: Powerful Owl Species Polygon

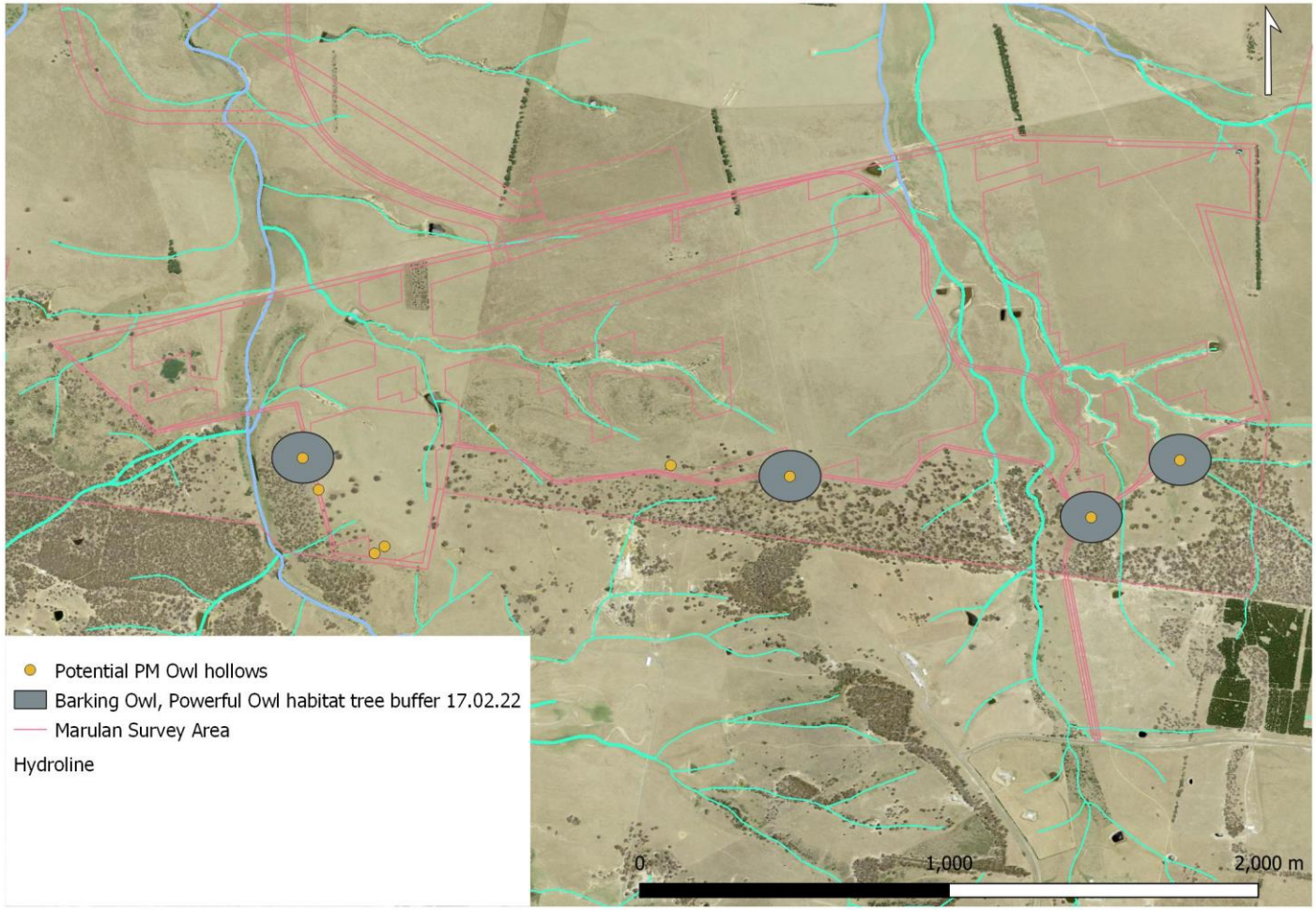

Figure 3-6: Masked Owl Species Polygon

3.6 THREATENED MARSUPIALS

Koala (*Phascolarctos cinereus*) can be surveyed for all year round (DPIE, 20201a). In line with survey guidelines presented in Appendix C of the 2019 Koala Habitat Protection Guideline (DPIE, 2019), the primary survey technique used in 2021 was SAT survey (Phillips and Callaghan 2011). This survey technique was supplemented with four nights of spotlighting transects, two in the vicinity of the proposed southern access road, and two in PCTs and paddock trees along the southern boundary and southwest paddock. One spotlighting transect was conducted in December 2021 along the southern access road, with the remainder conducted in February 2022. Records exist from the local area (roadkill on Hume Highway, within 2 km of site). The species was not sighted during any of the diurnal or nocturnal survey periods, despite the fact every tree in the study area is considered a Koala Use Tree Species (DPIE, 2019) in the Central and Southern Tablelands Koala Management Area. No scats or characteristic scratches on trees were observed during habitat assessment and SAT survey. SAT data are presented in Appendix C of this report. Due to the linear nature of suitable habitat within the study area, SAT surveys sampled large radial areas as their shape was modified to fit the survey areas (**Figure 2-1**). Also, spotlighting transects were run along the entire length of the study area rather than parallel transect. No species credit habitat exists in the study area.

As the site is on RU1, RU2 and/or RU3 zoned lands in Goulburn Mulwaree LGA, Koala Habitat Protection SEPP (2020) applies. With regard to this project, Core Koala Habitat is then defined by Part 1 of the 2020 SEPP. Based on site survey, the site contained no evidence of Koala presence, or a resident population. However, the site contains land that is considered Potential Koala Habitat under the 2020 SEPP. No quadrats were necessary as the number of *Eucalyptus tereticornis* in the study area was clearly greater than the minimum 15% to qualify as potential habitat (PCT1330 and paddock tree areas) as listed in Schedule 2 of the 2020 SEPP. It should be noted that all tree species on the Subject Land are listed as regionally relevant Koala use specie in Appendix A of the 2019 Koala Habitat Protection Guideline. BioNet shows two recorded roadkills within 2.5 km of site (**Figure 4-7**). No barrier to movement exists between these locations and the study area, noting that while highways present a risk of Koala mortality, they are not a barrier to movement. One record was a young individual in 2010, and another unclassified individual in 2018. As both of these records are within the last 18 years (three Koala generations), and the presence of young individuals suggests at least connection with a breeding population, the site was investigated for a resident

population. The lack of evidence of long-term presence or live individuals indicates that the Subject Land is not in use by the species and would therefore not be considered Core Koala Habitat under the 2020 SEPP. This may have consequences for consideration of MNES referral under the EPBC Act 1999.

Greater Glider (*Petauroides volans*) can be surveyed year round (DPIE, 2021a). Cameras placed out to survey for Squirrel Glider would be too low in the trees for Greater Glider, who do not move down the tree very often. The species was not detected from four nights spotlighting conducted in the treed portions of the study area. Every tree in the study area was spotlighted at least once. Treed areas exist largely as disjunct patches of mature trees, or edge habitat along a larger forest patch. This species is listed under the EPBC Act 1999, so may have referral implications. No species credit habitat exists in the study area.

Squirrel Gliders (*Petaurus norfolcensis*) can be surveyed for year-round (DPIE, 2021a). A number of possible Squirrel Glider images were captured on PIR camera in the vicinity of the southern access road between December 2021 and February 2022. Squirrel Gliders typically have a broader tail base than Sugar Glider, and never have white tips to the tail (that can be present or absent in Sugar Glider; van der Ree and Suckling, 2008). Examples of possible Squirrel Glider images are presented in **Plate 4-3**, showing the broader tail base than the Sugar Glider in the first image of **Plate 4-4**. However, the second image in **Plate 4-4** shows a definite Sugar Glider (with white tail tip) with a tail base as broad as the possible Squirrel Gliders seen in **Plate 4-3**. As such, those possible Squirrel Gliders are likely to simply be Sugar Gliders. Though occupation and activity of Sugar Gliders is very high in the vicinity of the southern access road (almost at least one glider image per camera per night), the area could be considered devoid of Squirrel Glider. No cameras were deployed in other treed portions of site. No Squirrel Gliders were recorded from four nights spotlighting across the study area. No species credit habitat exists in the study area.

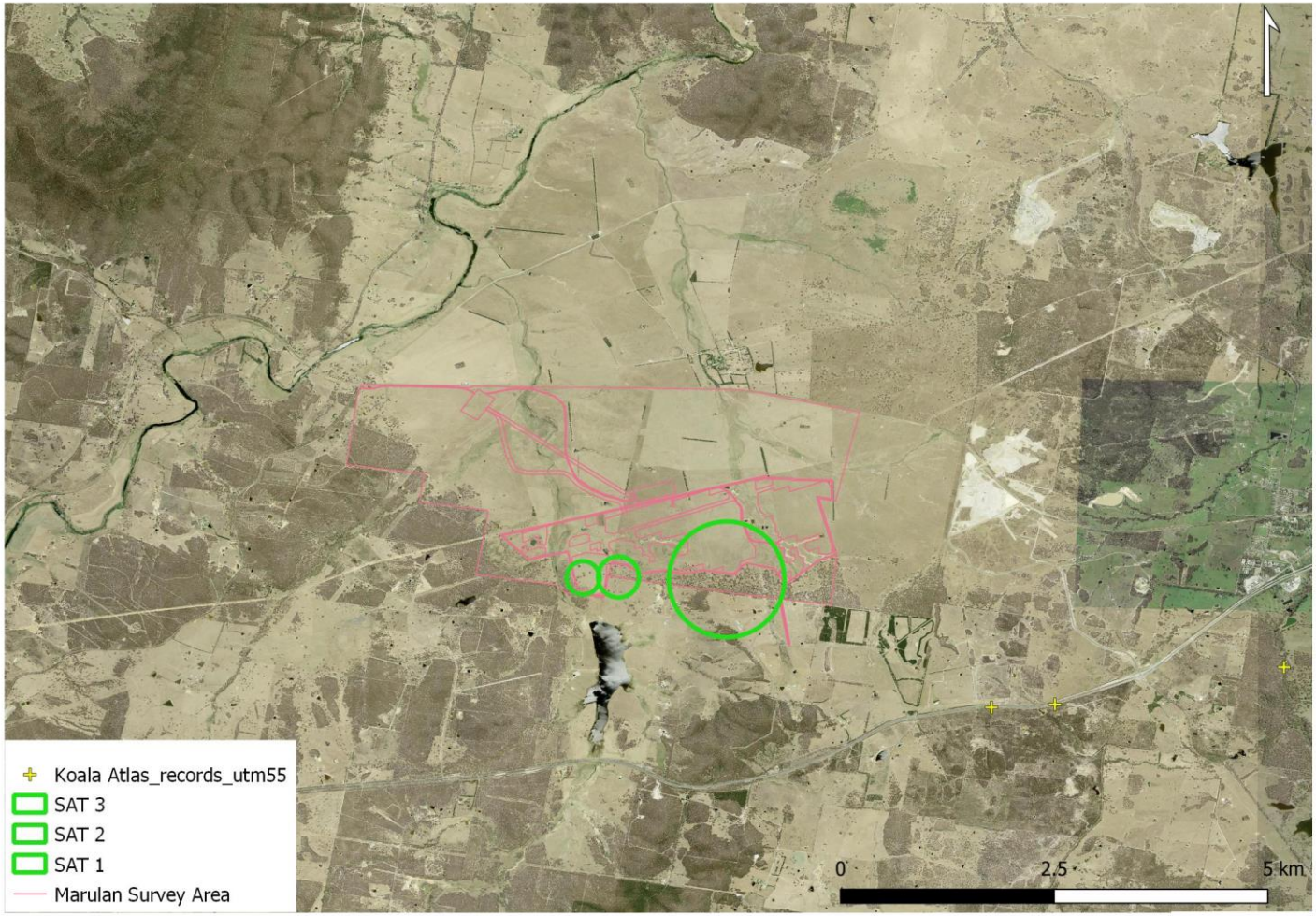

Figure 3-7: Local Koala Sightings

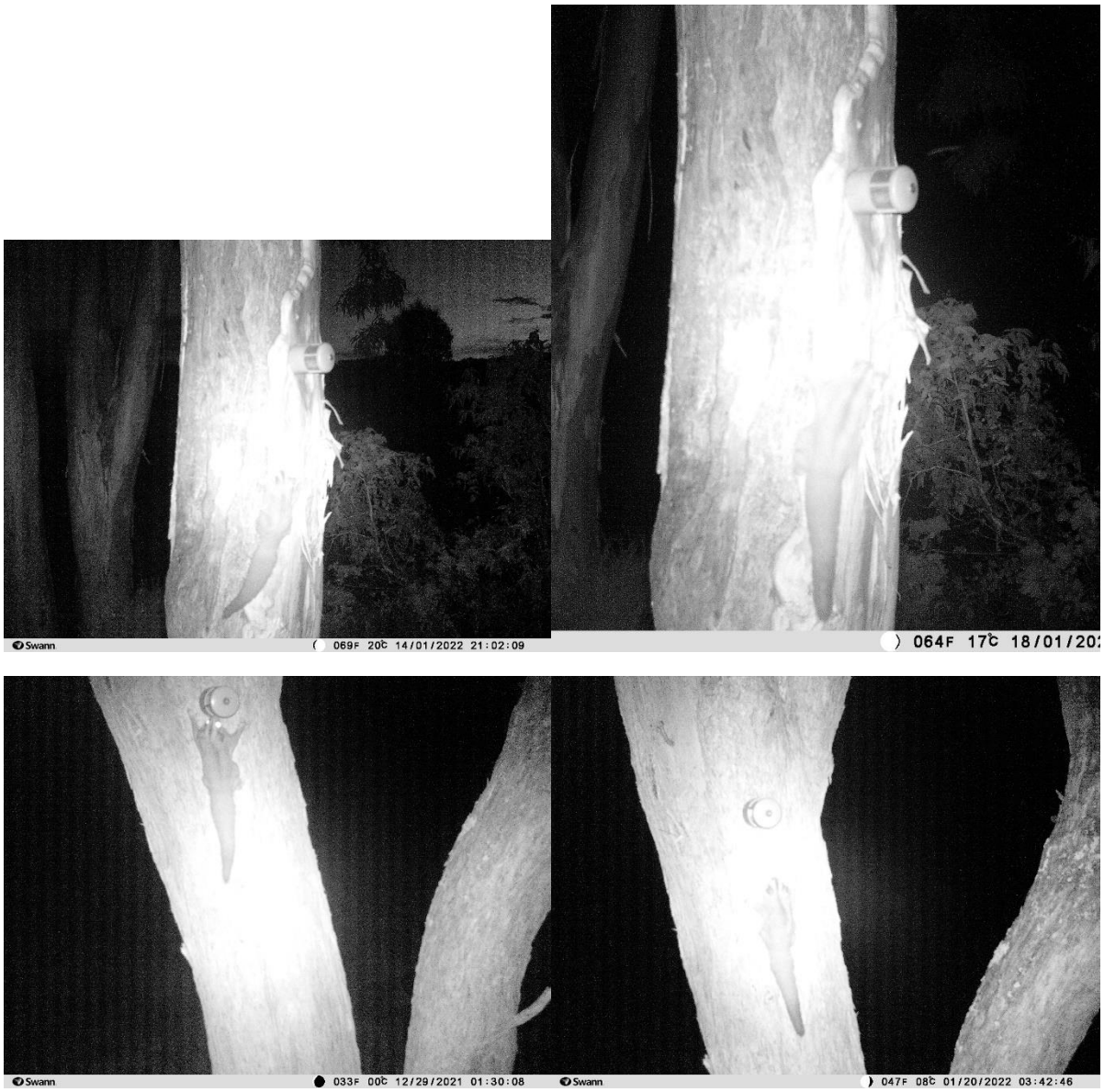

Plate 3-3: **Possible Squirrel Glider images from 2021-2022 surveys around the southern access road**

Plate 3-4: **Sugar Glider images from 2021-2022 surveys around the southern access road. Note the second image shows the white tip on tail which is characteristic of Sugar Glider (Squirrel Gliders never have white tip). This individual's tail is also just as bushy as that of the possible Squirrel Glider images in plate 4-3, suggesting all are Sugar Glider rather than Squirrel Glider.**

3.7 THREATENED BATS

Grey-headed Flying-fox (*Pteropus poliocephalus*) must be surveyed for between October and December when the species are utilising breeding camps (DPIE, 2021a). All survey areas contain flowering eucalypts which could be utilised by Grey-headed Flying-fox for foraging. Despite local records in Bionet (OEH, 2020b), there are no known breeding camps in the area. While on site for other weekly target surveys in December, no flying-fox (or their camps) were identified. No species credit habitat exists in the study area.

Large Bent-winged Bat (*Miniopterus orianae oceanensis*) is listed as a dual Species and Ecosystem Credit Species. The specified survey period for this species is December through February when females have migrated to a number of known maternity roosts (DPIE, 2021a). Known maternity roost sites include caves at Borenore, Wellington, Abercrombie, Jenolan, Kanangra-Boyd and Wombeyan. Large Bent-winged Bats will move up to 300 km between maternity roosts and overwintering roosts (Churchill 2008), with Bungonia and Wee Jasper being the closest large known maternity roosts (Dwyer and Hamilton-Smith 1965; OEH 2011). They will also move up to 65 km in a night to foraging habitat (Churchill 2008). Full surveys were not conducted for this species, but an assessment was carried out to assess its potential as a Species Credit Species. Contour maps suggest no presence of clifflines, and aerial images do not show any rock outcropping. No cave roosting habitat was observed in the landscape, despite a few probable calls of the species being identified during ultrasonic bat detection. The study area is likely to form foraging (Ecosystem Credit) habitat only.

Large-eared Pied Bat (*Chalinolobus dwyeri*) is listed as a Species Credit Species. The specified survey period for this species is November through January when females are utilising maternity roosts in rocky habitat (DPIE, 2021a). Study of contour maps, aerial imagery and on ground investigation show no evidence of rocky cave habitat for the species. Furthermore, the species was not recorded from nine detector nights in December and January. Most of the known roosts for this species occur in Sandstone geologies, which the site does not possess. The species has been recorded to the east of site at the Holcim quarry, but the study area does not contain any potential breeding constraint habitat, so no Species Credit habitat exists.

Southern Myotis (*Myotis macropus*) is listed as a Species Credit Species. The specified survey period for this species is October through March when females are utilising maternity roosts in hollow-bearing tree, rock fissures or artificial structures (DPIE, 2021a). Two hollow-bearing trees were mapped within 200 m of farm dams along the southern boundary of the survey footprint. Few call pulses from the acoustically similar Long-eared Bats were recorded. Six possible Southern Myotis calls were recorded from nine detector nights. These were sent to Glenn Hoye for clarification. Call parameters suggest it belonged to a *Nyctophilus spp.* not *Myotis macropus*. A local record exists along a creek to the west of site, and the train line to the north contains potentially suitable habitat by way of bridges over the major creeklines. However, there was no evidence of the species presence in the study area, so no Species Credit habitat exists in the development footprint.

Conclusion

Target fauna surveys of the study area were carried out in accordance with the BAM (DPIE, 2020a). December to February surveys showed no presence of Green and Golden Bell Frog, Square-tailed Kite, White-bellied Sea-eagle, Gang-gang Cockatoo, Koala, Greater Glider, Squirrel Glider or Southern Myotis. Habitat assessment ruled out the requirement to survey for Booroolong Frog, Little Eagle, Bush Stone-curlew, Brush-tailed Rock-wallaby, Grey-headed Flying-fox, Large bent-winged Bat and Large-eared Pied Bat due to the lack of suitable habitat in the study area. Potential habitat still exists for the following species who were not surveyed for during required timeframes, either due to site access issues or project timing constraints: Pink-tailed Legless Lizard, Striped Legless Lizard, Glossy Black-Cockatoo, Barking Owl, Powerful Owl and Masked Owl.

One additional threatened species was located in the survey area: one Diamond Firetail was observed foraging in the ephemeral creekline in February 2022.

Potential habitat remains unsurveyed for a number of EPBC Act 1999 listed entities. Submission of the proposal prior to survey work to address the importance of habitat to these species may involve referral to DAWE. Referral guidelines should be consulted.

All Ecosystem Credit Species are to be retained, except Painted Honeyeater which may have mistletoe < 5/ha unchecked over some parts of the site. This is unlikely to impact Ecosystem Credit calculations as they will be based on the Critically Endangered Regent Honeyeater.

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CERTIFIED PRACTISING ECOLOGICAL CONSULTANT
REGISTERED NUMBER: 10

21 March 2022

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Appendices

6.1 APPENDIX A: SURVEY AREA PLATES

Plate A6-1: Study area: grassland, creeklines, woodland.

6.2 APPENDIX B: FAUNA SPECIES LOCATED WITHIN THE STUDY AREA (2021-2022)

Scientific name	Common name	NSW status[1]	Commonwealth status	Observation type
Amphibians				
Crinia parinsignifera	Eastern Sign-bearing Froglet	P	-	Heard
Crinia signifera	Common Eastern Froglet	P	-	Spotlight
Limnodynastes dumerilii	Eastern Banjo Frog	P	-	Spotlight
Limnodynastes peronii	Brown-striped Frog	P	-	Spotlight
Limnodynastes tasmaniensis	Spotted Grass Frog	P	-	Spotlight
Litoria quiriatus	Screaming Tree Frog	P	-	Spotlight
Litoria peroni	Peron's Tree Frog	P	-	Spotlight
Pseudophryne bibronii	Bibron's Toadlet	P	-	Spotlight
Uperoleia laevigata	Smooth Toadlet	P	-	Spotlight
Reptiles				
Chelodina longicollis	Eastern Snake-necked Turtle	P	-	Sighted
Tiliqua scincoides	Eastern Blue-tongue	P	-	Sighted
Birds				
Chenonetta jubata	Australian Wood Duck	P	-	Sighted
Anas superciliosa	Pacific Black Duck	P	-	Sighted
Anas gracilis	Grey Teal	P	-	Sighted
Tachybaptus novaehollandiae	Australasian Grebe	P	-	Sighted
Ocyphaps lophotes	Crested Pigeon	P	-	Sighted
Podargus strigoides	Tawny Frogmouth	P	-	Spotlight
Aegotheles cristatus	Australian Owlet-nightjar	P	-	Heard
Phalacrocorax varius	Pied Cormorant	P	-	Sighted
Pelecanus conspicillatus	Australian Pelican	P	-	Sighted
Elanus axillaris	Black-shouldered Kite	P	-	Sighted
Accipiter fasciatus	Brown Goshawk	P	-	Sighted

Scientific name	Common name	NSW status[1]	Commonwealth status	Observation type
Aquila audax	Wedge-tailed Eagle	P	-	Sighted
Falco cenchroides	Nankeen Kestrel	P	-	Sighted
Falco berigora	Brown Falcon	P	-	Sighted
Fulica atra	Eurasian Coot	P	-	Sighted
Vanellus miles	Masked Lapwing	P	-	Sighted
Turnix spp.	Button-quail spp.	P	-	Sighted
Calyptorhynchus funereus	Yellow-tailed Black-Cockatoo	P	-	Sighted
Eolophus roseicapilla	Galah	P	-	Nesting
Cacatua sanguinea	Little Corella	P	-	Sighted
Platycercus elegans	Crimson Rosella	P	-	Sighted
Platycercus eximius	Eastern Rosella	P	-	Sighted
Psephotus haematonotus	Red-rumped Parrot	P	-	Sighted
Chrysococcyx lucidus	Shining Bronze-Cuckoo	P	-	Heard
Chrysococcyx basalis	Horsfield's Bronze-Cuckoo	P	-	Heard
Dacelo novaeguineae	Laughing Kookaburra	P	-	Sighted
Todiramphus sanctus	Sacred Kingfisher	P	-	Heard
Eurystomus orientalis	Dollarbird	P	-	Sighted
Malurus cyaneus	Superb Fairy-wren	P	-	Sighted
Gerygone olivacea	White-throated Gerygone	P	-	Heard
Acanthiza lineata	Striated Thornbill	P	-	Sighted
Acanthiza chrysorrhoa	Yellow-rumped Thornbill	P	-	Sighted
Manorina melanocephala	Noisy Miner	P	-	Sighted
Philemon corniculatus	Noisy Friarbird	P	-	Heard
Coracina novaehollandiae	Black-faced Cuckoo-shrike	P	-	Sighted
Lalage tricolor	White-winged Triller	P	-	Sighted
Pachycephala rufiventris	Rufous Whistler	P	-	Heard
Colluricincla harmonica	Grey Shrike-thrush	P	-	Heard

Scientific name	Common name	NSW status[1]	Commonwealth status	Observation type
Cracticus torquatus	Grey Butcherbird	P	-	Heard
Cracticus tibicen	Australian Magpie	P	-	Sighted
Rhipidura leucophrys	Willie Wagtail	P	-	Sighted
Corvus coronoides	Australian Raven	P	-	Sighted
Myiagra inequieta	Restless Flycatcher	P	-	Heard
Grallina cyanoleuca	Magpie-lark	P	-	Sighted
Cisticola exilis	Golden-headed Cisticola	P	-	Heard
Acrocephalus australis	Australian Reed-warbler	P	-	Heard
Cincloramphus cruralis	Brown Songlark	P	-	Sighted
Sturnus vulgaris	Common Starling	U	-	Sighted
Stagonopleura guttata	Diamond Firetail	V	-	Sighted
Anthus novaeseelandiae	Australian Pipit	P	-	Sighted
Mammals				
Antechinus spp.	Antechinus spp.	P	-	Camera
Petaurus breviceps	Sugar Glider	P	-	Camera
Trichosurus vulpecula	Common Brushtail Possum	P	-	Spotlighted, camera
Macropus giganteus	Eastern Grey Kangaroo	P	-	Sighted
Macropus robustus	Common Wallaroo	P	-	Sighted
Vombatus ursinus	Common Wombat	P	-	Spotlight
Wallabia bicolor	Swamp Wallaby	P	-	Sighted
Rattus rattus	Black Rat	U	-	Camera
Austronomus australis	White-striped Freetail-bat	P	-	Anabat
Chalinolobus gouldii	Gould's Wattled Bat	P	-	Anabat
Chalinolobus morio	Chocolate Wattled Bat	P	-	Anabat
Miniopterus orianae oceanensis	Large Bent-winged Bat	V	-	Anabat
Mormopterus (Ozimops) ridei	Eastern Free-tailed Bat	P	-	Anabat
Nyctophilus spp.	Long-eared Bat spp.	P	-	Anabat

Scientific name	Common name	NSW status[1]	Commonwealth status	Observation type
Vespadelus darlingtoni	Large Forest Bat	P	-	Anabat
Vespadelus regulus	Southern Forest Bat	P	-	Anabat
Vespadelus vulturnus	Little Forest Bat	P	-	Anabat
Vulpes vulpes	Fox	U	-	Spotlighted
Felis catus	Cat	U	-	Tracks
Oryctolagus cuniculus	Rabbit	U	-	Spotlighted
Bos taurus	European Cattle (feral and domestic)	U	-	Sighted
Ovis aries	Sheep (domestic)	U	-	Sighted
Fish				
Gambusia holbrooki	Plague Minnow	U	-	Sighted

Note: Threatened species are highlighted

[1] Species status (current as at February 2022). P = Protected species, V = Vulnerable species, U = Introduced species.

6.3 APPENDIX C: KOALA SAT SURVEY RESULTS SUMMARY

Date	Plot ID	UTM	Easting	Northing	Selection criteria	Tree species	DBH range	Radial area searched (ha)	Activity level	Use category
13/12/2021	K1, PCT1330	55	768251	6154282	Feed species, large paddock tree	*E. amplifolia/tereticornis,* *E. melliodora,* *E. bridgesiana, E. macrorhyncha*	0.19-1.42	211.1	0%	Low (East Coast low)
14/12/2021	K2, PCT1330	55	766483	6154367	Feed species, large paddock tree	*E. melliodora,* *E. macrorhyncha,* *E. amplifolia/tereticornis*	0.43-1.36	5.5	0%	Low (East Coast low)
14/12/2021	K3, PCT1330	55	766886	6154341	Feed species, large paddock tree	*E. melliodora,* *E. amplifolia/tereticornis,* *E. bridgesiana*	0.38-1.47	26.4	0%	Low (East Coast low)

APPENDIX E

EPBC ACT REFERRAL

Marulan Solar Farm

Application Number: **01054** Commencement Date: **11/04/2022** Status: **Locked**

1. About the project

1.1 Project details

1.1.1 Project title *

Marulan Solar Farm

1.1.2 Project industry type *

Energy Generation and Supply (renewable)

1.1.3 Project industry sub-type

Solar Farm

1.1.4 Estimated start date *

1/06/2024

1.1.4 Estimated end date *

1/12/2053

1.2 Proposed Action details

1.2.1 Provide an overview of the proposed action, including all proposed activities. *

The proposed development is a solar farm on predominantly cleared agricultural land in Marulan, NSW with a total project area of 406.8 hectares. The solar farm will include the following:

- **- Approximately 360,000 modules (solar panels) mounted on single axis-tracker units or fixed mounting frames;**
- **- Between 24 and 55 inverter stations, each containing an inverter between 2.2 and 4.92MW capacity and a 400V/33kV transformer;**
- **- Cabling, electrical connections, and switch-gear, attached to the mounting frame structures, to interconnect modules;**
- **- Underground cabling connecting arrays and inverter stations;**
- **- A 33/132kV substation; A 132 kV switching station in one of two possible locations;**
- **- A BESS, which may be distributed amongst the solar array development area (if DC coupled), or collated into an area proximate to the substation (if AC coupled);**
- **- Overhead or underground 132kV single circuit line power line connecting the solar farm substation to the switching station, which will cut into the existing Essential Energy owned 132kV transmission line;**
- **- Temporary construction compound south of the solar farm including material laydown areas, site offices, vehicle parking, and amenities;**
- **- Construction of an internal road from a new crossover at the site's Munro Road boundary;**
- **- Chain-link/barbed-wire security fence up to three metres in height; and**
- **- Specific native vegetation screening from identified visual impact locations.**

GROUND DISTURBANCE

Some grading works are expected to be required within the project area for installation of the solar racks and associated infrastructure. The solar racks can tolerate gentle slopes and undulating ground conditions, and therefore grading works would be limited to areas that are steeper in slope. and ground disturbance will be minimal, limited to:

- **Filling of three (3) existing farm dams ;**
- **Grass slashing, and removal of rock and timber debris as required in preparation for construction;**
- **The installation of the piles supporting the solar panels: – Which would be driven or screwed into the ground to a depth of approximately 1.5 metres; and – Resulting in a ground disturbance of approximately 1% (3.775 hectares) of the solar farm footprint.**
- **Construction of internal access tracks;**
- **Concrete foundations for the inverter stations, BESS, substation componentry and O&M building;**
- **Trenches for the installation of cables;**
- **Establishment of temporary staff amenities and offices for construction; and**
- **Construction of perimeter security fencing.**

This referral is being made due to the potential for impact on three threatened species: the Koala, Pink-tailed Legless Lizard and Striped Legless Lizard, and one threatened ecological community- Natural Temperate Grasslands.

The Striped Legless Lizard may be impacted by planned soil disturbance within its habitat by the installation of piles for solar panels. The pink-tailed Legless Lizard may be impacted by the disturbance of soil and movement of bush rock during planned construction of the access road from Munro Road. A total of 3.6 hectares of open woodland to be removed as part of the proposed activity, and a total of 16 paddock trees which are Koala feed trees will be removed as part of the planned construction of the solar farm. No Koalas were recorded on site during targeted searches. For a detailed assessment of the potential impact on EPBC-listed species and communities, see Section 2.4.6 in the attached BDAR (pages 80-94).

1.2.2 Is the project action part of a staged development or related to other actions or proposals in the region?

No

1.2.6 What Commonwealth or state legislation, planning frameworks or policy documents are relevant to the proposed action, and how are they relevant? *

The proposed solar farm is consistent with the definition of ‘electricity generating works’, defined under the applicable LEP, the Goulburn Mulwaree Local Environmental Plan 2009 (GMLEP) as: a building or place used for the purpose of— (a) making or generating electricity, or (b) electricity storage. Section 4.36(2) of the EP&A Act provides that a State Environmental Planning Policy may declare any development, or any class or description of development, to be SSD. Clause 8(1) of the State and Regional Development SEPP provides that development is declared to be SSD for the purposes of the EP&A Act if: (a) the development on the land concerned is, by the operation of an environmental planning instrument, not permissible without development consent under Part 4 of the EP&A Act; and (b) the development is specified in Schedule 1 or 2 of the SEPP. The proposed development is SSD on the following grounds: • Permitted only with consent in the RU1 Primary Production zone applying to the site under the GMLEP 2009, satisfying Section 8(1)(a) of the State and Regional Development SEPP; and • The proposed solar farm has CIV exceeding $30 million in accordance with Clause 20 in Schedule 1 of the State and Regional Development SEPP, satisfying Clause 8(1)(b) of the SEPP.

1.2.7 Describe any public consultation that has been, is being or will be undertaken regarding the project area, including with Indigenous stakeholders. Attach any completed consultation documentations, if relevant. *

At the project scoping stage, a community notification letter was issued to 50 non associated landowners located in proximity to the proposed development site. This notification introduced the project, outlined the planning process and provided contact details for the community infoline, mailbox and website. As a result of the consultation 4 phone calls and 2 emails were received between Wednesday 16 December to Thursday 14 January 2021.Feedback and discussion in these enquiries focused on: Registering details for further project updates; Local media interest; Visual impacts to adjacent properties; Site location; Construction impacts; Site access arrangement during operations.

A virtual pre-application discussion with Goulburn Mulwaree Council was completed by Zoom on the 17 November 2020.Council identified no in-principle concerns about the project. Recommendations were: The need for effective engagement with the community and nearby non associated receivers; The general suitability of the visual receiving environment; The benefits of co-location with other large scale projects, such as Gunlake and Holcim quarries; The benefits of considering Jerrara or Rampion Hills Roads in favour of Carrick Road, due to the intersection treatments in place with the highway; The need to ensure appropriate consideration of the potential for impacts to the Sydney Drinking Water Catchment; The bushfire prone status of the land.

Terrain Solar have submitted an initial preliminary connection enquiry to Essential Energy and have received a positive response. Terrain Solar are now in the process of putting together further information to support a full grid connection enquiry. Terrain Solar has issued correspondence to Inflection Resources, who hold exploration licence (EL8673) to the west of the site. An

ACHAR was prepared on Aboriginal cultural values of the Solar Farm site, and consultation with Aboriginal community members was undertaken in accordance with clause 80C of the National Parks and Wildlife Amendment (Aboriginal Objects and Aboriginal Places) Regulation 2010 and the Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010.The consultation steps outlined in the 2010 Guide are: Step 1 – Notification of project proposal and registration of interest. Step 2 – Presentation of information about the proposed project. Step 3 – Gathering information about cultural significance. Step 4 – Review of draft cultural heritage assessment report.

Opportunity for providing input into the cultural heritage values of the study area was provided in the ACHAR methodology, including invitation for feedback on the ACHAR methodology during field survey undertaken in 2021 by Premise and OzArk; and during subsequent test excavations undertaken in 2021 and 2022 by OzArk.

A consultation log has been maintained through the assessment process which details all correspondence with the Registered Aboriginal Parties (RAPs) for the proposed works. In accordance with Stage 4.1.2 of the Consultation Requirements, correspondence in the form of notification letters were issued on 7 May 2021 to the following organisations requesting details of Aboriginal people who may hold cultural knowledge relevant to determining the Aboriginal significance of Aboriginal objects and/or places within the Goulburn Mulwaree LGA: National Native Title Tribunal; Native Title Services Corporation Limited (NTSCORP); Heritage NSW; The Registrar, Aboriginal Land Rights Act 1983 (Office of the Registrar); South East Local Land Services (SELLS); Pejar Local Aboriginal Land Council; Goulburn Mulwaree Council.

In accordance with Stage 4.1.3 of the Consultation Requirements, Premise placed an advertisement in the Koori Mail and the Goulburn Post on 19 May 2021. The advertisement invited all Aboriginal persons and organisations who hold cultural knowledge relevant to determining the significance of Aboriginal objects and places in the study area to register their interest. Also, in accordance with Stage 4.1.3, registration of interest letters and/or emails were sent on 19 May 2021 to all Aboriginal persons and organisations identified through responses from the agencies contacted during Step 4.1.2. The letters provided details on the location and nature of the proposed works, as well as an invitation to register as an Aboriginal stakeholder. Fourteen days were allowed for registrations. A total of 15 Aboriginal stakeholders registered their interest in the proposed works. These groups or individuals constitute the Registered Aboriginal Parties (RAPs) for the MSF. Consultation with RAPs included review of ACHAR methodology, participation in test excavations, community engagement sessions via zoom and review of the final ACHAR. Each review period for a document allowed 28 days.

1.3.1 Identity: Referring party

Privacy Notice:

Personal information means information or an opinion about an identified individual, or an individual who is reasonably identifiable.

By completing and submitting this form, you consent to the collection of all personal information contained in this form. If you are providing the personal information of other individuals in this form, please ensure you have their consent before doing so.

The Department of Agriculture, Water and the Environment (the department) collects your personal information (as defined by the Privacy Act 1988) through this platform for the purposes of enabling the department to consider your submission and contact you in relation to your submission. If you fail to provide some or all of the personal information requested on this platform (name and email address), the department will be unable to contact you to seek further information (if required) and subsequently may impact the consideration given to your submission.

Personal information may be disclosed to other Australian government agencies, persons or organisations where necessary for the above purposes, provided the disclosure is consistent with relevant laws, in particular the Privacy Act 1988 (Privacy Act). Your personal information will be used and stored in accordance with the Australian Privacy Principles.

See our Privacy Policy to learn more about accessing or correcting personal information or making a complaint. Alternatively, email us at privacy@awe.gov.au.

☑ **Confirm that you have read and understand this Privacy Notice ***

1.3.1.1 Is Referring party an organisation or business? *

Yes

Referring party organisation details

ABN	82620885832

Organisation name	Premise Australia Pty Ltd
Organisation address	Level 11, 300 Adelaide St, Brisbane QLD 4000

Referring party details

Name	Isobel Colson
Job title	Senior Ecologist
Phone	0484084615
Email	isobel.colson@premise.com.au
Address	154 Peisley Street, Orange NSW 2800

1.3.2 Identity: Person proposing to take the action

1.3.2.1 Are the Person proposing to take the action details the same as the Referring party details? *

No

1.3.2.2 Is Person proposing to take the action an organisation or business? *

Yes

Person proposing to take the action organisation details

ABN	13616856172
Organisation name	Terrain Solar Pty Ltd
Organisation address	Suite 5, 20 Bundaroo Street, Bowral NSW 2576

Person proposing to take the action details

Name	Tom Allen
Job title	Project Development Manager
Phone	0400079641
Email	tom@terrainsolar.com
Address	Suite 5, 20 Bundaroo Street, Bowral NSW 2576

1.3.2.14 Are you proposing the action as part of a Joint Venture? *

No

1.3.2.15 Are you proposing the action as part of a Trust? *

No

1.3.2.17 Describe the Person proposing the action's history of responsible environmental management including details of any proceedings under a Commonwealth, State or Territory law for the protection of the environment or the conservation and sustainable use of natural resources against the Person proposing to take the action. *

Yes, Terrain Solar has a satisfactory record of responsible environment management. Terrain Solar Pty Ltd and its directors as at the application date has no recorded enforceable undertakings, prosecutions or civil proceedings listed on the public register under **section 308 of the *Protection of the Environment Operations Act 1997*** (the POEO Act). No current or previous EPBC Referrals on register.

1.3.3 Identity: Proposed designated proponent

1.3.3.1 Are the Proposed designated proponent details the same as the Person proposing to take the action? *

Yes

Proposed designated proponent organisation details

ABN	13616856172
Organisation name	Terrain Solar Pty Ltd
Organisation address	Suite 5, 20 Bundaroo Street, Bowral NSW 2576

Proposed designated proponent details

Name	Tom Allen
Job title	Project Development Manager
Phone	0400079641
Email	tom@terrainsolar.com
Address	Suite 5, 20 Bundaroo Street, Bowral NSW 2576

1.3.4 Identity: Summary of allocation

Confirmed Referring party's identity

The Referring party is the person preparing the information in this referral.

ABN	82620885832
Organisation name	Premise Australia Pty Ltd
Organisation address	Level 11, 300 Adelaide St, Brisbane QLD 4000
Representative's name	Isobel Colson
Representative's job title	Senior Ecologist
Phone	0484084615
Email	isobel.colson@premise.com.au
Address	154 Peisley Street, Orange NSW 2800

Confirmed Person proposing to take the action's identity

The Person proposing to take the action is the individual, business, government agency or trustee that will be responsible for the proposed action.

ABN	13616856172
Organisation name	Terrain Solar Pty Ltd
Organisation address	Suite 5, 20 Bundaroo Street, Bowral NSW 2576
Representative's name	Tom Allen
Representative's job title	Project Development Manager
Phone	0400079641
Email	tom@terrainsolar.com
Address	Suite 5, 20 Bundaroo Street, Bowral NSW 2576

Confirmed Proposed designated proponent's identity

The Person proposing to take the action is the individual or organisation proposed to be responsible for meeting the requirements of the EPBC Act during the assessment process, if the Minister decides that this project is a controlled action.

Same as Person proposing to take the action information.

1.4 Payment details: Payment exemption and fee waiver

1.4.1 Do you qualify for an exemption from fees under EPBC Regulation 5.23 (1) (a)? *

No

1.4.3 Has the department issued you with a credit note? *

No

1.4.5 Have you applied for or been granted a waiver for full or partial fees under Regulation 5.21A? *

No

1.4.7 Are you going to apply for a waiver of full or partial fees under EPBC Regulation 5.21A? *

No

1.4.8 Would you like to add a purchase order number to your invoice? *

No

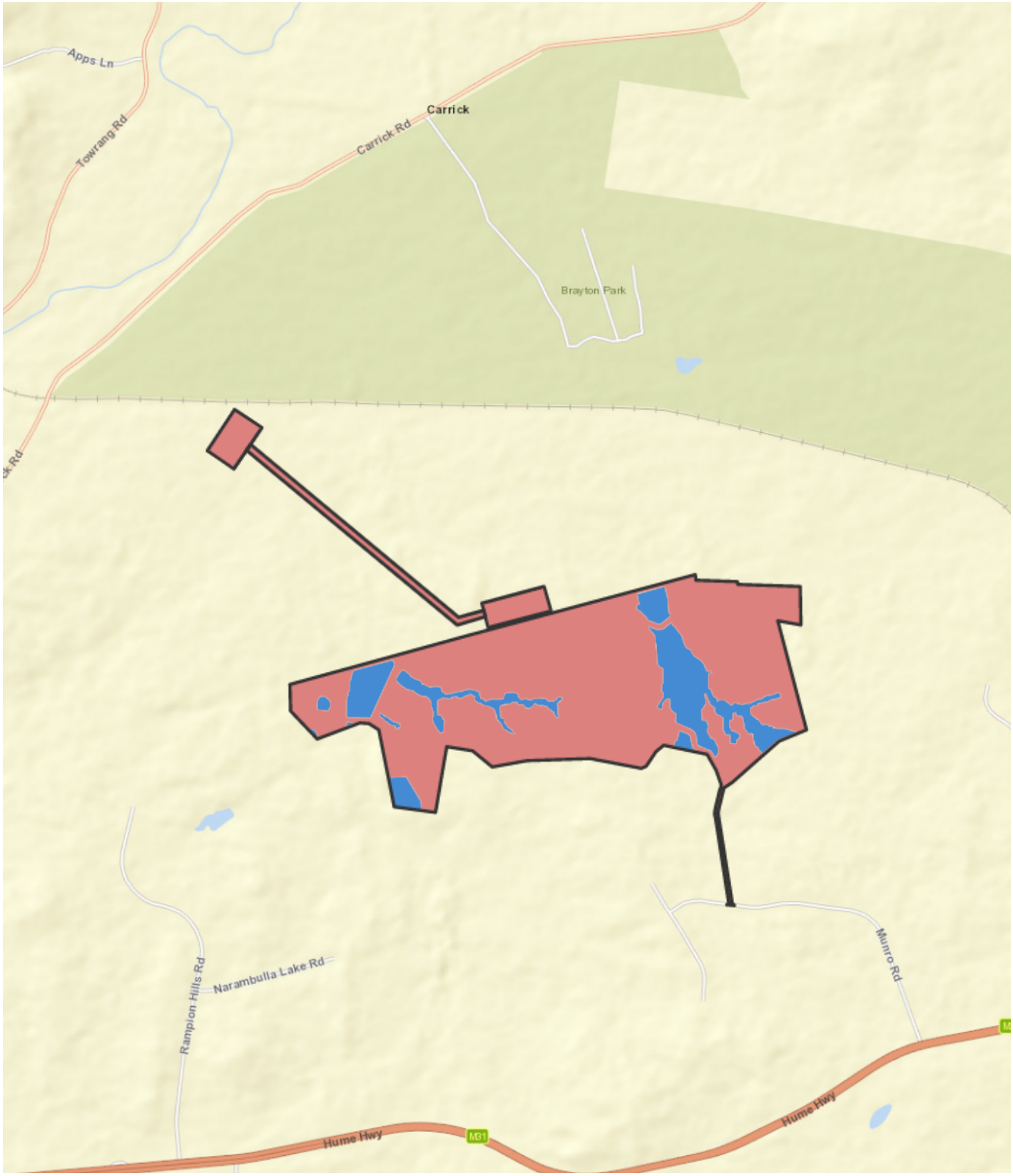
1.4 Payment details: Payment allocation

1.4.10 Who would you like to allocate as the entity responsible for payment? *

Person proposing to take the action

2. Location

2.1 Project footprint



2.2 Footprint details

2.2.1 What is the address of the proposed action? *

Carrick Road, Carrick, NSW, 2580 Australia

2.2.2 Where is the primary jurisdiction of the proposed action? *

New South Wales

2.2.3 Is there a secondary jurisdiction for this proposed action? *

No

2.2.5 What is the tenure of the action area relevant to the project area? *

Part Lot 55 DP 1141136 - Freehold

3. Existing environment

3.1 Physical description

3.1.1 Describe the current condition of the project area's environment.

The Subject Land is located in the Goulburn Mulwaree Local Government Area, 14 km east of Goulburn within the Southern Tablelands of NSW. The development footprint (Subject Land) is approximately 406.3 hectares (ha), of which 375.5 ha is to be occupied by the proposed solar farm. The Subject Land is the subject of this BDAR and is formed of a single allotment: Lot 55 DP 1141136.

The terrain is gently undulating low hills with some gullying associated with waterways. Elevation ranges from 620 metres (m) Australian Height Datum (AHD) in the west to 667 m in the central southern extent of the site.

Existing formal and informal roads present on the property that have been used for access by the farmer will be utilised and upgraded for large vehicle access (7 m width). Existing fencing will be removed and replaced with tall security fencing on the outer boundary of the solar farm. The main access route will be constructed to Munro Road which provides access to the Hume Highway from the southern boundary, to overcome the barrier which is created by the railway line north of the solar farm. General arrangement of the solar farm is shown in Figure 2 of the attached BDAR, on page 9.

Vegetation on the proposed solar farm area consists of cleared modified pastures, low-lying wetland areas with native grasses and sedges, patches of semi-cleared and remnant native woodland, and one native planting.

3.1.2 Describe any existing or proposed uses for the project area.

The current landuse is agricultural, and the land is zoned as RU1 Primary Production. Surrounding land use is RU1 within Lockyersleigh, RU2 Rural Landscape to the south and north, and C3 Environmental Management on the western and part of the southern boundary. The C3 zoning represents a Biodiversity Stewardship site which has been established on an adjoining property. The proposed activity will not require a change in land zoning since it is an approved use under clause 2.36 of the Transport and Infrastructure SEPP.

The Subject Land occurs on land which is the ancestral country of the Gundangurra nation. It is located within the Lockyersleigh property which was established in 1827 as a land grant to Major Lockyer. Lockyersleigh is one of the oldest privately owned properties in the Goulburn area and has been in the same family since the 1850s. The property was initially cleared of timber for grazing sheep for wool production and has undergone extensive pasture modification. The original vegetation on the Subject Land would have been grassy woodlands.

3.1.3 Describe any outstanding natural features and/or any other important or unique values that applies to the project area.

No outstanding natural features or unique values occur on the project area.

3.1.4 Describe the gradient (or depth range if action is to be taken in a marine area) relevant to the project area.

The Subject Land ranges from 620 metres (m) Australian Height Datum (AHD) in the west to 667 m in the central southern extent of the site.

3.2 Flora and fauna

3.2.1 Describe the flora and fauna within the affected area and attach any investigations of surveys if applicable.

Vegetation survey methods are described in the 'Marulan Solar Farm Draft BDAR', section 2.2.2 pages 23-25. Vegetation on the site is detailed in section 2.2.3 to 2.2.6, pages 20-37. Fauna survey results are summarised in the same document, pages 38-42 and Appendix D. Threatened species habitat assessment is detailed in Table 9 (pages 44-64). No threatened fauna were found on the site, but presence is assumed for the Striped Legless Lizard and Pink-tailed Legless Lizard. Suitable habitat for each species is shown in Figures 12 (page 75) and Figure 14 (page 77). No threatened flora were found as a result of targeted searches.

3.2.2 Describe the vegetation (including the status of native vegetation and soil) within the project area.

The Subject Land predominantly sits within the Garland Soil Landscape with the western extent of the site (west of the Narambulla Creek) and part of the proposed access route sits within the Blakney Creek Soil Landscape (Hird, 1991). Soils int he Garland Soil Landscape have formed in-situ from granitic parent rock and form alluvial-colluvial deposits. This Landscape occurs on gently undulating rises and low hills between 600-900 m elevation and is associated with permanent erosional stream

channels. Light sandy duplex soils (Yellow Podzolic Soils) occur on the upper slopes, yellow duplex soils with sandy textured topsoils occur on mid and lower slopes, Sandy Red and Yellow Earths occur on sideslopes and Deep Siliceous Sands occur in drainage lines. Yellow Podzolic Soils have moderately erodible topsoil, moderate fertility, pH of 5.5 and have imperfect drainage. This is similar to Yellow Solodic Soils, however, these soils have moderate drainage. In contrast Siliceous Sands are a minor component of this landscape, are acidic, moderately well-drained with moderately fertility and erodibility. The Blakney Creek Soil Landscape soils have also formed in-situ on alluvial-colluvial materials derived from sandstone, greywacke, phyllite, shale, slate and quartzite. This landscape also occurs between 600-900 m elevation in proximity to widely spaced permanent erosional stream channels. Red Podzolic Soils occur on crests and upper sides of hills and are hardsetting with moderate drainage, high topsoil erodibility and low fertility, with a pH of 5.0. Similarly, Yellow Podzolic Soils in this landscape are also hardsetting but occur on sideslopes and footslopes. These soils have moderate drainage, high topsoil erodibility and low fertility with a pH of 6.5.

Vegetation on the proposed solar farm area consists of cleared modified pastures, low-lying wetland areas with native grasses and sedges, patches of semi-cleared and remnant native woodland, and one native planting.Sampling by Premise has identified three PCTs on the Subject Land:

- **PCT 351 - Brittle Gum - Broad-leaved Peppermint - Red Stringybark open forest in the north-western part (Yass to Orange) of the South Eastern Highlands Bioregion**
- **PCT 1110 - River Tussock - Tall Sedge - Kangaroo Grass moist grasslands of the South Eastern Highlands Bioregion**
- **PCT 1330 - Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion.**

Using the vegetation classifications developed by Tozer et al. (2010), most of the woodland vegetation on the site conforms to the Tableland Grassy Box-Gum Woodland (Map Unit GW p24) and Tableland Swamp Flats Forest (GW p520).Assessment of suitable plant community types (PCTs) has considered several factors including landform, soils, dominant overstorey species and structure. Vegetation identified on the Subject Land was compared to the vegetation community details and scientific descriptions for the relevant PCTs using the BioNet Vegetation Classification System. The Subject Landis located in a fragmented and highly cleared agricultural district and is bordered by cleared agricultural land with modified pastures to the north and east. Remnant native vegetation on the Subject Land is predominantly restricted to the drainage around the Narambulla Creek, and to scattered trees and small patches with exotic understorey, which are connected to varying degrees with several large but fragmented tracts of remnant woodland which adjoin the Subject Land to the south and west. Higher native vegetation covers at close to natural densities exist along the southern boundary of the Subject Land where the proposed access road alignment will connect to Munro Road.

3.3 Heritage

3.3.1 Describe any Commonwealth heritage places overseas or other places recognised as having heritage values that apply to the project area.

No Commonwealth heritage places apply to the project area.

3.3.2 Describe any Indigenous heritage values that apply to the project area.

An ACHAR has been prepared to address Secretary's Environmental Assessment Requirements (SEARs) relevant to Aboriginal heritage and provides an assessment of the likely impacts of the development.
Subject to the SEARs issued for the MSF, an archaeological survey was undertaken over a period of three days between 28 September 2021 and 30 September 2021 by a team of 2 archaeologists and 1 Registered Aboriginal Party (RAP) representative. Subsequent test excavations were undertaken over a period of 6 days during December 2021 and February 2022. A team of three archaeologists and five RAP representatives per day undertook the test excavation program.
A total of six archaeological sites have been identified within the study area inclusive of five previously

recorded AHIMS sites and one new site (AHIMS #51-6-0908) recorded during the site survey. One additional site is located directly adjacent to the border of the study area.
All six sites are artefact sites and consist of low-density artefact scatters or isolated finds.
One additional site is located out of the study area, however, is located adjacent to the study area boundary and consists of a stone quarry site (AHIMS ID # 51-6-0372).
A total of six locations were targeted through test excavations. Artefacts from the program were predominantly recorded in the top soil and the underlying sandy loam layer within the upper 15cm of the soil profile. A total number of 203 Aboriginal objects were recorded from 19 out of 72 test excavation squares.
With the inclusion of new site recordings due to the test excavation program, there are nine known sites within the study area.
Consideration of data both from the region and the study area indicates that Aboriginal occupation was focused near the hills to the south and east of the study area, with only isolated camping activities evident in the rolling hills that characterise much of the study area. Analysis of test excavation findings indicates that occupation was more concentrated in the southwest of the study area nearer to the hill topography with only low-density occupation in the less-sheltered rolling hills. The evidence suggests Aboriginal occupation within the study area at least during the past 7,000 years, with activity predominantly occurring around landforms associated with Narambulla Creek.

More detailed information is recorded in Section 3.7, 3.8 and 5 in the attached 'Marulan Solar Farm ACHAR'.

3.4 Hydrology

3.4.1 Describe the hydrology characteristics that apply to the project area and attach any hydrological investigations or surveys if applicable. *

See the attached hydrology report 'Marulan Hydrology Report' for details of the hydrology characteristics which apply to the project area.

Based off the topography, drainage of the subject site is generally as follows: • Topography ranges from 703.591m AHD to 654.597m AHD; • The site has a small ridge that traverses the site from south to north; • The proposed solar farm location is on a small ridge; • The site generally drains in a north direction to Wollondily River.

Two listed creeks are located on the site: Narambulla Creek and Lockyersleigh Creek. Three sub-catchments occur on the solar farm footprint (see appendix B of the attached 'Marulan Hydrology Report'.

4. Impacts and mitigation

4.1 Impact details

Potential Matters of National Environmental Significance (MNES) relevant to your proposed action area.

EPBC Act section	Controlling provision	Impacted	Reviewed
S12	World Heritage	No	Yes
S15B	National Heritage	No	Yes
S16	Ramsar Wetland	No	Yes
S18	Threatened Species and Ecological Communities	Yes	Yes

EPBC Act section	Controlling provision	Impacted	Reviewed
S20	Migratory Species	No	Yes
S21	Nuclear	No	Yes
S23	Commonwealth Marine Area	No	Yes
S24B	Great Barrier Reef	No	Yes
S24D	Water resource in relation to large coal mining development or coal seam gas	No	Yes
S26	Commonwealth Land	No	Yes
S27B	Commonwealth heritage places overseas	No	Yes
S28	Commonwealth or Commonwealth Agency	No	Yes

4.1.1 World Heritage

You have identified your proposed action will likely directly and/or indirectly impact the following protected matters.

A direct impact is a direct consequence of an action taken – for example, clearing of habitat for a threatened species or permanent shading on an ecological community as the result of installing solar panels.

An indirect impact is an 'indirect consequence' such as a downstream impact or a facilitated third-party action.

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4.1.1.1 Is the proposed action likely to have any direct and/or indirect impact on any of these protected matters? *

No

4.1.1.3 Briefly describe why your action is unlikely to have a direct and/or indirect impact. *

No World Heritage Listed sites occur on or near the Subject Land and therefore will not be impacted by the action.

4.1.2 National Heritage

You have identified your proposed action will likely directly and/or indirectly impact the following protected matters.

A direct impact is a direct consequence of an action taken – for example, clearing of habitat for a threatened species or permanent shading on an ecological community as the result of installing solar panels.

An indirect impact is an 'indirect consequence' such as a downstream impact or a facilitated third-party action.

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4.1.2.1 Is the proposed action likely to have any direct and/or indirect impact on any of these protected matters? *

No

4.1.2.3 Briefly describe why your action is unlikely to have a direct and/or indirect impact. *

No items of National Heritage significance occur on or near the Subject Land and therefore will not be impacted by the proposed action.

4.1.3 Ramsar Wetland

You have identified your proposed action will likely directly and/or indirectly impact the following protected matters.

A direct impact is a direct consequence of an action taken – for example, clearing of habitat for a threatened species or permanent shading on an ecological community as the result of installing solar panels.

An indirect impact is an 'indirect consequence' such as a downstream impact or a facilitated third-party action.

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4.1.3.1 Is the proposed action likely to have any direct and/or indirect impact on any of these protected matters? *

No

4.1.3.3 Briefly describe why your action is unlikely to have a direct and/or indirect impact. *

No RAMSAR wetlands occur on or near the Subject Land and therefore will not be impacted upon by the proposed action.

4.1.4 Threatened Species and Ecological Communities

You have identified your proposed action will likely directly and/or indirectly impact the following protected matters.

A direct impact is a direct consequence of an action taken – for example, clearing of habitat for a threatened species or permanent shading on an ecological community as the result of installing solar panels.

An indirect impact is an 'indirect consequence' such as a downstream impact or a facilitated third-party action.

Threatened species

Direct impact	Indirect impact	Species
Yes		Acacia bynoeana
No	No	Acacia bynoeana
Yes		Anthochaera phrygia
No	No	Anthochaera phrygia
Yes		Aprasia parapulchella
Yes		Botaurus poiciloptilus

Direct impact	Indirect impact	Species
No	No	Botaurus poiciloptilus
Yes		Calidris ferruginea
No	No	Calidris ferruginea
Yes		Callocephalon fimbriatum
No	No	Callocephalon fimbriatum
Yes		Chalinolobus dwyeri
No	No	Chalinolobus dwyeri
Yes		Dasyurus maculatus maculatus (SE mainland population)
No	No	Dasyurus maculatus maculatus (SE mainland population)
Yes		Delma impar
Yes		Dodonaea procumbens
No	No	Dodonaea procumbens
Yes		Eucalyptus aggregata
No	No	Eucalyptus aggregata
Yes		Falco hypoleucos
No	No	Falco hypoleucos
Yes		Grantiella picta
No	No	Grantiella picta
Yes		Hirundapus caudacutus
No	No	Hirundapus caudacutus
Yes		Lathamus discolor
No	No	Lathamus discolor
Yes		Leucochrysum albicans subsp. tricolor
No	No	Leucochrysum albicans subsp. tricolor
Yes		Macquaria australasica
No	No	Macquaria australasica
Yes		Numenius madagascariensis
No	No	Numenius madagascariensis
Yes		Petauroides volans
No	No	Petauroides volans
Yes		Petaurus australis australis
No	No	Petaurus australis australis
Yes		Petrogale penicillata
No	No	Petrogale penicillata
Yes		Phascolarctos cinereus (combined populations of Qld, NSW and the ACT)

Direct impact	Indirect impact	Species
No	Yes	Phascolarctos cinereus (combined populations of Qld, NSW and the ACT)
Yes		Polytelis swainsonii
No	No	Polytelis swainsonii
Yes		Pomaderris cotoneaster
No	No	Pomaderris cotoneaster
Yes		Pomaderris pallida
No	No	Pomaderris pallida
Yes		Pseudomys novaehollandiae
No	No	Pseudomys novaehollandiae
Yes		Pteropus poliocephalus
No	No	Pteropus poliocephalus
Yes		Pycnoptilus floccosus
No	No	Pycnoptilus floccosus
Yes		Rhizanthella slateri
No	No	Rhizanthella slateri
Yes		Rostratula australis
No	No	Rostratula australis
Yes		Rutidosis leptorhynchoides
No	No	Rutidosis leptorhynchoides
Yes		Thesium australe
No	No	Thesium australe

Ecological communities

Direct impact	Indirect impact	Ecological community
Yes		Natural Temperate Grassland of the South Eastern Highlands
Yes		White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland

4.1.4.1 Is the proposed action likely to have any direct and/or indirect impact on any of these protected matters? *

Yes

4.1.4.2 Briefly describe why your action has a direct and/or indirect impact on these protected matters. *

Detailed information on the MNES assessment undertaken is documented in Section 2.4.6.2 of the attached draft BDAR (Pages 74-85).

Natural Temperate Grasslands of the South Eastern Highlands Critically Endangered Ecological Community (NTG-SEH):

The location of the threatened ecological community is the overflow of the Narambulla Creek on the western side of the proposed solar farm footprint. A large part of the area has been avoided but a track will be constructed with a culvert over the creek and fenceline will be cleared as part of the proposed development. **The total area of planned clearing (direct impact) of this community on the Marulan Solar Farm is 5.07 hectares.**

Koala:

SAT surveys and spotlighting was conducted with the result that no recent or historical evidence of the species was found on the Subject Land. However, the presence of high-use tree species on the Subject Land and proximity of recent records mean that the site is potential habitat for the species. Clearing of habitat will consist of a total area of 3.6 hectares of open woodland to be removed as part of the proposed activity, and a total of 16 paddock trees, all of which are Koala feed species.

Striped Legless Lizard:

The species has a known population at nearby Goulburn and the Subject Land is located within the modelled distribution for the species. A total area of 4.7 ha of exotic pasture has been identified as potential Striped Legless Lizard habitat. 1.1 hectares have been avoided in the planning process and the remaining 3.6 ha of exotic pasture will be cleared as part of the proposed activity.

Pink-tailed Legless Lizard:

The Pink-tailed Legless Lizard (*Aprasia parapulchella*) is listed as Vulnerable under the EPBC Act. The Solar Farm occurs within the known range for the species, and the species has been recorded from north of the site at Taralga, NSW. *Aprasia parapulchella* relies on open woodland areas with scattered, partially buried rock and native grasses. Two areas within the project boundary include potential habitat for the species: the south-western corner which includes rocky outcrops, and the southern access road which also includes some native grasses and scattered surface rock. No survey was conducted for the species and therefore presence must be assumed. The total potential habitat area for the species within the project boundary is 3.25 ha. A total area of 1.91 ha of habitat is to be avoided with a remaining area of 1.34 ha of potential habitat to be disturbed as part of the proposed Solar Farm. Disturbance will involve the removal of rock along the proposed access road. Rock to be removed will be placed in adjacent areas.

4.1.4.4 Do you consider this likely direct and/or indirect impact to be a Significant Impact? *

Yes

4.1.4.5 Describe why you consider this to be a Significant Impact. *

Natural Temperate Grassland:

As per the draft BDAR, the vegetation around Narambulla Creek meets the minimum diagnostic criteria for this community.

Method 'B' of CEEC condition criteria was used to assess whether the proposed development requires referral.

Sampling was carried out during October 2021 in favourable conditions, during spring and after a season of high rainfall. Two of the tree vegetation integrity sampled in the area of native grasslands in the creek conformed to the EPBC CEEC condition criteria when assessed using Method 'B'. As per the approved conservation advice for the NTG- SEH: "The areas considered critical to the survival of the ecological community cover all patches that meet the key diagnostic characteristics and condition thresholds for the ecological community plus buffer zones". Proposed actions include the construction of a new road and clearing of vegetation for trenching of an underground cable. These are potentially significant impacts on the Natural Temperate Grasslands community since they involve the permanent clearing of an area 'critical to the survival of the community'. Permanent clearing or significant soil disturbance proposed on the site will equal 5.07 hectares in total. Therefore, referral is required to assess the impacts of the project on the NTG – SEH CEEC.

Koala:

Based on the updated Conservation Advice and the Koala habitat assessment tool in the previous referral guidelines for the Vulnerable Koala, the habitat within the southern woodland which connects to the Subject Land, and includes trees on the Subject Land, can be classified as Critical Habitat. The available habitat on the Subject Land is not currently in use by the Koala. Trees to be removed occur on the edge of this critical habitat and are spaced further apart than the southern woodland with some occurring as individual paddock trees. Trees are large and mature and Koalas are known to preferentially feed on large trees, including paddock trees. For this reason, there may be some adverse effect on the critical habitat in the locality in the short term. Tree planting will replace trees but the lag time between planting and maturity will reduce the number of suitable feed trees in the short term. The area of trees to be removed accounts for approximately 3.3 % of the contiguous critical habitat (the southern woodland covers approximately 110 hectares).

The habitat on the Solar Farm site may form part of an individual's range and be used for dispersal or shelter in drought and during fire. It is not likely that removal of a small number of trees from the edge of the woodland will greatly affect the suitability of the site as a refuge for the Koala, since the woodland along the southern boundary will not be cleared. However, the activity will require referral, to seek guidance in lieu of up-to-date referral guidelines for the species, and the clearing of feed trees from the Subject Land.

Striped Legless Lizard:

Due to time constraints of the proposed solar farm the species was not surveyed for and instead presence is assumed, therefore it must be assumed that the proposed solar farm may impact on an important population of the species. While avoidance and minimisation measures will be employed, there is uncertainty whether the action will result in a significant impact on the Striped Legless Lizard and may fit the High risk action: Changes in soil structure and terrestrial cover (such as removal of rocks and/or fallen timber) and therefore referral is required.

Pink-tailed Legless Lizard:

Rocks are important for *Aprasia parapulchella* because they provide shelter and foraging opportunities. The rocks which are to be removed will be placed in the paddock immediately adjacent to the access road, and rocks will not be removed from the ridgeline in the southwest of the site. However the movement of rocks during construction of the access road would have a temporary disruptive effect on a local

population through disturbance and would therefore have some negative impact on habitat critical for the species. Therefore, referral is required.

4.1.4.7 Do you think your proposed action is a controlled action? *

Yes

4.1.4.8 Please elaborate why you think your proposed action is a controlled action. *

The matter is a controlled action due to the risk of a significant impact under the EPBC Guidelines for referral.

4.1.4.10 Please describe any avoidance or mitigation measures proposed for this action and attach any supporting documentation for these avoidance and mitigation measures. *

Opportunities to avoid and minimise impacts were considered during the planning stage of the Solar Farm. The Subject Land has been reconfigured in response to on-ground habitat assessment and the identification of sensitive areas. This includes the exclusion of an area of rocky habitat in the southwestern corner which is potential habitat for the Pink-tailed Legless Lizard, amendment of the southern boundary to avoid areas of native woodland and exclusion of streams and wetland areas where feasible. A large part of the Natural Temperate Grasslands has been avoided as part of this action.

Four potential (prescribed) impacts from Chapter 6 of the NSW BAM 2020 have been identified as relevant for threatened species on the Subject Land. These are the presence of rock outcrops, which are potential habitat for the Pink-tailed Legless Lizard, exotic-dominated pastures which may form part of the habitat of the Striped Legless Lizard, waterbodies along which the Natural Temperate Grassland occur and a potential breeding habitat tree for threatened owls (listed under the BC Act) along the proposed access route.

A large rock outcrop in the south-western corner of the Subject Land has been excluded from the tracker footprint along with a 50m buffer. The 26m corridor in which the access route is planned contains small surface rocks and some larger embedded rocks. Small, embedded rocks and a large, embedded rock along the proposed access route cannot be avoided due to the restricted access options for the site.

Sedimentation during construction is a potential impact of the proposed Solar Farm. Trackers will be installed by drilling of post holes and other measures to reduce soil disturbance. Buffers of 40 metres have been applied to the streams and creeks for the construction of solar panel trackers. A number of small farm dams will be decommissioned and filled. The Water Cycle Management Study conducted for the site will inform which dams must be left in place to avoid water quality impacts.

Further mitigation measures will be employed to reduce the impact of the Solar Farm on threatened species and communities, as documented in Section 3.3 of the attached BDAR. These include a vegetation removal strategy to reduce the risk of impact to fauna during vegetation removal, a weed management strategy to reduce the potential risk of impact from weed incursions as a result of the proposed Solar Farm, an animal pest management and monitoring strategy to control foxes, rabbits and mice on the Solar Farm land, fire management plan to reduce the risk of wildfire within the proposed Solar Farm and adjacent areas, and movement of any felled timber or bushrock to adjacent woodland to mitigate the loss of hollows and rocky habitat from the Subject Land.

4.1.4.11 Please describe any proposed offsets and attach any supporting documentation relevant to these measures. *

Offsetting via the Bilateral Agreement with NSW Government is proposed, via the Biodiversity Offsets Scheme (BOS). Clearing of PCT 1110 (Natural Temperate Grasslands) and impacts on the Striped Legless Lizard and Pink-tailed Legless Lizard will generate an Ecosystem Credit and Species Credit offset liability under the BOS. The total offset liability is documented in the attached draft BDAR. Offsetting for the Koala is currently contained within the Ecosystem Credit liability and additional offsets may be required.

4.1.5 Migratory Species

You have identified your proposed action will likely directly and/or indirectly impact the following protected matters.

A direct impact is a direct consequence of an action taken – for example, clearing of habitat for a threatened species or permanent shading on an ecological community as the result of installing solar panels.

An indirect impact is an 'indirect consequence' such as a downstream impact or a facilitated third-party action.

Direct impact	Indirect impact	Species
Yes		Actitis hypoleucos
Yes		Apus pacificus
Yes		Calidris acuminata
Yes		Calidris ferruginea
Yes		Calidris melanotos
Yes		Gallinago hardwickii
Yes		Hirundapus caudacutus
Yes		Monarcha melanopsis
Yes		Motacilla flava
Yes		Myiagra cyanoleuca
Yes		Numenius madagascariensis
Yes		Rhipidura rufifrons

4.1.5.1 Is the proposed action likely to have any direct and/or indirect impact on any of these protected matters? *

No

4.1.5.3 Briefly describe why your action is unlikely to have a direct and/or indirect impact. *

Species which may utilise the Subject Land during migration are the Latham's Snipe and Sharp-tailed Sandpiper. Both species prefer mudflats with emergent vegetation but may also use wet tussock grassland and sedgeland. Potential suitable habitat on the proposed Solar Farm site is restricted to areas immediately around Narambulla Creek. Conditions are likely to only be suitable during periods of high rainfall when these systems have shallow water present. Waterways and their flood zones have been excluded from the Subject Land (Solar Farm footprint). Potential indirect impacts on the species are water quality changes and noise during construction. Sediment management measures during construction will minimise the risk of causing any impacts to water quality. Noise management will include avoidance of sensitive areas such as those around creeks, and management of noise levels as per the EIS. Consequently, no direct or indirect impacts on these migratory species is anticipated.

4.1.6 Nuclear

4.1.6.1 Is the proposed action likely to have any direct and/or indirect impact on this protected matter? *

No

4.1.6.3 Briefly describe why your action is unlikely to have a direct and/or indirect impact. *

No nuclear storage or generation facilities occur on or near the Subject Land and therefore will not be impacted on by the proposed action.

4.1.7 Commonwealth Marine Area

You have identified your proposed action will likely directly and/or indirectly impact the following protected matters.

A direct impact is a direct consequence of an action taken – for example, clearing of habitat for a threatened species or permanent shading on an ecological community as the result of installing solar panels.

An indirect impact is an 'indirect consequence' such as a downstream impact or a facilitated third-party action.

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4.1.7.1 Is the proposed action likely to have any direct and/or indirect impact on any of these protected matters? *

No

4.1.7.3 Briefly describe why your action is unlikely to have a direct and/or indirect impact. *

No Commonwealth Marine Areas occur on or near the Subject Land and will not be directly or indirectly impacted by the proposed action.

4.1.8 Great Barrier Reef

4.1.8.1 Is the proposed action likely to have any direct and/or indirect impact on this protected matter? *

No

4.1.8.3 Briefly describe why your action is unlikely to have a direct and/or indirect impact. *

The Subject Land does not occur within the catchment area for the Great Barrier Reef and the action will not impact on this protected matter.

4.1.9 Water resource in relation to large coal mining development or coal seam gas

4.1.9.1 Is the proposed action likely to have any direct and/or indirect impact on this protected matter? *

No

4.1.9.3 Briefly describe why your action is unlikely to have a direct and/or indirect impact. *

The proposed development is not a large coal mining development or coal seam gas development.

4.1.10 Commonwealth Land

You have identified your proposed action will likely directly and/or indirectly impact the following protected matters.

A direct impact is a direct consequence of an action taken – for example, clearing of habitat for a threatened species or permanent shading on an ecological community as the result of installing solar panels.

An indirect impact is an 'indirect consequence' such as a downstream impact or a facilitated third-party action.

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4.1.10.1 Is the proposed action likely to have any direct and/or indirect impact on any of these protected matters? *

No

4.1.10.3 Briefly describe why your action is unlikely to have a direct and/or indirect impact. *

The Subject Land does not occur on or near Commonwealth Land.

4.1.11 Commonwealth heritage places overseas

You have identified your proposed action will likely directly and/or indirectly impact the following protected matters.

A direct impact is a direct consequence of an action taken – for example, clearing of habitat for a threatened species or permanent shading on an ecological community as the result of installing solar panels.

An indirect impact is an 'indirect consequence' such as a downstream impact or a facilitated third-party action.

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4.1.11.1 Is the proposed action likely to have any direct and/or indirect impact on any of these protected matters? *

No

4.1.11.3 Briefly describe why your action is unlikely to have a direct and/or indirect impact. *

The Subject Land does not include Commonwealth Heritage places overseas and the proposed action will have no impact on these protected matters.

4.1.12 Commonwealth or Commonwealth Agency

4.1.12.1 Is the proposed action to be taken by the Commonwealth or a Commonwealth Agency? *

No

4.2 Impact summary

Conclusion on the likelihood of significant impacts

You have indicated that the proposed action will likely have a significant impact on the following Matters of National Environmental Significance:

- Threatened Species and Ecological Communities (S18)

Conclusion on the likelihood of unlikely significant impacts

You have indicated that the proposed action will unlikely have a significant impact on the following Matters of National Environmental Significance:

- World Heritage (S12)
- National Heritage (S15B)
- Ramsar Wetland (S16)
- Migratory Species (S20)
- Nuclear (S21)
- Commonwealth Marine Area (S23)
- Great Barrier Reef (S24B)
- Water resource in relation to large coal mining development or coal seam gas (S24D)
- Commonwealth Land (S26)
- Commonwealth heritage places overseas (S27B)
- Commonwealth or Commonwealth Agency (S28)

4.3 Alternatives

4.3.1 Do you have any possible alternatives for your proposed action to be considered as part of your referral? *

No

4.3.8 Describe why alternatives for your proposed action were not possible. *

Due to the limited timeframe attached to the SEARS and lease agreement no other options are available for timing. The SEARS and landholder agreement limit the land which may be used in the development to the proposed project area.

5. Lodgement

5.1 Attachments

1.2.7 Public consultation regarding the project area

#1.	Marulan Solar Farm ACHAR	Document	Aboriginal Cultural Heritage Report

3.1.1 Current condition of the project area's environment

#1.	Marulan Solar Farm BDAR	Document	Draft Biodiversity Development Assessment Report

3.2.1 Flora and fauna within the affected area

#1.	Marulan Solar Farm BDAR	Document	Draft Biodiversity Development Assessment Report

3.3.2 Indigenous heritage values that apply to the project area

#1.	Marulan Solar Farm ACHAR	Document	Aboriginal Cultural Heritage Report

3.4.1 Hydrology characteristics that apply to the project area

#1.	Marulan Hydrology Report	Document	Hydrology Report

4.1.4.2 (Threatened Species and Ecological Communities) Why your action has a direct and/or indirect impact on the identified protected matters

#1.	Marulan Solar Farm BDAR	Document	Draft Biodiversity Development Assessment Report

4.3.8 Why alternatives for your proposed action were not possible

#1.	Marulan Solar Farm BDAR	Document	Draft Biodiversity Development Assessment Report

5.2 Declarations

Completed Referring party's declaration

The Referring party is the person preparing the information in this referral.

ABN	82620885832
Organisation name	Premise Australia Pty Ltd
Organisation address	Level 11, 300 Adelaide St, Brisbane QLD 4000
Representative's name	Isobel Colson
Representative's job title	Senior Ecologist
Phone	0484084615
Email	isobel.colson@premise.com.au
Address	154 Peisley Street, Orange NSW 2800

☑ Check this box to indicate you have read the referral form. *

☑ I would like to receive notifications and track the referral progress through the EPBC portal. *

☑ By checking this box, I, **Isobel Colson of Premise Australia Pty Ltd**, declare that to the best of my knowledge the information I have given on, or attached to this EPBC Act Referral is complete, current and correct. I understand that giving false or misleading information is a serious offence. *

☑ I would like to receive notifications and track the referral progress through the EPBC portal. *

Completed Person proposing to take the action's declaration

The Person proposing to take the action is the individual, business, government agency or trustee that will be responsible for the proposed action.

ABN	13616856172
Organisation name	Terrain Solar Pty Ltd
Organisation address	Suite 5, 20 Bundaroo Street, Bowral NSW 2576
Representative's name	Tom Allen
Representative's job title	Project Development Manager
Phone	0400079641
Email	tom@terrainsolar.com
Address	Suite 5, 20 Bundaroo Street, Bowral NSW 2576

Check this box to indicate you have read the referral form. *

I would like to receive notifications and track the referral progress through the EPBC portal. *

I, **Tom Allen of Terrain Solar Pty Ltd**, declare that to the best of my knowledge the information I have given on, or attached to the EPBC Act Referral is complete, current and correct. I understand that giving false or misleading information is a serious offence. I declare that I am not taking the action on behalf or for the benefit of any other person or entity. *

I would like to receive notifications and track the referral progress through the EPBC portal. *

Completed Proposed designated proponent's declaration

The Proposed designated proponent is the individual or organisation proposed to be responsible for meeting the requirements of the EPBC Act during the assessment process, if the Minister decides that this project is a controlled action.

Same as Person proposing to take the action information.

Check this box to indicate you have read the referral form. *

I would like to receive notifications and track the referral progress through the EPBC portal. *

I, **Tom Allen of Terrain Solar Pty Ltd**, the Proposed designated proponent, consent to the designation of myself as the Proposed designated proponent for the purposes of the action described in this EPBC Act Referral. *

I would like to receive notifications and track the referral progress through the EPBC portal. *

APPENDIX F

EPBC REFERRAL SUPPORTING LETTER

Premise Australia Pty Ltd
ABN: 82 620 885 832
154 Peisley St, Orange NSW 2800
PO Box 1963, Orange NSW 2800
02 6393 5000
orange@premise.com.au
premise.com.au

Our Ref: 221106_LET_006B

27 May 2022

Sarah Dent
Southern NSW Assessments Section | Environment Approvals Division
Department of Agriculture, Water and the Environment
John Gorton Building
GPO Box 858
Canberra ACT, 2601

Dear Sarah

PROPOSED MARULAN SOLAR FARM – REFERAL 01054 UNDER THE ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999

We refer to the above matter and write further to our Teams meeting of 24 May 2021 with Sarah Dent and Mark Jenkins of the Department of Agriculture, Water and the Environment (DAWE).

We understand that DAWE seek additional information to assist in their assessment of the Marulan Solar Farm (EPBC Act referral 01054), submitted via the DAWE EPBC Act Business Portal on 26 April 2022.

We understand that DAWE specifically seek additional information in respect of the following:

- Clarification/confirmation of the extent of direct and indirect impacts
- Clarification of the contextual environment of the impacted areas of the referred species
- The nature/level of development to the impacted areas of the referred species
- A high level summary of mitigation measures to be implemented in the delivery of the project to minimise direct and indirect impacts to the referred species during construction and operation of the proposed solar farm.

The following sections of this letter considers each of the four referred species in the context of the above dot points.

<u>NATURAL TEMPERATE GRASSLANDS (PCT 1110)</u>

Context

Natural Temperate Grassland (NTG) was identified via site surveys in the low lying, wet areas adjacent to creeks within the subject land, particularly along the alignment of Narambulla Creek. The vegetation is described in Table 6 and Section 2.2.4.3 of the Premise Biodiversity Development Assessment Report (BDAR) as *Moist grassland dominated by the native grasses Tussock (Poa labillardierei subsp. labillardierei) and Tall Sedge (Carex appressa), as well as the exotics Phalaris (Phalaris aquatica), a Fescue (Vulpias pp.) and Blackberry (Rubus fructicosus agg.*

Anglocandicans). This moist grassland vegetation continues downstream along Narambulla Creek, in varying condition, spreading out along low lying areas to where it meets the Wollondilly River approximately 2 km north of the subject land. The total area of Natural Temperate Grassland on the subject land with the potential to be impacted by the project is 5.07 ha, which is part of a larger area extending downstream over an estimated 144.42 ha (Figure 10 of the BDAR and depicted in **Appendix A, Figure 1**). It is also noted that a mapped extent of Natural Temperate Grassland in the central area of the site (approximately 1.36 ha) has been avoided and included in a project exclusion area. This area is reflected in **Figure 1** in **Appendix A**.

This vegetation community has endured the recent severe drought, and persisted on the subject land as part of an agricultural grazing system for many years.

Impact summary

Impacts to NTG areas are described in relation to **Figure 2** and **Figure 3** in **Appendix A**.

Figure 3 identifies the alignment of a connecting electricity transmission line (ETL) that would be built either above or below ground, together with a supporting internal access road.

If the ETL is constructed underground, it would be built using a cut and cover trenching technique and the land would be rehabilitated on completion to ensure reestablishment of the NTG. If above ground, three poles, with a permanent disturbance footprint of 10m2 each (30m2 in total) would be erected. Areas disturbed during construction would be minimised and rehabilitated on completion to ensure reestablishment of the NTG.

The road through this area would be a width of 5m, together with 0.5 metre either side for drainage management. Low lying sections would be constructed utilising culverts to ensure no significant change to water movement. During construction, careful controls would be implemented to limit the spread of sediment or other materials with the potential to impact water quality, managed through a soil and water management plan as a part of the project CEMP. Indicative measures are outlined in Table 1. The area of permanent disturbance to the NTG in this area is approximately 0.39 hectares.

In **Figure 3**, there are two areas of NTG disturbance.

The north-western disturbance area would be partly or fully impacted by solar panels (trackers and strings), together with minor electrical trenching to connect to inverters. Whilst disturbance in this area is expected, this would be offset through the measures outlined in the *Biodiversity Conservation Act 2016*. The landscape would be rehabilitated on completion to encourage reestablishment of the NTG. The area of permanent disturbance in this area is approximately 0.45 hectares.

The area in the south of the exclusion zone would be impacted by construction of an internal road connecting the areas of the solar farm together. The method of construction and mitigation measures would be as per the measures outlined in relation to the ETL alignment and road above, and the measures outlined in Table 1. The area of permanent disturbance in this area is approximately 0.1 hectares.

The original BDAR also included areas for visual screening by means of vegetation planting at the north and south of the exclusion zone, which would have had the potential to impact the NTG. These screening areas are not required as a result of the Landscape and Visual Impact Assessment and have therefore been removed.

Avoidance

Appendix A, Figure 4 shows areas of NTG adjacent to the creek in the centre of the site that are not impacted by the project and would remain within the exclusion areas. Measures to manage these areas during construction are outlined in Table 1.

Through a process of refinement of project components, the proposed solar farm will result in the loss of 9,400 square metres (0.94 ha), which represents 0.6% of this vegetation community along Narambulla Creek. It is predicted that the condition of NTG will improve with the total or temporary removal of livestock from the landscape, and the extent will increase with the protection of riparian areas in the proposed exclusion zones on the subject land.

Mitigation Measures

To minimise impacts to the Natural Temperate Grasslands, it is proposed to include a suite of controls within a project Construction Environmental Management Plan (CEMP) that would be adopted by the project EPC contractor and managed for the life of the project. These measures include but are not limited to the measures outlined by project phase in **Table 1**.

Table 1 – Summary of mitigation measures – Natural Temperate Grassland

Phase	Mitigation Measure
Pre-construction	Prepare a detailed NTG management Plan to be incorporated into the project CEMP to outline measures for protection and mitigation (including those outlined within this document), to be prepared in conjunction with project ecologists.
	Areas of NTG that are not proposed to be disturbed are to be identified prior to works commencing and are to be clearly marked with demarcation tape/fencing to ensure that these areas are clearly understood and to limit inadvertent entry/disturbance
Construction	Areas of NTG are not to be used for equipment laydown areas or for the parking of vehicles
	Laydown and vehicle parking areas to be established well clear of NTG areas.
	Run-off from laydown and parking areas to be managed to ensure flows are diverted away from NTG areas
	No refuelling or maintenance to take place in or near NTG areas
	Refuelling or maintenance to be completed only in designated areas that are suitably designed and bunded to ensure the capture of pollutants
Post construction	Area of NTG temporarily impacted during construction (such as areas adjacent to disturbance areas or areas where trenching installed) to be appropriately rehabilitated to ensure they return to the condition prior to works commencing
	Ongoing weed and pest management within NTG areas on site as part of an OEMP to bring about improved outcomes for NTG areas
	Ongoing monitoring of NTG areas as part of the OEMP and annual reporting

Subject to the implementation of the above measures, it is considered that impacts to the Natural Temperate Grasslands as a result of the project can be effectively minimised.

STRIPED LEGLESS LIZARD *(DELMAR IMPAR)*

Context

The striped legless lizard is understood to favour native tussock grassland areas, including exotic grasslands, that have been relatively undisturbed as a result of agricultural activities and are in close proximity to open woodlands. Sheltering occurs beneath rocks or logs during winter. Following discussions and site visits with NSW DPE BCS it is agreed that potential habitat on the site is limited to areas adjacent to the creekline in the western extent of the site (refer **Appendix A, Figure 5**).

Connected land to the north has the potential to host the species given the generally consistent terrain and landscape features.

Impact summary

Impacts are likely in the areas outlined in **Appendix A, Figure 5** associated with the installation of solar infrastructure.

Mitigation Measures

To minimise impacts to the Striped Legless Lizard, it is proposed to include a suite of controls within a project CEMP that would be adopted by the project EPC contractor and managed for the life of the project. These measures include but are not limited to the measures outlined by project phase in **Table 2.**

Table 2 – Summary of mitigation measures – Striped Legless Lizard

Phase	Mitigation Measure
Pre-construction	Prepare a detailed Fauna Management Plan to be incorporated into the project CEMP to outline measures for protection and mitigation (including those outlined within this document), to be prepared in conjunction with project ecologists.
	Areas outside of the project footprint assessed as being potential habitat for the striped legless lizard to be identified with demarcation fencing to ensure no inadvertent access during construction.
Construction	Areas outside of the project footprint assessed as being potential habitat for the striped legless lizard are not to be used for equipment laydown areas or for the parking of vehicles
	Laydown and vehicle parking areas to be established well clear of potential habitat for the striped legless lizard.

PINK TAILED LEGLESS LIZARD (APRASIA PARAPULCHELLA)

Context

The pink tailed legless lizard is understood to favour well drained rocky areas or areas containing scattered partially buried rocks, and on land within 50 metres of these areas. Rocky areas within the site are limited to areas in the south-west of the site and areas through the access handle in the south of the site.

Rocky areas exist outside of the site with the potential to provide habitat for the pink tailed legless lizard to the south and south-west that would not be impacted by the project.

Impact summary

Impacts to the pink tailed legless lizard would entail construction of an up to 6 metre wide access road through the 30-metre-wide access handle, with the potential to impact rocky habitat and potential to disturb pink tailed legless lizard. It is noted that there is habitat directly to the west of the access handle (as per **Appendix A, Figure 6**) that would not be impacted by the project.

Mitigation measures

To minimise impacts to the pink tailed legless lizard, it is proposed to include a suite of controls within a project CEMP that would be adopted by the project EPC contractor and managed for the life of the project. These measures include but are not limited to the measures outlined by project phase in **Table 3.**

Table 3 – Summary of mitigation measures – pink tailed legless lizard

Phase	Mitigation Measure
Pre-construction	Prepare a detailed Fauna Management Plan to be incorporated into the project CEMP to outline measures for protection and mitigation (including those outlined within this document), to be prepared in conjunction with project ecologists.
	Areas outside of the project footprint assessed as being potential habitat for the pink tailed legless lizard to be identified with demarcation fencing to ensure no inadvertent access during construction.
	Rocks and suitable habitat areas within the access handle to be checked for the species by the project ecologist prior to works commencing, and any identified lizards to be relocated to suitable habitat
	Where feasible, rocks within the access handle with the potential to provide habitat that may be impacted by the project to be relocated prior to works commencing so that the habitat value is not lost.
Construction	Areas outside of the project footprint assessed as being potential habitat for the pink tailed legless lizard are not to be used for equipment laydown areas or for the parking of vehicles
	Laydown and vehicle parking areas to be established well clear of potential habitat for the pink tailed legless lizard.

KOALA (PHASCOLARCTOS CINEREUS)

Context

The nearest recorded locations of the Koala are approximately 3 km to the south-east. Site surveys have not detected any examples of the species being located on the property. This survey included the woodland community in the south of the site

Impact summary

There will be no impacts to Koala as a result of the project. Avoidance of the woodland minimises the risk of loss of Koala habitat.

Mitigation measures

To minimise impacts to Koala, it is proposed to include a suite of controls within a project CEMP that would be adopted by the project EPC contractor and managed for the life of the project. These measures include but are not limited to the measures outlined by project phase in **Table 4.**

Table 4 – Summary of mitigation measures – Koala

Phase	Mitigation Measure
Pre-construction	Prepare a detailed Fauna Management Plan to be incorporated into the project CEMP to outline measures for protection and mitigation (including those outlined within this document), to be prepared in conjunction with project ecologists.
	Areas outside of the project footprint assessed as being potential habitat for the Koala to be identified with demarcation fencing to ensure no inadvertent access during construction.
Construction	Areas outside of the project footprint assessed as being potential habitat for the Koala are not to be used for equipment laydown areas or for the parking of vehicles
	Laydown and vehicle parking areas to be established well clear of potential habitat for the Koala.

CONCLUSION

We trust this information assists with DAWE's consideration of the project. Please contact Premise with any questions.

Yours sincerely

DAVID WALKER
General Manager - Central NSW

APPENDIX A
FIGURES

Figure 1 – Vegetation patch sizes

Figure 2 – Natural Temperate Grasslands within the transmission line alignment

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Figure 3 – Natural Temperate Grassland within the site western extent

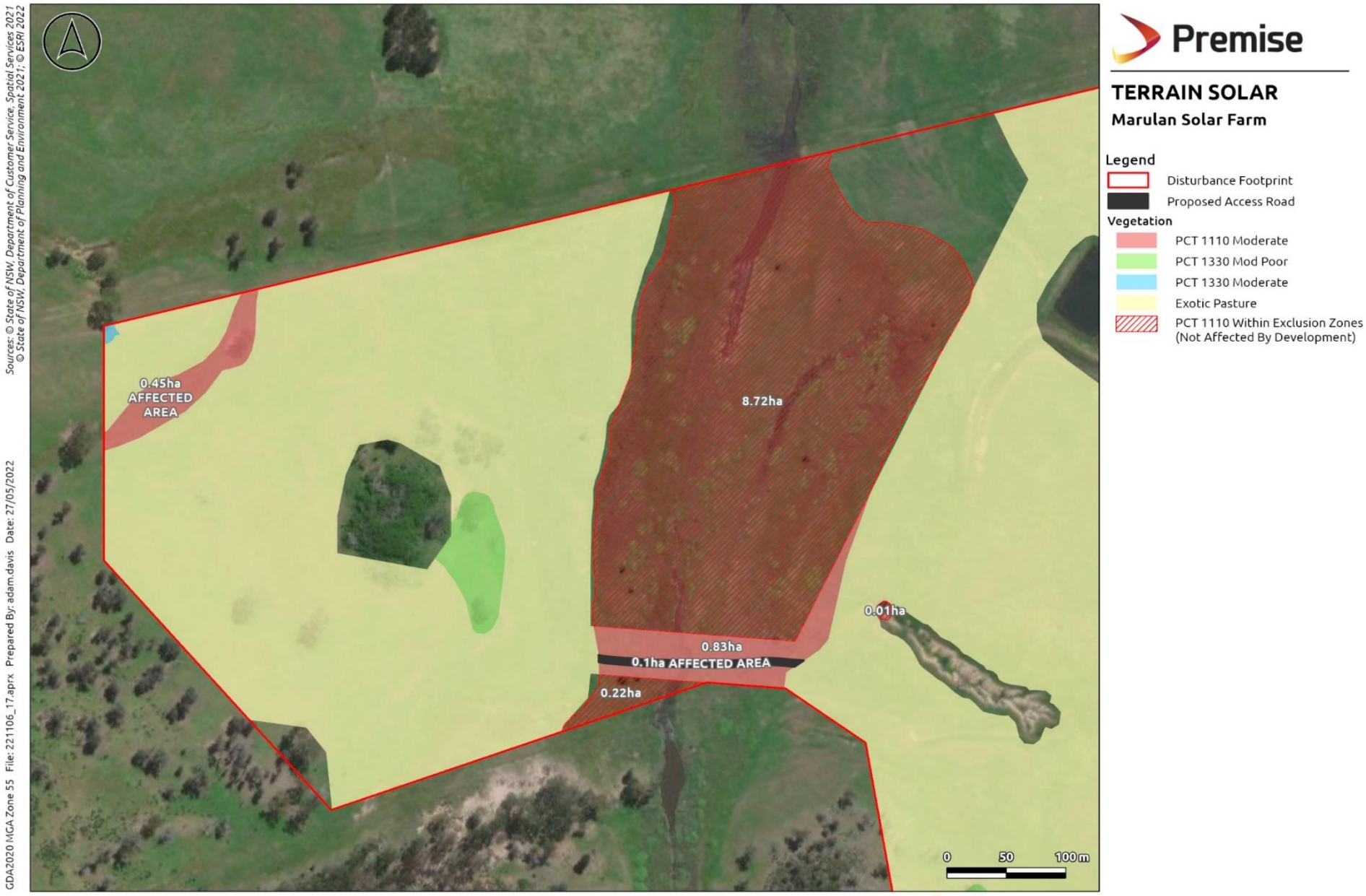


Figure 4 – Avoided areas of Natural Temperate Grasslands

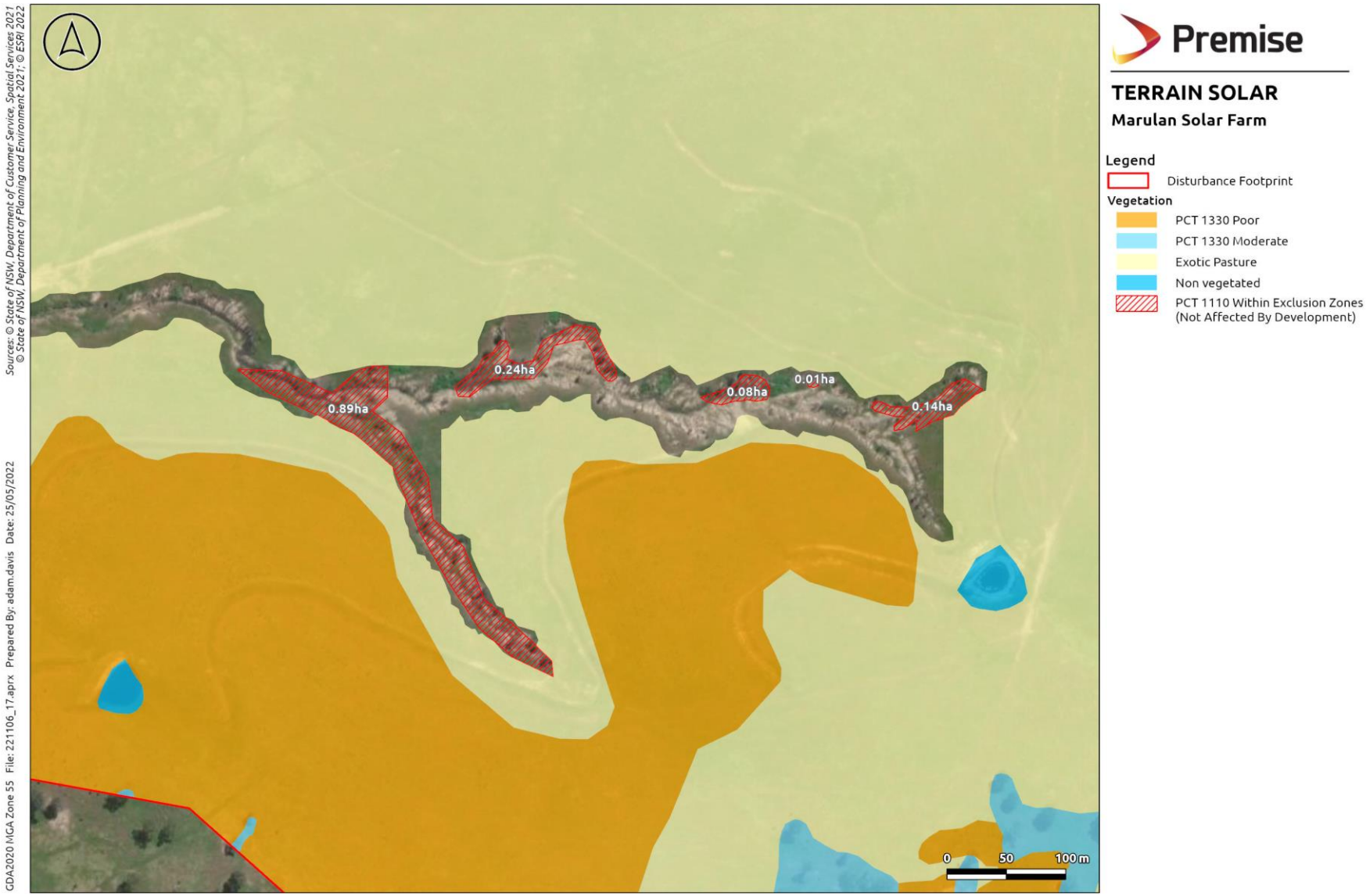


Figure 5 – Striped legless lizard habitat

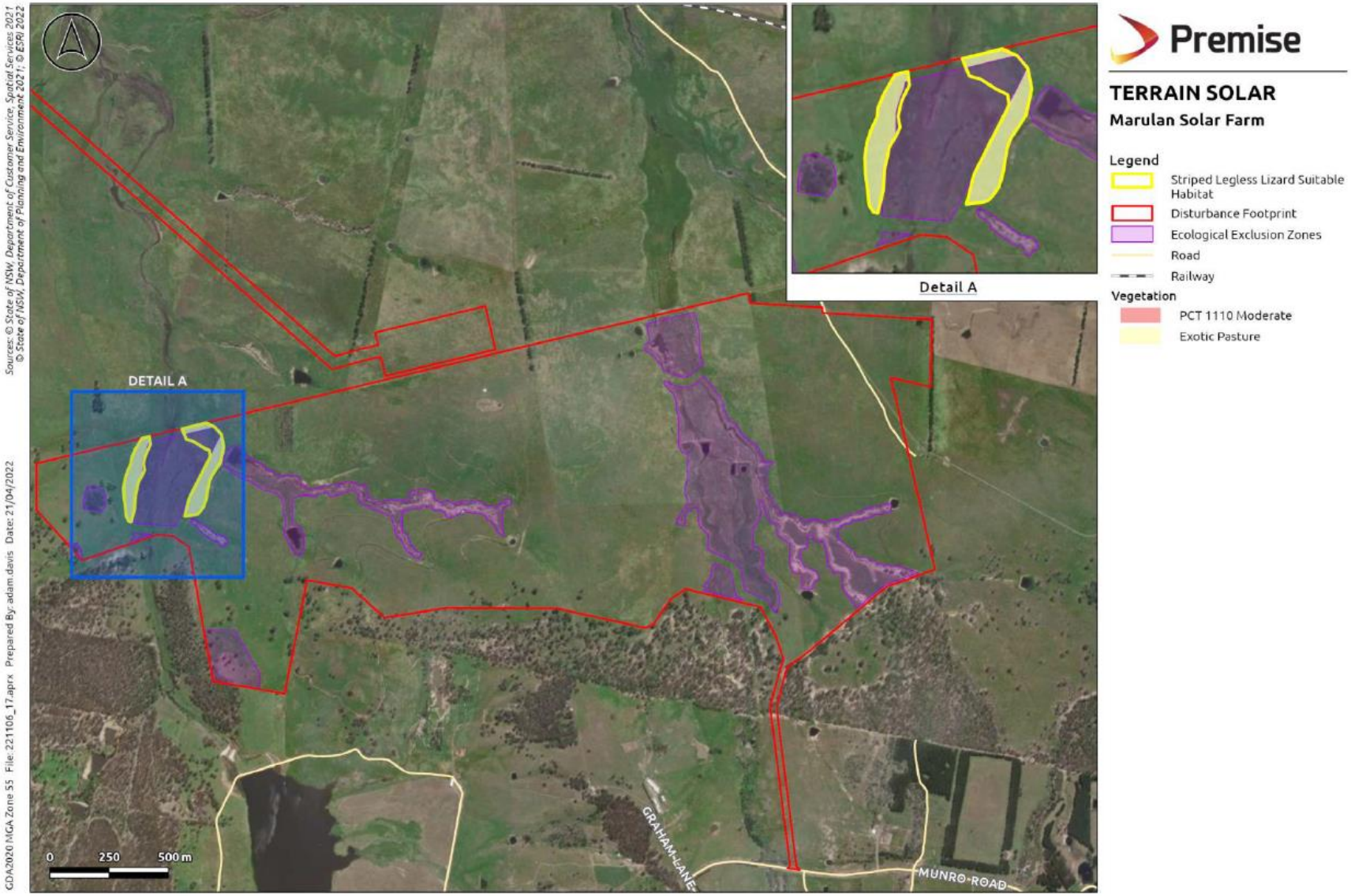


Figure 6 – Pink tailed legless lizard habitat

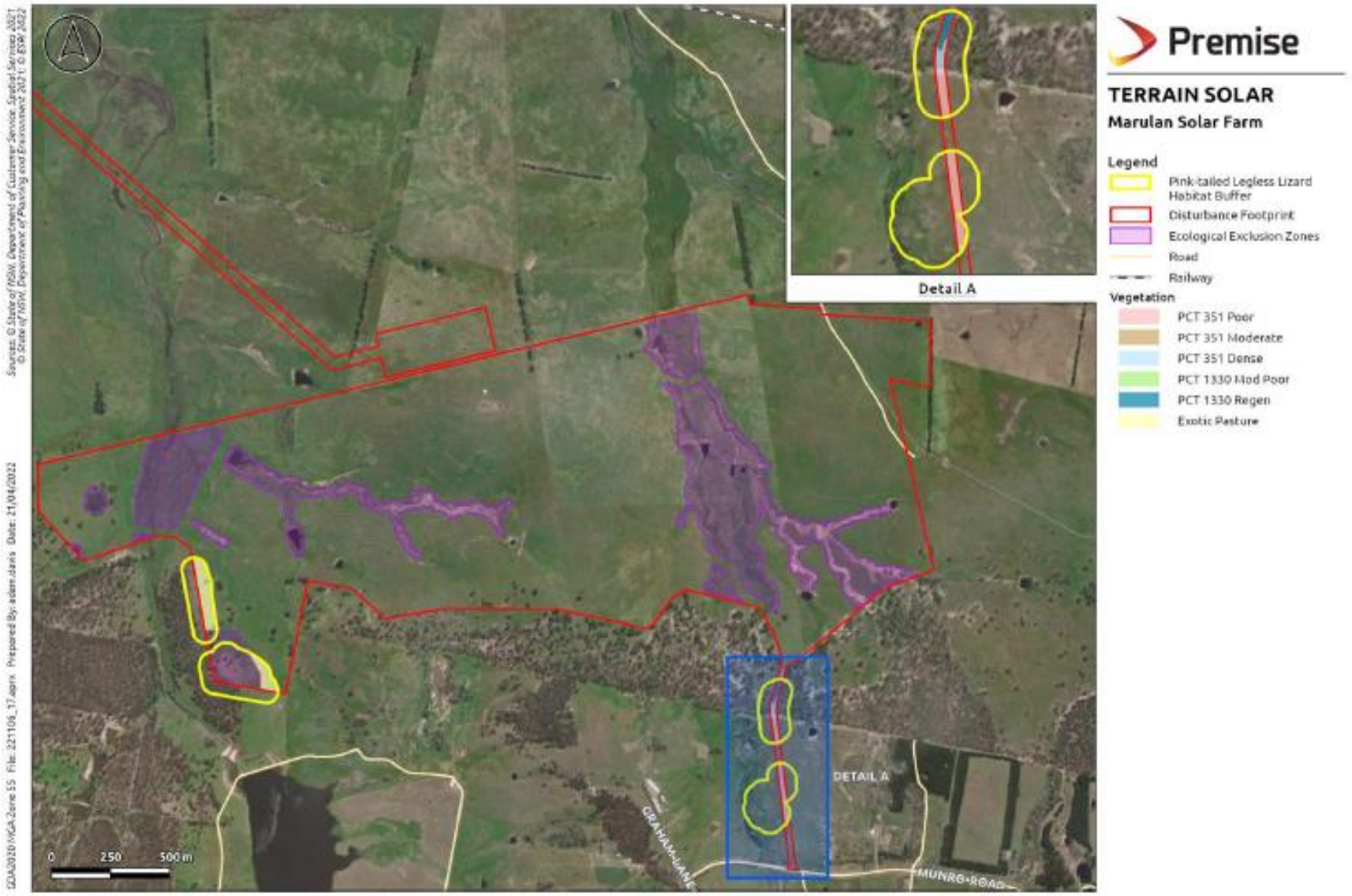
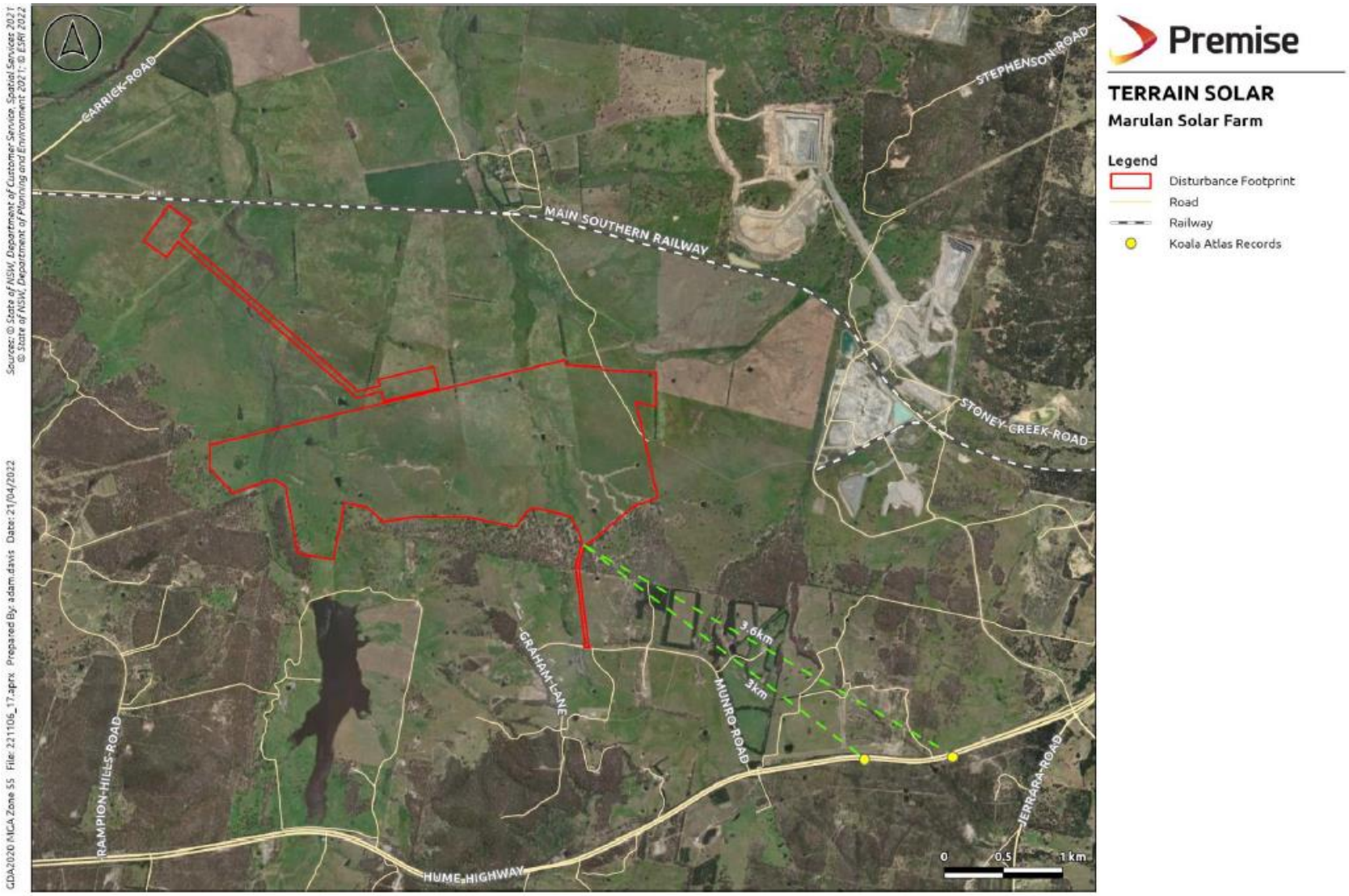


Figure 7 – Koala atlas records



Premise

APPENDIX G

EPBC ACT REFERRAL OUTCOME NOTIFICATION

Australian Government
Department of Agriculture, Water and the Environment

NOTIFICATION OF
REFERRAL DECISION – NOT CONTROLLED ACTION

MARULAN SOLAR FARM 2022/09218

This decision is made under Section 75 of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Proposed action

person proposing to take the action	Terrain Solar Pty Ltd **ACN 616 856 172**
proposed action	To construct, operate and decommission a solar farm, battery energy storage system and associated infrastructure, approximately 14 km east of Goulburn, Carrick Road, Carrick, NSW: [See EPBC Act referral 2022/09218].

Referral decision: Not a controlled action

status of proposed action	The proposed action is not a controlled action.

Person authorised to make decision

name and position	**Miriam Gerrick** **A/g Assistant Secretary** **Environment Assessments (NSW, ACT) Branch**
signature	Mgerrick
date of decision	27 June 2022

T +61 2 6274 1111
John Gorton Building
King Edward Terrace
Parkes ACT 2600
GPO Box 858
Canberra ACT 2601
awe.gov.au
ABN 34 190 894 983

APPENDIX H

LANDSCAPE CONCEPT PLAN

iris

Marulan Solar Farm

740 Carrick Road, Terrain Solar Pty Ltd

Landscape Concept

May 2022

EXISTING CONDITIONS:

The site includes a few scattered trees but is otherwise cleared and has historically been used for grazing and cropping. There is a single row of mature trees along part of the eastern boundary of the site (image 1), and extending along fence lines, north of the site. These rows of trees, possibly planted as wind breaks, are a landscape feature in this area.

The gently undulating landform within the site descends to shallow gullies, creeks and dams, including Narambulla Creek and Lockyersleigh Creek, each containing a few low native shrubs and trees (image 2).

There is also some native vegetation on the adjoining low hills to the south of the site, which forms a visual screen (image 3). There are ornamental trees and gardens along the surrounding driveways and around the residential dwellings (image 4 and 5).

Image 4 - Ornamental trees at Lockyersleigh House, forming a parkland setting to the property

Image 5 - Poplar and other ornamental species forming a wind break and visual screen near Lockyersleigh House

LANDSCAPE STRATEGY:

A landscape concept plan has been developed based on consideration of the potential visibility of the site. The objectives of this landscape plan are to:

- Reduce the visibility of the site from adjacent sensitive recievers (including neighbouring residences, Carrick Road and the Hume Highway) over time
- Improve the character of the landscape through the restoration of native vegetation
- Provide habitat and increase local biodiversity through the use of local plant species.

The landscape plan identifies seven landscape treatments for the site. These are:

1. Native screen planting, lower slopes
2. Native screen planting, upper slopes
3. Riparian vegetation, dry lower slopes
4. Riparian vegetation, wet upper slopes
5. Scattered trees on upper slopes
6. River Tussock grassland
7. Pasture grasses

These landscape treatments are shown on the landscape plan on Figure 2.

To ensure the suitability of planting for the local conditions, the plant species proposed for these landscape treatments have been selected from the:

- *Goulburn Mulwaree Development Control Plan 2009*, Appendix B Preferred Planting Species
- *Planting your patch, A guide to revegetation on your property,* State of New South Wales Local Land Services, 2016.

Advice from the project ecologist has also been incorporated into the plant selection.

Further consultation with Council Officers and local land care groups would be undertaken during detail design.

Image 1 - Existing trees along fenceline, at eastern site boundary

Image 2 - Native planting along Lockyersleigh Creek, north of the site, viewed from Carrick Road

Image 3 - Native planting along southern site boundary, viewed from Munro Road

iris

Marulan Solar Farm

Landscape Concept

FIGURE 1: EXISTING CONDITIONS & LANDSCAPE STRATEGY

Date: 22 April 2022
Issue: Rev2

Drawn: FW/SR

Key:

- Existing trees to be retained
- Vegetation to be removed
- **1.** Native screen planting- lower slopes
- **2.** Native screen planting- upper slopes
- **3.** Riparian vegetation- wet lower slopes
- **4.** Riparian vegetation- dry upper slopes
- **5.** Scattered trees- upper slopes
- **6.** River Tussock grassland
- **7.** Access road screening (subject to stakeholder engagement)
- **8.** Pasture Grasses

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Marulan Solar Farm

Landscape Concept

FIGURE 2: LANDSCAPE PLAN

Date: 25 May 2022
Issue: Rev4

Drawn: FW/SR

NATIVE SCREEN PLANTING

A mix of native trees and shrubs with a dense and compact habit have been selected to provide a maximum screening effect.

The following plant list includes some acacias which are 'pioneer species'. These plants will establish quickly and form an effective visual screen in the short term. While these pioneer species are relatively short lived (i.e. 7-12 years), they will disperse seed and new plants will regenerate so that a self-sustaining vegetation screen is maintained in the long term. Pioneer species assist with weed management and support the growth of longer lived species, such as Eucalypts.

1. NATIVE SCREEN PLANTING - Lower slopes

Plant list:

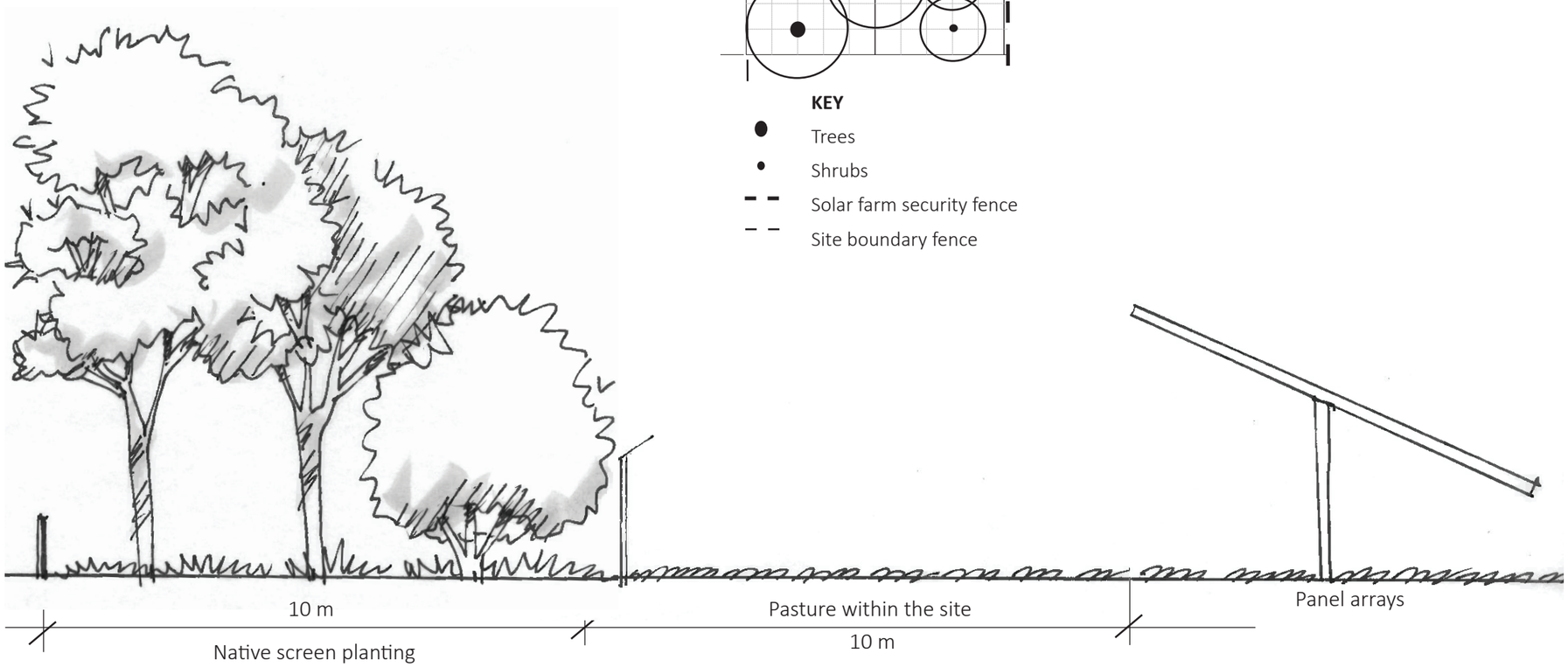
Species name, Common name	Mature height
Native trees	
*Acacia decurrens, Green Wattle**	*6m*
*Acacia mearnsii, Black wattle**	*6m*
*Acacia parramattensis, Tindale**	*10m*
*Acacia dealbata, Silver Wattle***	
*Allocasuarina luehmannii, Bull oak**	*10m*
*Allocasuarina verticalla, Drooping she-oak**	*10m*
*Eucalyptus amplifolia, Cabbage Gum **	*30m*
*Eucalyptus blakelyi, Blakely's Red Gum**	*25m*
*Eucalyptus bridgesiana, Apple Box**	*25m*
*Eucalyptus cinerea, Argyle apple***	*15-30m*
*Eucalyptus ovata, Black Gum**	*15-30m*
*Eucalyptus melliodora, Yellow Box**	*30m*
*Eucalyptus pauciflora, Snow Gum**	*15m*
*Eucalyptus stellulata, Black sallee**	*15m*
Native shrubs	
*Callistemon citrinus, Crimson Bottlebrush**	*1-2m*
*Jacksonia scoparia, Dogwood**	*4m*
*Leptospermum polygalfolium, Tea Tree**	*3m*

Source:
* *Goulburn Mulwaree Development Control Plan 2009*, Appendix B Preferred Planting Species
** Selected on advice from project ecologist

2. NATIVE SCREEN PLANTING - Upper slopes

Plant list:

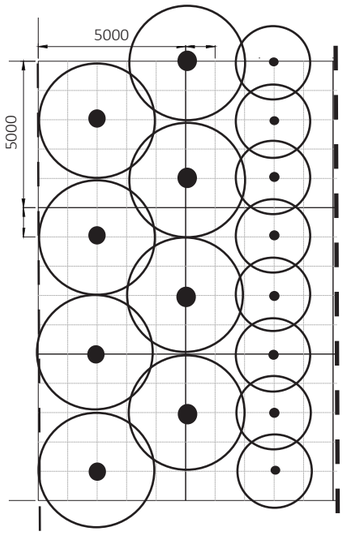
Species name, Common name	Mature height
Native trees	
*Eucalyptus blakelyi, Blakely's Red Gum**	*25m*
*Eucalyptus bridgesiana, Apple Box**	*25m*
*Eucalyptus cinerea, Argyle apple***	*15-30m*
*Eucalyptus pauciflora, Snow Gum**	*15m*
*Eucalyptus stellulata, Black sallee**	*15m*
*Eucalyptus tereticornis, Forest Red Gum***	*15-30m*
Native shrubs	
*Acacia decurrens, Green Wattle**	*6m*
*Acacia mearnsii, Black wattle**	*6m*
*Acacia parramattensis, Tindale**	*10m*
*Callistemon citrinus, Crimson Bottlebrush**	*1-2m*
*Jacksonia scoparia, Dogwood**	*4m*
*Leptospermum polygalfolium, Tea Tree**	*3m*



A - A Indicative cross section - Native screen planting

Plant set-out matrix

Trees and shrubs will be staggered to maximise the screening effect as per the following diagram.



KEY

- Trees
- Shrubs
- Solar farm security fence
- Site boundary fence

Scale: 0m 1 2 5m

Specification notes

- Three offset rows of trees and shrubs as per the set out matrix.
- 12 month establishment followed by a 24 month maintenance period
- Activities during establishment would include watering, weed management and replacement of dead plant stock as required.
- Activities during the maintenance period would include weed management, topping up of mulch as required and replacing dead plant stock as soon as practicable.

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Marulan Solar Farm

Landscape Concept

FIGURE 3: NATIVE SCREEN PLANTING

Date: 22 April 2022 Drawn: FW/SR
Issue: Rev2

RIPIARIAN AREAS

Riparian areas would be revegetated with a mix of locally native trees and shrubs including species to provide habitat for native wildlife. This mix of trees will create a framework for natural regeneration.

Riparian vegetation would be planted along the first and second order streams in accordance with the *NRAR Guidelines for controlled activities on waterfront land* (2018). That is 10 metres above the top of bank (20 metre + channel width) for 1st order streams, and 2- metres above the top of bank (40 metres + channel width) for 2nd order streams.

Larger trees would be setback from the solar farm fence to minimise overshadowing. There would be random distances between rows of trees (3 m to 10 m) and some rows would include curves to improve habitat complexity. Plant density and layout should be in accordance with the *Planting your patch, A guide to revegetation on your property.*

3. RIPARIAN AREAS - Wet lower slopes
Plant list:

Native trees

Species name, Common name	Mature height
*Acacia dealbata, Silver Wattle**	*8m*
Acacia mearnsii, Black Wattle	*15m*
Acacia melanoxylon, Blackwood	*20m*
Allocasuarina luehmannii, Bull oak	*10m*
*Eucalyptus amplifolia, Cabbage Gum **	*30m*
*Eualyptus blakelyi, Blakelys red gum**	*25m*
Eucalyptus pauciflora, Snow Gum	*20-30m*
Eucalyptus stellulata, Black Sallee	*15m*
*Eucalyptus ovata, Black Gum**	*15-30m*
Eucalyptus aggregata, Black Gum	*18m*
*Melaleuca ericifolia, Swamp Paperbark**	*4-5m*
*Melaleuca styphyloides, Prickly Paperbark**	*10m*

Shrubs & Grasses

Species name, Common name	Mature height
Callistemon sieberi, Swamp bottlebrush	*2m*
Hakea microcarpa, Small fruit Hakea	*2m*
Leptospermum polygalifolium, Yellow tea tree	*1-3m*
Leptospermum myrtifolium, Myrtle tea tree	*1-3m*
Lomandra longifolia, Spiny Matrush	*1m*
Poa labillardieri, common tussock grass	

4. RIPARIAN AREAS - Dry upper slopes
Plant list:

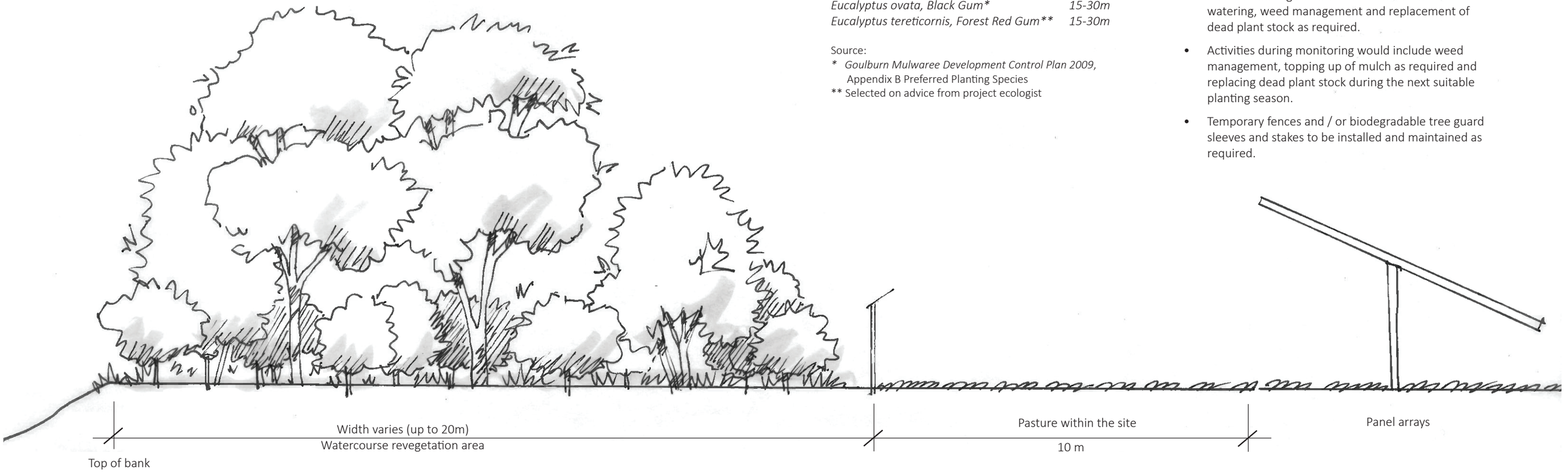
Native trees

Species name, Common name	Mature height
*Acacia dealbata, Silver Wattle**	*8m*
*Acacia mearnsii, Black Wattle***	*15m*
*Eucalyptus amplifolia, Cabbage Gum **	*30m*
*Eucalyptus bridgesiana, Apple box**	*25m*
*Eucalyptus cinerea, Argyle apple***	*15-30m*
*Eucalyptus ovata, Black Gum**	*15-30m*
*Eucalyptus tereticornis, Forest Red Gum***	*15-30m*

Source:
* *Goulburn Mulwaree Development Control Plan 2009,* Appendix B Preferred Planting Species
** Selected on advice from project ecologist

Specification notes

- Weeds, including *Juncus acutus* to be removed
- No trees or shrubs should be planted in the channel or main water flow area
- Spot planting technique to be used to retain groundcover and minimise site disturbance,
- Trees to be setback from the solar farm fence by a minimum of 10 metres
- Individual planting holes to be excavated, backfilled with ameliorated site soil and mulch to be applied across disturbed area
- 12 month establishment followed by a 24 month maintenance period
- Individual planting holes to be excavated, backfilled with ameliorated site soil and mulch to be applied across disturbed area
- Plants will be 50 x 50 mm tubestock or similar
- Activities during establishment would include watering, weed management and replacement of dead plant stock as required.
- Activities during monitoring would include weed management, topping up of mulch as required and replacing dead plant stock during the next suitable planting season.
- Temporary fences and / or biodegradable tree guard sleeves and stakes to be installed and maintained as required.



B - B Indicative cross section - Riparian areas

Scale: 0m 1 2 5m

iris

Marulan Solar Farm

Landscape Concept

FIGURE 4: RIPARIAN AREAS

Date: 22 April 2022
Issue: Rev2

Drawn: FW/SR

5. SCATTERED TREES ON UPPER SLOPES

Groups and scattered idividual trees would be located on the upper slopes of the site and within the adjacent field.

These trees will be local native species with a single trunk and open canopy. These will provide some filtering of views where the solar farm can be seen from elevated areas, provide tree canopy cover and habitat.

Plant list:

Large native trees

Species name, Common name	Mature height
*Eucalyptus amplifolia, Cabbage Gum **	*30m*
*Eucalyptus bridgesiana, Apple box**	*25m*
*Eucalyptus cinerea, Argyle apple***	*15-30m*
*Eucalyptus melliodora, Yellow box**	*30m*
*Eucalyptus tereticornis, Forest Red Gum***	*15-30m*

Source:
* *Goulburn Mulwaree Development Control Plan 2009*, Appendix B Preferred Planting Species
** Ecologist advice

Plant set-out

Trees would be setout in an informal layout, with individual and groups of trees . All trees to be set back a minimum of 10 metres and larger trees by 20 metres from the solar farm fence to minimise overshadowing of the panel array area.

Specification notes

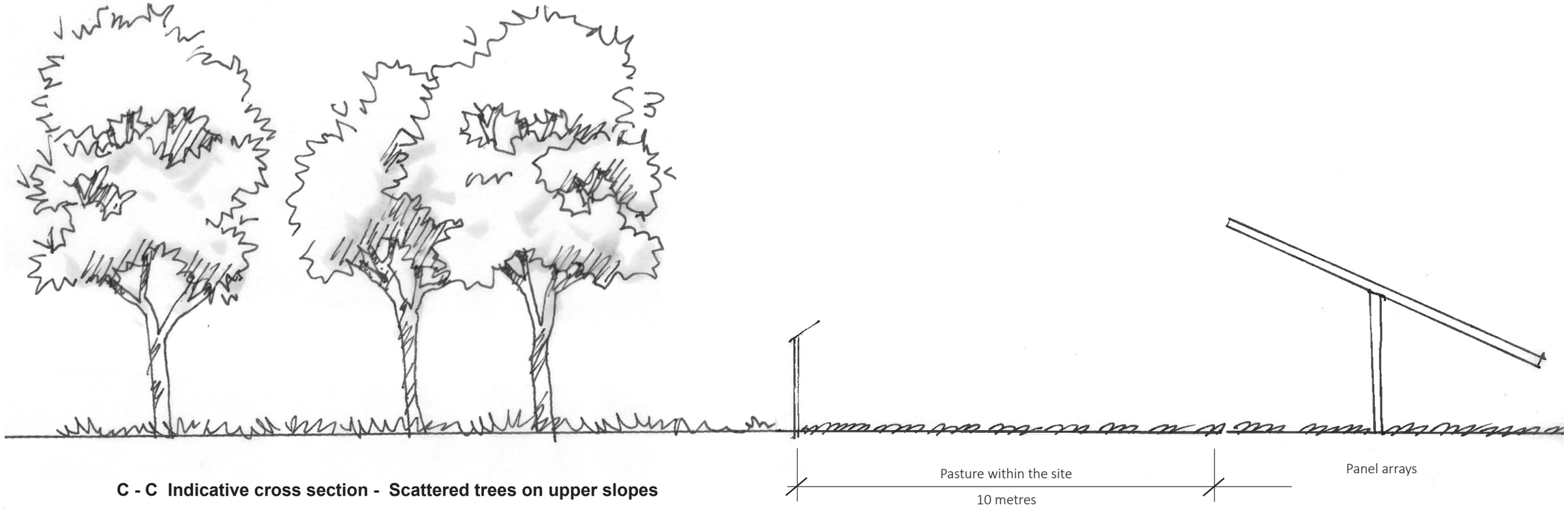
- Individual planting holes to be excavated, backfilled with ameliorated site soil and mulch to be applied across disturbed area.
- Plants will be 50 x 50 mm tubestock or similar
- There would be 12 month establishment followed by a 24 month maintenance period
- Activities during establishment would include watering, weed management and replacement of dead plant stock as required. Activities during monitoring would include weed management
- Activities during maintenance would include weed management, topping up of mulch as required and replacing dead plant stock during the next suitable planting season.
- Temporary fences and / or tree guard sleeves and stakes to be installed and maintained as necessary.

6. RIVER TUSSOCK GRASSLAND

The native Rivwer Tussock Grassland is part of a Critically Endangered Ecological community. Improvement of this zone would involve removal of weeds including Hawthorn and Blackberry.

8. PASTURE GRASSES

Areas within the solar farm fence will be sown with pasture grasses to allow for grazing of the property during operation.



C - C Indicative cross section - Scattered trees on upper slopes

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Marulan Solar Farm

Landscape Concept

FIGURE 5: SCATTERED TREES IN PASTURE AREAS

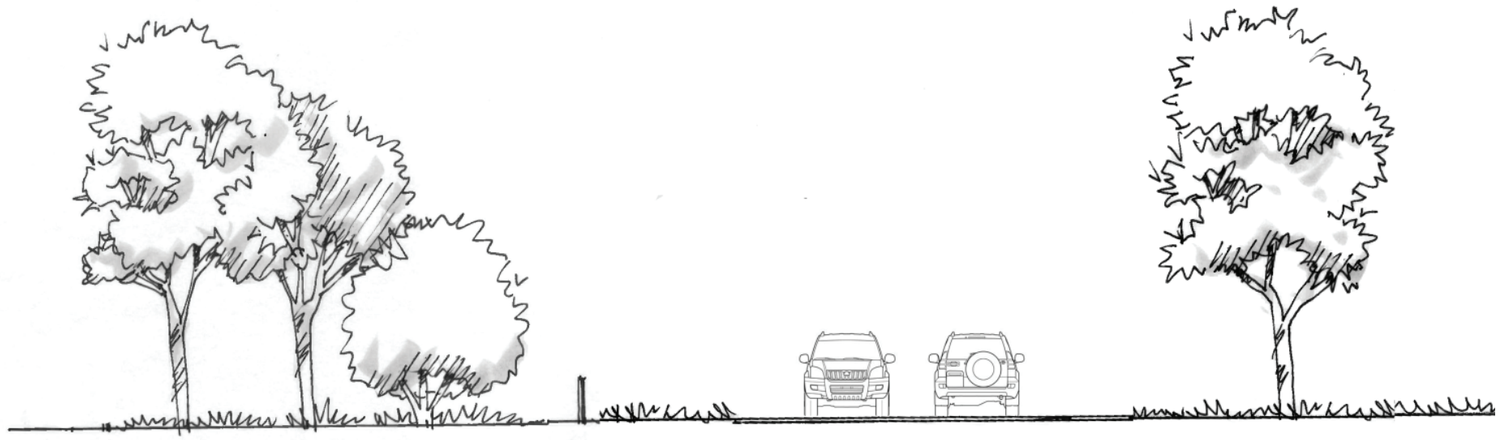
Date: 22 February 2022 Drawn: FW/SR
Issue: Rev2

7. ACCESS ROAD SCREENING

Options for trees within the access corridor, or within neighbouring properties.

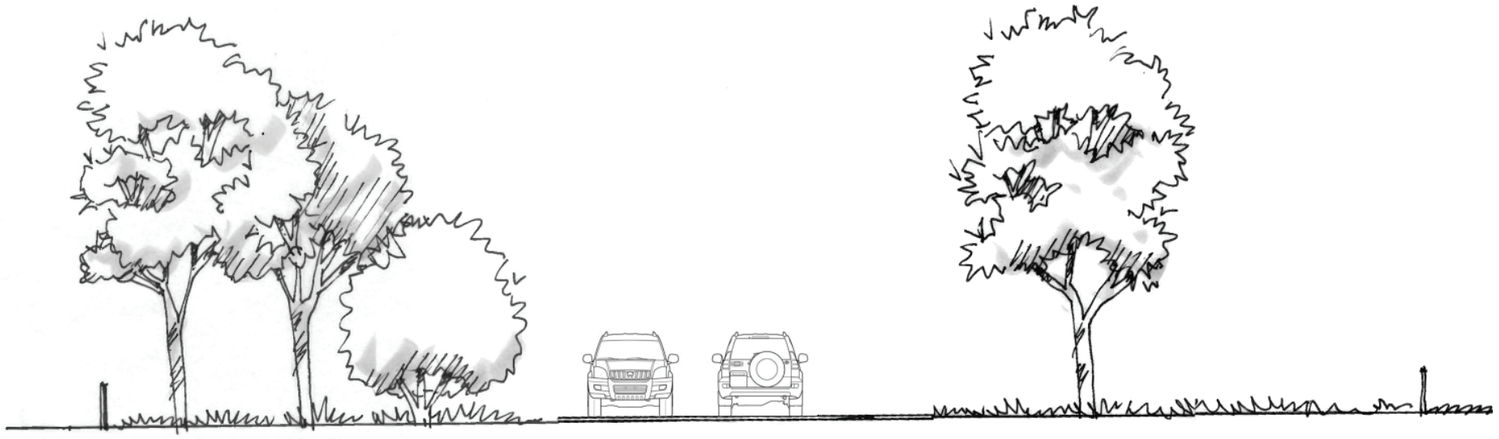
D - D Indicative cross section - Access Road screening

Vegetation within the access road corridor and on neighbouring property to fill gaps in existing screening vegetation.



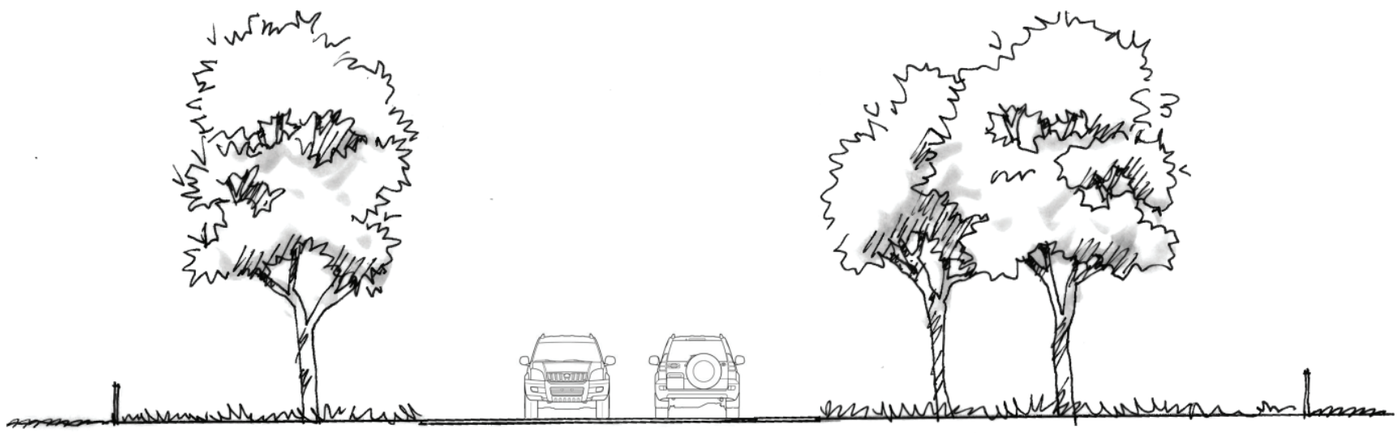
E - E Indicative cross section - Access Road screening (Option A)

Vegetation within the access road corridor, including trees and shrubs.



E - E Indicative cross section - Access Road screening (Option B)

Vegetation within the access road corridor, including scattered trees.



Premise