



# Biodiversity Development Assessment Report

CULCAIRN SOLAR FARM



SEPTEMBER 2020



## Document Verification



Project Title:

Culcairn Solar Farm

Project Number:	18-441			
Project File Name:	Culcairn Solar Farm			
Revision	Date	Prepared by (name)	Reviewed by (name)	Approved by (name)
Draft 1.0	12/11/19	Elijah Elias, Daniel Perkovic, Aleksei Atkin	Julie Gooding (BAAS18074)	Erwin Budde
Final 1.1	27/11/19	Elijah Elias, Daniel Perkovic, Aleksei Atkin	Julie Gooding (BAAS18074)	Erwin Budde
Final 1.3	25/05/20	Lisa Hamilton (BAAS19039)	Mitch Palmer (BAAS17051)	Erwin Budde
Final 1.3	23/09/20	Lisa Hamilton (BAAS19039)	Mitch Palmer (BAAS17051)	Erwin Budde

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

NGH Consulting Pty Ltd (ACN: 124 444 622. ABN: 31 124 444 622)

[www.nghenvironmental.com.au](http://www.nghenvironmental.com.au)

e: [ngh@nghenvironmental.com.au](mailto:ngh@nghenvironmental.com.au)

**Sydney Region**  
18/21 mary st  
surry hills nsw 2010 (t 02 8202 8333)

**Newcastle - Hunter and North Coast**  
1/54 hudson st  
hamilton nsw 2303 (t 02 4929 2301)

**Canberra - NSW SE & ACT**  
8/27 yellourn st (po box 62)  
fyshwick act 2609 (t 02 6280 5053)

**Wagga Wagga - Riverina and Western NSW**  
35 kincaid street (po box 5464)  
wagga wagga nsw 2650 (t 02 6971 9696)

**Bega - ACT and South East NSW**  
suite 1, 216 carp st (po box 470)  
bega nsw 2550 (t 02 6492 8333)

**Brisbane**  
suite 4, level 5, 87 wickham terrace  
spring hill qld 4000 (t 07 3129 7633)



# CONTENTS

<b>EXECUTIVE SUMMARY .....</b>	<b>IX</b>
<b>1 INTRODUCTION.....</b>	<b>11</b>
1.1 THE PROPOSAL.....	11
1.2 THE DEVELOPMENT SITE.....	12
1.2.1 Site location .....	12
1.2.2 Site description .....	14
1.3 STUDY AIMS .....	15
1.4 SOURCE OF INFORMATION USED IN THE ASSESSMENT .....	16
<b>2 LANDSCAPE FEATURES .....</b>	<b>17</b>
2.1 IBRA BIOREGIONS AND SUBREGIONS .....	17
2.2 NATIVE VEGETATION.....	17
2.3 CLEARED AREAS.....	17
2.4 RIVER AND STREAMS .....	18
2.5 WETLANDS .....	20
2.6 CONNECTIVITY FEATURES .....	20
2.7 AREAS OF GEOLOGICAL SIGNIFICANCE .....	20
2.8 AREAS OF OUTSTANDING BIODIVERSITY VALUE.....	21
2.9 SITE CONTEXT COMPONENTS .....	21
<b>3 NATIVE VEGETATION.....</b>	<b>24</b>
3.1 NATIVE VEGETATION EXTENT .....	24
3.2 LAND CATEGORY ASSESSMENT.....	29
3.3 PLANT COMMUNITY TYPES (PCTS).....	30
3.3.1 Methods to assess PCTS.....	30
3.3.2 PCTS identified on the development site.....	30
3.4 VEGETATION INTEGRITY ASSESSMENT .....	44
3.1.1 Vegetation zones and survey effort .....	44
3.4.1 Paddock Trees.....	57
3.4.2 Vegetation integrity assessment results.....	59
<b>4 THREATENED SPECIES.....</b>	<b>60</b>
4.1 ECOSYSTEM CREDIT SPECIES.....	60
4.1.1 Species excluded from the assessment .....	63
4.2 SPECIES CREDIT SPECIES.....	63

4.2.1	Candidate species to be assessed .....	63
4.2.2	Exclusions based on habitat features .....	69
4.2.3	Inclusions based on habitat features .....	70
4.2.4	Candidate species requiring confirmation of presence or absence .....	71
4.2.5	Species survey methods .....	74
4.3	ADDITIONAL HABITAT FEATURES RELEVANT TO PRESCRIBED BIODIVERSITY IMPACTS .....	81
4.3.1	Occurrences of karst, caves, crevices and cliffs .....	81
4.3.2	Occurrences of rock .....	81
4.3.3	Occurrences of human made structures and non-native vegetation.....	81
4.3.4	Hydrological processes that sustain and interact with the rivers, streams and wetlands .....	81
<b>5</b>	<b>MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE .....</b>	<b>82</b>
5.1	WETLANDS OF INTERNATIONAL IMPORTANCE .....	82
5.2	THREATENED ECOLOGICAL COMMUNITIES .....	82
5.3	THREATENED SPECIES .....	86
5.4	MIGRATORY SPECIES .....	86
<b>6</b>	<b>AVOID AND MINIMISE IMPACTS .....</b>	<b>87</b>
6.1	AVOIDING AND MINIMISING IMPACTS ON NATIVE VEGETATION AND HABITAT.....	87
6.1.1	Site selection – consideration of alternative locations/routes.....	87
6.1.2	Proposal components – consideration of alternate modes or technologies.....	87
6.1.3	Proposal planning phase – detailed design .....	88
6.2	AVOIDING AND MINIMISING PRESCRIBED BIODIVERSITY IMPACTS.....	90
6.2.1	Impacts of development on the habitat of threatened species or ecological communities associated with human made structures or non-native vegetation.....	90
6.2.2	Impacts of development on the connectivity of different areas of habitat or threatened species that facilitates the movement of these species across their range.....	90
6.2.3	Impacts of development on movement of threatened species that maintain their lifecycle. ....	91
6.2.4	Impacts of development on water quality, waterbodies and hydrological processes that sustain threatened species and threatened ecological communities. ....	91
6.2.5	Impacts of vehicle strikes on threatened species or on animals that are part of a TEC.....	91
<b>7</b>	<b>IMPACTS UNABLE TO BE AVOIDED .....</b>	<b>92</b>
7.1	DIRECT IMPACTS .....	92
7.1.1	Changes in vegetation integrity scores .....	93
7.1.2	Loss of species credit species habitat or individuals.....	93
7.1.3	Loss of hollow-bearing trees.....	94
7.2	INDIRECT IMPACTS.....	94

7.3	PREScribed IMPACTS .....	100
7.3.1	Impacts to karst, caves, crevices, cliffs and other features of geological significance .....	100
7.3.2	Impacts of development on the habitat of threatened species or ecological communities associated with rocks .....	100
7.3.3	Impacts of development on the habitat of threatened species or ecological communities associated with human made structures .....	100
7.3.4	Impacts of development on the habitat of threatened species or ecological communities associated with non-native vegetation .....	100
7.3.5	Impacts of development on the connectivity of different areas of habitat of threatened species that facilitates the movement of those species across their range .....	101
7.3.6	Impacts of the development on movement of threatened species that maintains their life cycle ..	101
7.3.7	Impacts of development on water quality, waterbodies and hydrological processes that sustain threatened species and threatened ecological communities (including subsidence or upsidence resulting from underground mining or other development) .....	101
7.3.8	Impacts of vehicle strikes on threatened species of animals or on animals that are part of a TEC ..	101
7.4	IMPACTS TO MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE .....	102
7.4.1	Wetlands of international importance .....	102
7.4.2	Threatened Ecological Communities .....	102
7.4.3	Threatened Species .....	102
7.4.4	Potential Koala habitat .....	104
1.1.1	Migratory Species .....	106
7.5	LIMITATIONS TO DATA, ASSUMPTIONS AND PREDICTIONS .....	106
<b>8</b>	<b>MITIGATING AND MANAGING IMPACTS.....</b>	<b>107</b>
8.1	MEASURES.....	107
8.1.1	Impacts from the clearing of vegetation and habitats .....	107
8.1.2	Indirect impacts .....	107
8.1.3	Prescribed impacts .....	107
8.2	ADAPTIVE MANAGEMENT STRATEGY .....	116
<b>9</b>	<b>SERIOUS AND IRREVERSIBLE IMPACTS (SAIL).....</b>	<b>117</b>
9.1	POTENTIAL SERIOUS AND IRREVERSIBLE IMPACT ENTITIES.....	117
9.1.1	Threatened ecological communities.....	117
9.1.2	Threatened species.....	117
9.2	ASSESSMENT OF SERIOUS AND IRREVERSIBLE IMPACTS .....	117
9.2.1	White Box - Yellow Box – Blakely’s Red Gum Woodland (Box-gum Woodland) .....	117
<b>10</b>	<b>REQUIREMENT TO OFFSET .....</b>	<b>122</b>
10.1	IMPACTS REQUIRING AN OFFSET .....	122

10.1.1 Ecosystem credits .....	122
10.1.2 Paddock tree credits .....	123
10.1.3 Species credits .....	123
10.1.4 Offsets required under the EPBC Act.....	124
10.2 IMPACTS NOT REQUIRING AN OFFSET.....	124
10.3 AREAS NOT REQUIRING ASSESSMENT .....	124
10.4 SUMMARY OF OFFSET CREDITS REQUIRED.....	129
<b>11 CONCLUSIONS.....</b>	<b>130</b>
<b>12 REFERENCES.....</b>	<b>131</b>
<b>APPENDIX A PLOT FIELD DATA.....</b>	<b>I</b>
<b>13 I</b>	
<b>APPENDIX B Paddock TREES .....</b>	<b>I</b>
<b>APPENDIX C FAUNA SPECIES .....</b>	<b>III</b>
<b>APPENDIX D PROTECTED MATTERS SEARCH RESULTS .....</b>	<b>VI</b>
<b>APPENDIX E EPBC SPECIES HABITAT ASSESSMENT .....</b>	<b>VII</b>
<b>APPENDIX F EPBC ASSESSMENT OF SIGNIFICANT IMPACT .....</b>	<b>I</b>
<b>APPENDIX G LAND CATEGORY ASSESSMENT .....</b>	<b>XVI</b>
<b>APPENDIX H. BAM CALCULATOR CREDIT REPORT .....</b>	<b>XVII</b>
<b>APPENDIX I UPDATED CONSTRAINTS AND LAYOUT MAP .....</b>	<b>I</b>

## TABLES

Table 2-1 Percent Native Vegetation Cover in the buffer area. ....	22
Table 3-1 River Red Gum herbaceous – grassy very tall open forest wetland on inner floodplains in the lower slopes sub-region of the NSW South Western Slopes Bioregion and the Eastern Riverina Bioregion .....	32
Table 3-2 Yellow Box - River Red Gum tall grassy riverine woodland of NSW South Western Slopes Bioregion and Riverina Bioregion.....	34
Table 3-3 Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions.....	36
Table 3-4 Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion .....	38
Table 3-5 Vegetation zones for the development site.....	45
Table 3-6 Current vegetation integrity scores for each vegetation zone within the development site.....	59

Table 4-1 Ecosystem credit species. ....	60
Table 4-2 Candidate species credit species requiring assessment .....	64
Table 4-3 Species credit species excluded based on absent habitat features .....	69
Table 4-4 Summary of species credit species surveyed at the development site .....	71
Table 5-1 Condition threshold assessment for the federally listed White Box - Yellow Box - Blakely's Red Gum Grassy Woodlands and derived native grasslands .....	84
Table 7-1 Potential impacts to biodiversity during the construction and operational phases.....	92
Table 7-2 Table of current and future vegetation integrity scores for each vegetation zone within the development site. ....	93
Table 7-3 Summary of species credit species loss at the development site. ....	93
Table 7-4 Hollow Bearing Trees impacted by the proposal. ....	94
Table 7-5 Potential impacts on biodiversity during the construction and operational phases.....	95
Table 7-6: Koala habitat assessment tool for inland areas (DoE 2014) .....	104
Table 8-1 Mitigation measures proposed to avoid and minimise impacts on native vegetation and habitat .....	109
Table 10-1 PCTs and vegetation zones that require offsets. ....	122
Table 10-2 Paddock trees that require offsets. ....	123
Table 10-3 Species credit species that require offsets. ....	123
Table 10-4 Summary of offset credits required.....	129
Table 13-1 Assessment of Significance for endangered ecological communities .....	II
Table 13-2 Assessment of Significance for critically endangered EPBC species .....	III

## FIGURES

Figure 1-1 Site map of the proposed Culcairn Solar Farm. ....	13
Figure 2-1 Cleared Vegetation within the site .....	18
Figure 2-2 Back Creek .....	19
Figure 2-3 Farm Dam on site.....	19
Figure 2-4 Wetlands identified in the Greater Hume LEP.....	20
Figure 2-5 Location map .....	23
Figure 3-1 Native vegetation extent within the development site.....	25



Figure 3-2 Native vegetation extent within the development site.....	26
Figure 3-3 Native vegetation extent within the development site.....	27
Figure 3-4 Native vegetation extent within the development site.....	28
Figure 3-5 River Red Gum Herbaceous – grassy very tall open forest wetland on inner floodplains in the lower slopes sub-region of the NSW South Western Slopes Bioregion and the Eastern Riverina Bioregion. ....	33
Figure 3-6 Yellow Box - River Red Gum tall grassy riverine woodland of NSW South Western Slopes Bioregion and Riverina Bioregion .....	35
Figure 3-7 Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions.....	37
Figure 3-8 Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion .....	39
Figure 3-9 PCTs and TECs at the development site .....	40
Figure 3-10 PCTs and TECs at the development site .....	41
Figure 3-11 PCTs and TECs at the development site .....	42
Figure 3-12 PCTs and TECs at the development site .....	43
Figure 3-13 Vegetation zones at the development site.....	53
Figure 3-14 Vegetation zones at the development site.....	54
Figure 3-15 Vegetation zones at the development site.....	55
Figure 3-16 Vegetation zones at the development site.....	56
Figure 3-17 Paddock trees within the development site.....	58
Figure 4-1 Threatened species polygons and targeted survey locations.....	77
Figure 4-2 Threatened species polygons and targeted survey locations.....	78
Figure 4-3 Threatened species polygons and targeted survey locations.....	79
Figure 4-4 Threatened species polygons and targeted survey locations.....	80
Figure 6-1 Project footprint .....	89
Figure 7-1 Estimated zones of indirect impact for the proposal .....	99
Figure 9-1 Location of serious and irreversible impacts .....	121
Figure 10-1 Impacts requiring offset, not requiring offset and not requiring assessment.....	125
Figure 10-2: Impacts requiring offset, not requiring offset and not requiring assessment.....	126

Figure 10-3: Impacts requiring offset, not requiring offset and not requiring assessment.....127

Figure 10-4: Impacts requiring offset, not requiring offset and not requiring assessment.....128

## ACRONYMS AND ABBREVIATIONS

BAM	Biodiversity Assessment Methodology
BC Act	Biodiversity Conservation Act 2016 (NSW)
BDAR	Biodiversity Development Assessment Report
Biosecurity Act	Biosecurity Act 2015
BOM	Australian Bureau of Meteorology
CEEC	Critically endangered ecological communities
CEMP	Construction environmental management plan
Cwth	Commonwealth
DBH	Diameter at Breast Height
EEC	Endangered ecological community
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999 (Cwth)
EP&A Act	Environmental Planning and Assessment Act 1979 (NSW)
FM	Fisheries Management Act 1994 (NSW)
GHG	Greenhouse gases
ha	Hectares
HBT	Hollow-bearing trees
IBRA	Interim Biogeographic Regionalisation of Australia
ISEPP	State Environmental Planning Policy (Infrastructure) 2007 (NSW)
km	Kilometres
LEP	Local Environment Plan
LRET	Large-scale renewable energy target
m	Metres
MNES	Matters of National environmental significance under the EPBC Act (c.f.)
MW	Megawatt
NSW	New South Wales
OEH	(NSW) formerly Office of Environment and Heritage, now Biodiversity Conservation Division, Department Planning, Industry & Environment

PV	Photovoltaic
SAII	Serious and Irreversible Impact
SEARs	Secretary's Environmental Assessment Requirements
SEPP	State Environmental Planning Policy (NSW)
sp/spp	Species/multiple species
SSD	State Significant Development
TEC	Threatened Ecological Community
VIS	Vegetation Integrity Score

## EXECUTIVE SUMMARY

NGH Consulting has prepared this BDAR on behalf of NEOEN for the Culcairn Solar Farm, 4.3 km northeast of Culcairn, NSW. The proposal would develop around 892 ha hectares (ha) of the 1049 ha development site.

The aim of this BDAR is to address the biodiversity matters raised in the Secretary's Environmental Assessment Requirements (SEARs) and to address the requirements of the *Biodiversity Conservation Act 2016* (NSW) (BC Act) and the *Environmental Protection and Biodiversity Conservation Act 1999* (Cwth) (EPBC Act). This BDAR forms part of an Environmental Impact Statement (EIS) for the State Significant Development (SSD), prepared under Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

The Biodiversity Assessment Methodology (BAM) is the required assessment methodology for SSDs that trigger the NSW Biodiversity Offsets Scheme under the BC Act. This report follows the field work methodologies and assessment required by the BAM.

Comprehensive mapping and field surveys were completed in accordance with the requirements of the BAM. The majority of the development site has been cleared of native vegetation, and cultivated for agriculture, which is the dominant land use in the area. Approximately 996 ha of the development site is comprised of non-native vegetation in the form of exotic pastures and crops. This has been validated through the completion of a Land Category Assessment (NGH, 2020). Around 51 ha of native vegetation occurs in the development site, comprised of scattered isolated patches of remnant woodland, paddock trees and derived grassland. The native vegetation is comprised of four Plant Community Types (PCTS). These are;

- PCT 5 – River Red Gum herbaceous-grassy very tall open forest wetland on inner floodplains in the lower slopes sub-region of the NSW South Western Slopes Bioregion and the Eastern Riverina Bioregion.
- PCT 74 - Yellow Box - River Red Gum tall grassy riverine woodland of NSW South Western Slopes Bioregion and Riverina Bioregion.
- PCT 76 Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions.
- PCT 277 – Blakely's Red Gum – Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion.

PCT 76 is listed as Endangered under the BC Act as it forms part of the TEC - Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregion. 0.78 ha of this PCT was unable to be surveyed and assumed to meet criteria for the EPBC listed community. Impacts to this PCT have been avoided.

PCT 74 and PCT 277 form part of the Endangered Ecological Community (EEC): White Box-Yellow Box-Blakely's Red Gum woodland under the BC Act. These communities within the development site do not meet the criteria for the federally listed CEEC, due to having a very degraded understory dominated by exotic annual grasses.

Consideration has been given to avoiding and minimising impacts to native vegetation throughout each phase of the proposal. Site design options have been assessed against key environmental, social and economic criteria. Larger patches of remnant woodland and creek lines have been avoided by the development footprint. In May 2020, the designs were further refined to avoid native vegetation, including the avoidance to a further 20 paddock trees. In September 2020, the development footprint was further

reduced from 1084 ha to 892 ha based on feedback from the Department of Primary Industries and Environment (DPIE). This included removing the area north of Cummings Road which resulted in a reduction of 13 paddock trees requiring offset and minor reduction in disturbances to derived grassland communities. As such, the reduction in the development site and development footprint has resulted in field data collected now being outside the current development site, however all field data collected during surveys has been utilised in this assessment and is considered representative of the vegetation zones being impacted. Mitigation and management measures would be put in place to adequately address impacts associated with the proposal, both direct and indirect.

For biodiversity impacts that are unavoidable, the proposal would require the removal of:

- 0.31 ha of PCT 277 – Blakely’s Red Gum – Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion
- 0.01 ha of PCT 5 River Red Gum herbaceous-grassy very tall open forest wetland on inner floodplains in the lower slopes sub-region of the NSW South Western Slopes

The removal of this native vegetation generated the following ecosystem credits;

- PCT 277 – Blakely’s Red Gum – Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion – 7 credits.
- PCT 5 River Red Gum herbaceous-grassy very tall open forest wetland on inner floodplains in the lower slopes sub-region of the NSW South Western Slopes–1 credit

No other PCTs were impacted as a result of the proposal.

The removal of 64 paddock trees generated the following credits:

- PCT 76 – Western Grey Box tall grassy woodland – 17 credits.
- PCT 277 – Blakely’s Red Gum – Yellow Box grassy tall woodland - 44 credits.

No threatened species were detected during surveys of the Development Site. Targeted surveys were undertaken for 33 candidate credit species associated with PCTS within the development site. No species credit species were identified within the development site. Four species were unable to be surveyed for during the appropriate survey period or sub-optimal seasonal conditions and were assumed to be present within suitable habitat including;

- Pine Donkey Orchid (*Diuris tricolor*) within PCT 76 with a native understory
- Small Scurf-pea (*Cullen parvum*), Small Purple-pea (*Swainsona recta*) and Silky Swainson-pea (*Swainsona sericea*) -assumed present within suitable habitat along Weeamera Road

The removal of suitable habitat along Weeamera Road relating to these threatened species credit species generated the following species credits.

- Small Scurf-pea *Cullen parvum* (Assumed presence) – 5 credits.
- Small Purple-pea *Swainsona recta* (Assumed presence) – 5 credits.
- Silky Swainson-pea *Swainsona sericea* (Assumed presence) – 5 credits.

The retirement of the credits generated will be carried out in accordance with the NSW Biodiversity Offsets Scheme under the BC Act. With the retirement of credits and effective implementation of the mitigation measures, the proposal would be consistent with the requirements of the BAM.



# 1 INTRODUCTION

The Culcairn Solar Farm proposal is classified as State Significant Development (SSD) under the State and Regional Development State Environmental Planning Policy (SEPP) and therefore a 'major project'. This Biodiversity Development Assessment Report (BDAR) assesses the impacts of the proposed Culcairn Solar Farm (the proposal) according to the NSW Biodiversity Assessment Methodology (BAM) as required by the Secretary's Environmental Assessment Requirements (SEARs) for the proposal. NGH Consulting has prepared this report on behalf of the proponent, Neoen Australia Pty Ltd.

The following terms are used in this document:

- **Development footprint** – The area of land that is directly impacted on by the proposal. Including, solar array design, perimeter fence, Asset protection Zones (APZ), access roads, transmission line footprint and areas used to store construction materials. The development footprint is approximately 892 ha.
- **Development site** – The area of land within a proposed development, including public road and intersection upgrades, that are subject to potential direct and indirect impacts from the proposal. The development site is approximately 1049 ha. The development site is the area surveyed for this assessment.
- **Subject land** – The combined areas of the development site and development footprint within affected lot boundaries, and the area where the BAM has been applied.
- **Buffer area** – All land within 1500 m of the outside edge of the boundary of the development footprint.

## 1.1 THE PROPOSAL

Culcairn Solar Farm would occupy around 892 hectares (ha) of the 1049 ha development site, retaining existing viable native vegetation remnants that occur on the array site. The proposal would comprise the installation of a solar plant that would generate a maximum 350 MW of renewable energy for the national grid, enough to power approximately 140,000 homes in the Greater Hume area.

The proposal would consist of the following components:

- Single axis tracker photovoltaic solar panels mounted on steel frames over most of the site.
- Battery storage to store energy produced on site (100 MWh capacity).
- Underground and overground electrical conduits and cabling to connect the arrays and to the inverters and transformers.
- Systems of inverter units and voltage step-up throughout the arrays.
- On site substation, connecting to existing 330 kV TransGrid transmission line.
- Site office and maintenance building, vehicle parking areas, internal access tracks and perimeter security fencing.
- Site access track off Cummings Road (both sides of Cummings Road) and unnamed Crown and local roads that cross the site.
- Road crossing and easement electrical crossing through underground and/or overhead lines.

In total, the construction phase of the proposal is expected to take 12 to 18 months. The Culcairn Solar Farm is expected to operate for around 30 years. Approximately 5 to 10 operations and maintenance

personnel would operate the plant. The solar farm would be decommissioned at the end of its operational life; all above ground infrastructure and below ground infrastructure less than 2500 mm deep would be removed in consultation with the landowner, with the site to be returned to its existing land capability for agricultural land use.

## **1.2 THE DEVELOPMENT SITE**

### **1.2.1 Site location**

The proposed location of Culcairn Solar Farm is in the Greater Hume Local Government Area (LGA), around 35 km north of Albury as shown in Figure 1-1.

The subject land comprises Lots 70-73, 86 DP 753764; Lots 9-11, 45-47, 53, 54 DP 753735; Lot 1 DP 179854; Lot 114 DP 664997; Lot 1 DP 575478; Lot 1 DP 171815; Lot 1 DP 945904; Lot B DP 9720541069452 as shown in Figure 1-1.



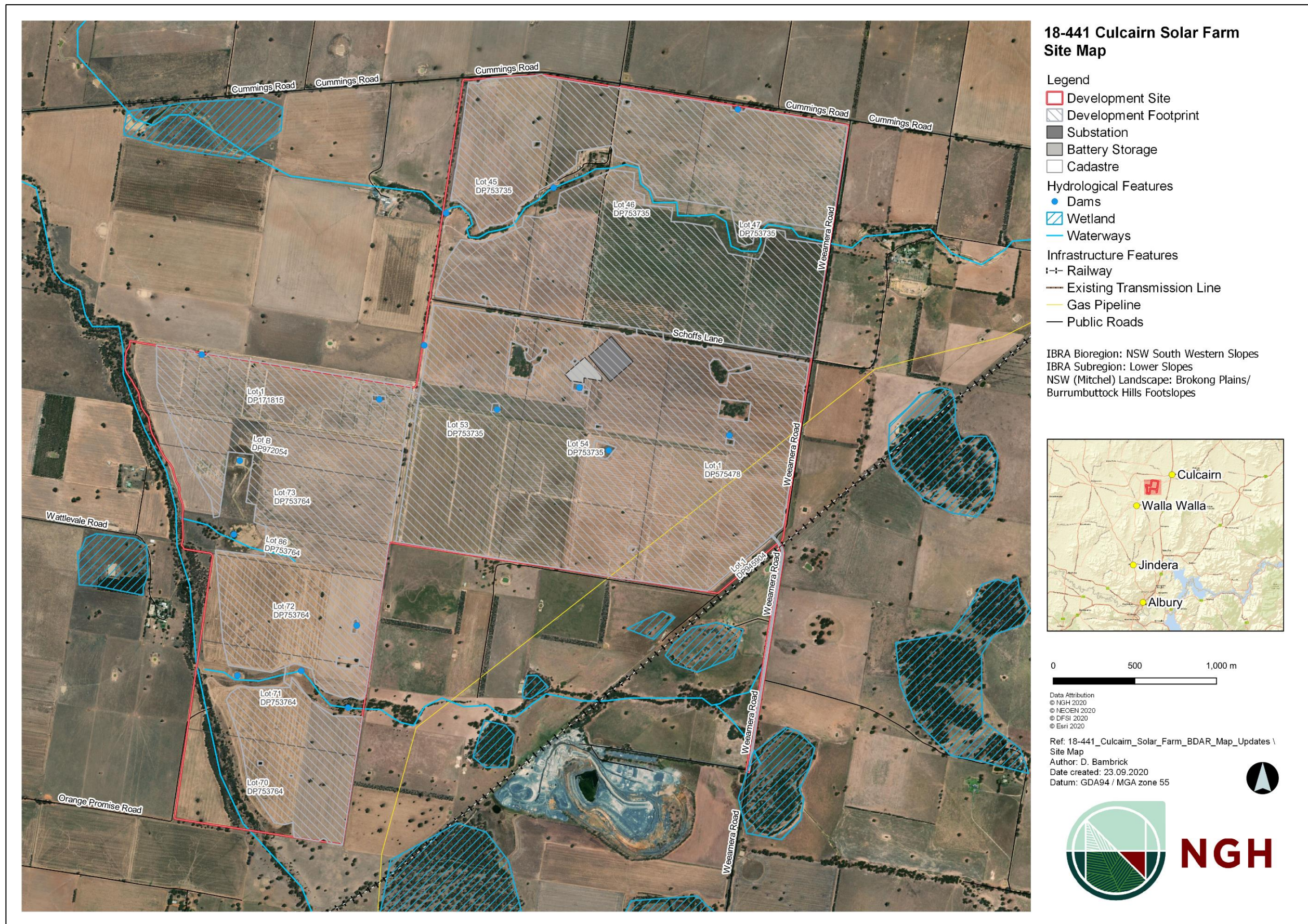


Figure 1-1 Site map of the proposed Culcairn Solar Farm.



### **1.2.2 Site description**

The development site is located within the Greater Hume Local Government Area (LGA). It is accessed primarily from Cummings Road, approximately 4 km west of the intersection with the Olympic Highway, with alternative access points off Weeamera Road. Cummings Road and Weeamera Road are both local roads managed and maintained by Greater Hume Shire Council. An existing quarry is located on Weeamera Road, and the intersection of Benambra Road and Cummings Road has already been upgraded to facilitate turning heavy vehicles.

The development site is agricultural land comprising several large paddocks that are generally flat and largely cleared and cultivated primarily for cropping. Native vegetation remains in the form of scattered paddock trees, roadside vegetation, riparian vegetation, and small isolated patches of remnant woodland. Two watercourses run through or along the boundary of the development site, Back Creek to the west, and three unnamed ephemeral drainage lines flowing east-west through the development site. Back Creek and the small unnamed drainage lines are generally dry, experiencing water flow only at times of high rainfall. Within the development site, sections of these creek lines are bordered by planted and remnant native vegetation.

Culcairn is the closest town to the proposal, approximately 4.7 km north-east of the proposal. Culcairn is located approximately 50 km north of the major town of Albury, with a population of 1,473 as at the 2016 Census (ABS 2018b). Culcairn has a number of attractions including the Station House Museum, Morgan's Lookout, Culcairn Bike Track, Culcairn Golf Club, and Culcairn Hotel. The population for Albury's urban locality in June 2018 was recorded as 53,289 persons (Population Australia 2018). It supports supermarkets, post offices, service stations, accommodation, restaurants, medical services and recreation facilities.

The Murray River and Lake Hume are located approximately 45 km south and 22 km south-east, respectively, of the proposal. The Benambra National Park and Tabletop Nature Reserve are located approximately 10 km east and 15 km south-east, respectively, of the proposed.

The proposal is within the South Western Slopes Bioregion and the main vegetation types identified in this bioregion are open woodlands of White Box Grassy Woodlands, Grey Box tall grassy woodland, Blakely's Red Gum – Yellow Box grassy tall woodland, and River Red Gum open forest wetlands.

## 1.3 STUDY AIMS

This BDAR has been prepared by NGH Consulting on behalf of Neoen Australia.

The aim of this BDAR is to address the requirements of the BAM, as required in the SEARs and summarised below.

Secretary's Environmental Assessment Requirement	Where addressed
<p>The EIS must address the following specific issues:</p> <p>Biodiversity impacts related to the proposed development are to be assessed in accordance with section 7.9 of the <i>Biodiversity Conservation Act 2016</i> using the Biodiversity Assessment Method (BAM) and documented in a Biodiversity Development Assessment Report (BDAR). The BDAR must include information in the form detailed in the Biodiversity Conservation Act 2016 (s6.12), Biodiversity Conservation Regulation 2017 (s6.8) and the BAM, unless OEH and DPE determine that the proposed development is not likely to have any significant impact on biodiversity values.</p>	<b>Sections 2, 3 and 4</b>
<p>The BDAR must document the application of the avoid, minimise and offset framework including assessing all direct, indirect and prescribed impacts in accordance with the BAM.</p>	<b>Sections 6, 7 and 8</b>
<p>The BDAR must include details of the measures proposed to address the offset obligation as follows;</p> <ol style="list-style-type: none"> <li>The total number and classes of biodiversity credits required to be retired for the development/project;</li> <li>The number and classes of like-for-like biodiversity credits proposed to be retired;</li> <li>The number and classes of biodiversity credits proposed to be retired in accordance with the variation rules;</li> <li>Any proposal to fund a biodiversity conservation action;</li> <li>Any proposal to make a payment to the Biodiversity Conservation Fund.</li> </ol> <p>If seeking approval to use the variation rules, the BDAR must contain details of the reasonable steps that have been taken to obtain requisite like-for-like biodiversity credits</p>	<b>Section 10</b>
<p>The BDAR must be submitted with all digital spatial data associated with the survey and assessment as per Appendix 11 of the BAM:</p> <ul style="list-style-type: none"> <li>Location of biodiversity development site</li> <li>Biodiversity development site boundary map</li> <li>Cadastral map of biodiversity development site</li> <li>Table of PCTs at the biodiversity development site and the number of ecosystem credits created</li> <li>Table of threatened species at the biodiversity development site and the number of species credits created</li> <li>Submitted proposal in the Credit Calculator</li> </ul>	<p><b>Figure 1-1</b> <b>Figure 1-1</b> <b>Section 10.1.1</b></p> <p><b>Section 10.1.3</b></p>
<p>The BDAR must be prepared by a person accredited in accordance with the Accreditation Scheme for the Application of the Biodiversity Assessment Method Order 2017 under s6.10 of the BC Act 2016.</p>	<b>Document verification (front of document)</b>

No specific considerations for any threatened species, populations or communities were specified in the SEARs or by the NSW Office of Environment and Heritage (OEH).



## 1.4 SOURCE OF INFORMATION USED IN THE ASSESSMENT

The following information sources were used in this BDAR:

- Proposal layers, construction methodology and concept designs provided by EB Pro Pty Ltd.
- Australian Government's Species Profiles and Threats (SPRAT) database  
<http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl>
- DPI profiles of threatened species, population, and ecological communities
- Commonwealth Department of Environment and Energy Protected Matters Search Tool  
Accessed online at <http://environment.gov.au/epbc/protected-matters-search-tool>
- Australia's IBRA Bioregions and Sub-bioregions. Accessed  
<http://environment.gov.au/land/nrs/science/ibra/australias-bioregions-maps>
- Department of Environment and Climate Change NSW (DECC) (2002). Descriptions for NSW (Mitchell) Landscapes, Version 2
- NSW OEH's Biodiversity Assessment Method (BAM) calculator  
(<http://www.environment.nsw.gov.au/bbccapp/ui/mynews.aspx>)
- NSW OEH's BioNet threatened biodiversity database  
Accessed online via login at <http://www.bionet.nsw.gov.au/>
- NSW OEH Threatened Species Profiles  
<http://www.environment.nsw.gov.au/threatenedSpeciesApp/> and  
[www.environment.nsw.gov.au/AtlasApp/UI\\_Modules/](http://www.environment.nsw.gov.au/AtlasApp/UI_Modules/)
- OEH BioNet Vegetation Classification Database (OEH 2017)  
Accessed online via login at <http://www.environment.nsw.gov.au/NSWVCA20PRapp/default.aspx>
- OEH VIS Mapping  
Accessed online at <http://www.environment.nsw.gov.au/research/VISmap.htm>
- Office of Environment and Heritage (OEH) (2017). Biodiversity Assessment Method
- NSW Government SEED Mapping  
[https://geo.seed.nsw.gov.au/Public\\_Viewers/index.html?viewer=Public\\_Viewers&locale=en-AU](https://geo.seed.nsw.gov.au/Public_Viewers/index.html?viewer=Public_Viewers&locale=en-AU)
- NSW Biodiversity Values Map  
<https://www.lmbc.nsw.gov.au/Maps/index.html?viewer=BVMap>

## 2 LANDSCAPE FEATURES

### 2.1 IBRA BIOREGIONS AND SUBREGIONS

Interim Biogeographic regionalisation for Australia (IBRA) Bioregions are geographically distinct bioregions based on common climates, geology, landforms and native vegetation (Thackaway and Creswell, 1995). There are 89 IBRA bioregions within Australia. The development site falls within the NSW South Western Slopes IBRA Bioregion. The South Western Slopes is an extensive area of foothills and isolated ranges, comprising the lower inland slopes of the Great Dividing Range extending from north of Cowra through southern NSW into western Victoria. The NSW portion of the bioregion occupies about 10.1% of the state. Towns located in the bioregion include Cootamundra, Mudgee, Gundagai, Narrandera, Parkes, Wagga Wagga and Young.

The Lower Slopes Subregion is characterised by wide valleys of the Riverina alluvial fans containing isolated peaks and undulating hilly ranges. The geology of the Lower Slopes comprises Ordovician to Devonian faulted sedimentary rocks imbedded with large areas of intrusive granites.

The Lower Slopes also contains large areas of Tertiary and Quaternary alluvium deposits. Vegetation communities within the subregion occupy suitable landscapes, such as:

- White Cypress Pine on the ranges.
- Poplar Box, Kurrajong, Wilga and Red Box in the north.
- Grey Box woodlands with Yellow Box, White Cypress Pine and Belah on lower areas.
- Myall, Rosewood and Yarran on grey clays.
- Dwyer's Gum on granite.
- Red Ironbark on sedimentary rocks.
- River Red Gum on all streams with Black Box in the west.

### 2.2 NATIVE VEGETATION

An assessment of native vegetation in the 1500 m buffer area was undertaken using aerial imagery, State Vegetation Mapping (OEH, 2016b) and field assessments. Approximately 13.51% (608.02ha) of native vegetation occurs in the surrounding 1500 m buffer area. This vegetation, in the landscape surrounding the development site is predominantly open woodland comprised of Blakely's Red Gum (*Eucalyptus blakelyi*), Yellow Box (*Eucalyptus melliodora*), Western Grey Box (*Eucalyptus microcarpa*), White Box (*Eucalyptus albens*) and River Red Gum (*Eucalyptus camaldulensis*), and Plains Grass Grassland.

### 2.3 CLEARED AREAS

An assessment of cleared areas in the 1500 m buffer area was undertaken using aerial imagery, State Vegetation Mapping (OEH, 2016b), NSW Landuse Mapping (OEH, 2017) and field assessments. Approximately 86.5% (3891.43 ha) of the buffer area comprises cleared vegetation, predominantly cropped paddocks and occasional roads and residences.



Figure 2-1 Cleared Vegetation within the site

## **2.4 RIVER AND STREAMS**

The proposal is located approximately 45 km north of the Murray River. Two watercourses run through or along the boundary of the development site, Back Creek to the west, and two unnamed ephemeral drainage lines flow westward into Back Creek through the centre of the development site. These creeks are classified as first or second order streams under the Strahler Stream Classification System (DPI 2018). These creeks are generally dry, experiencing water flow only at times of high rainfall.

Sixteen (16) man-made farm dams exist within the development site (Figure 2-3). These dams are generally heavily utilised by stock and devoid of native vegetation.





Figure 2-2 Back Creek



Figure 2-3 Farm Dam on site



## 2.5 WETLANDS

An EPBC Protected Matters search completed on 9<sup>th</sup> August 2019 identified seven wetlands of international importance. The closest of these are the Barmah Forest and NSW Central Murray State Forests both between 100 km and 150 km from the development site, downstream within the Murray Catchment. The EPBC Protected Matters search identified no nationally important wetland that would potentially be impacted by land use at the development site. Culcairn Swamp (Gum Swamp), is located about 2.5 km west from the development site and is a seasonal swamp that is mostly dry during the warmer months.

Several smaller, unlisted swamps were identified near the development site. These are shown in Figure 2 - 4 from the Greater Hume LEP.

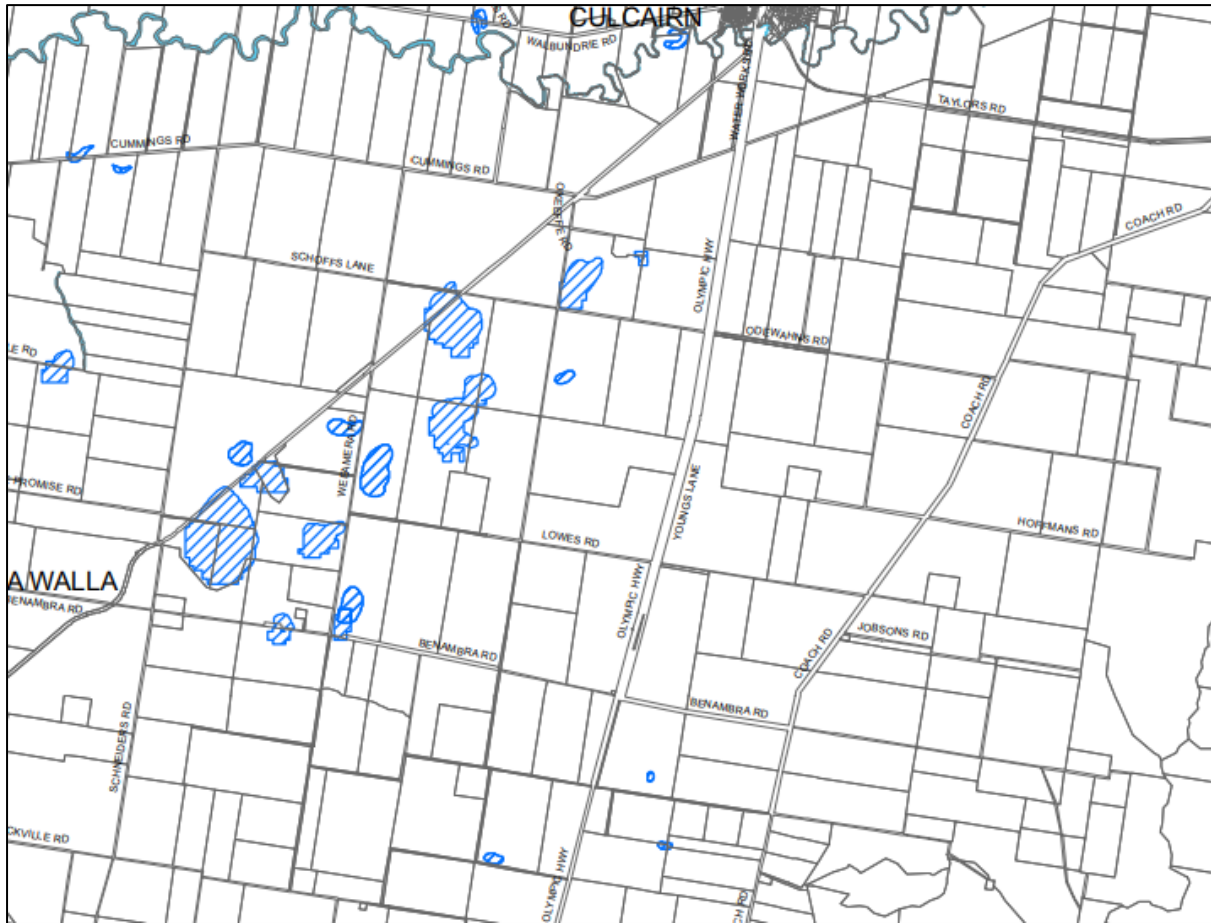


Figure 2-4 Wetlands identified in the Greater Hume LEP.

## 2.6 CONNECTIVITY FEATURES

The 1.5 km buffer area is largely cleared and heavily fragmented and provides minimal connectivity. Back Creek provides a wildlife corridor through the bottom southwestern corner of the development site which connects to Billabong Creek north of the development site.

## 2.7 AREAS OF GEOLOGICAL SIGNIFICANCE

No karsts, caves, crevices or cliffs or other areas of geological significance occur in or adjacent to the development site.



## 2.8 AREAS OF OUTSTANDING BIODIVERSITY VALUE

No Areas of Outstanding Biodiversity Value (AOBV) occur within the development site.

## 2.9 SITE CONTEXT COMPONENTS

### Method applied

The proposal conforms to the definition of a *site-based development* under the Biodiversity Assessment Methodology. The site-based development assessment methodology has been used in this BAM assessment. The Percent Native Vegetation was calculated by estimating the percent cover of native vegetation relevant to the benchmark for the PCT. PCTs were allocated based on existing vegetation mapping, field inspections and aerial imagery.

### Percent Native Vegetation Cover

As determined by GIS mapping from aerial imagery, approximately 608.02 ha of native vegetation occurs in the 1500 m buffer area (Figure 2-4). This native vegetation in the landscape surrounding the development is considered to be predominantly grassy woodland comprised of Blakely's Red gum (*Eucalyptus blakelyi*), River Red Gum (*Eucalyptus camaldulensis*) and Yellow Box (*Eucalyptus melliodora*).

Eleven PCTs occurred in the 1500 m buffer area (Table 2-1). Areas of native vegetation were calculated using GIS mapping. The total area of the 1500 m<sup>2</sup> buffer area is 4499.45 ha. The Percent Native Vegetation Cover within the 1500 m buffer area surrounding the development site prior to the development was calculated to be 13.51 %. This was entered into the BAM calculator for the proposal.

Table 2-1 Percent Native Vegetation Cover in the buffer area.

Plant Community Type	Area of native vegetation (ha)
<i>River Red Gum herbaceous-grassy very tall open forest wetland on inner floodplains in the lower slopes sub-region of the NSW South Western Slopes Bioregion (PCT 5)</i>	134.29
<i>Lignum shrubland wetland of the semi-arid (warm) plains (mainly Riverina Bioregion and Murray Darling Depression Bioregion) (PCT 17)</i>	13.21
<i>Canegrass swamp tall grassland wetland of drainage depressions, lakes and pans of the inland plains (PCT 24)</i>	10.2
<i>Derived Grassland of the NSW South Western Slopes (PCT 45)</i>	110.69
<i>Yellow Box - River Red Gum tall grassy riverine woodland of NSW South Western Slopes Bioregion and Riverina Bioregion (PCT 74)</i>	0.083
<i>Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions (PCT 76)</i>	146.0
<i>Western Grey Box - Cypress Pine shrubby woodland on stony footslopes in the NSW South Western Slopes Bioregion and Riverina Bioregion (PCT 110)</i>	2.33
<i>Riparian Blakelys Red Gum - box - shrub - sedge - grass tall open forest of the central NSW South Western Slopes Bioregion</i>	5.54
<i>River Red Gum swampy woodland wetland on cowals (lakes) and associated flood channels in central NSW (PCT 249)</i>	120.03
<i>River Red Gum shrub/grass riparian tall woodland or open forest wetland mainly in the upper slopes sub-region of the NSW South Western Slopes bioregion and western South East Highlands Bioregion</i>	0.4
<i>White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion (PCT 266)</i>	4.693
<i>Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion (PCT 277)</i>	54.91
<b>TOTAL</b>	<b>608.02</b>



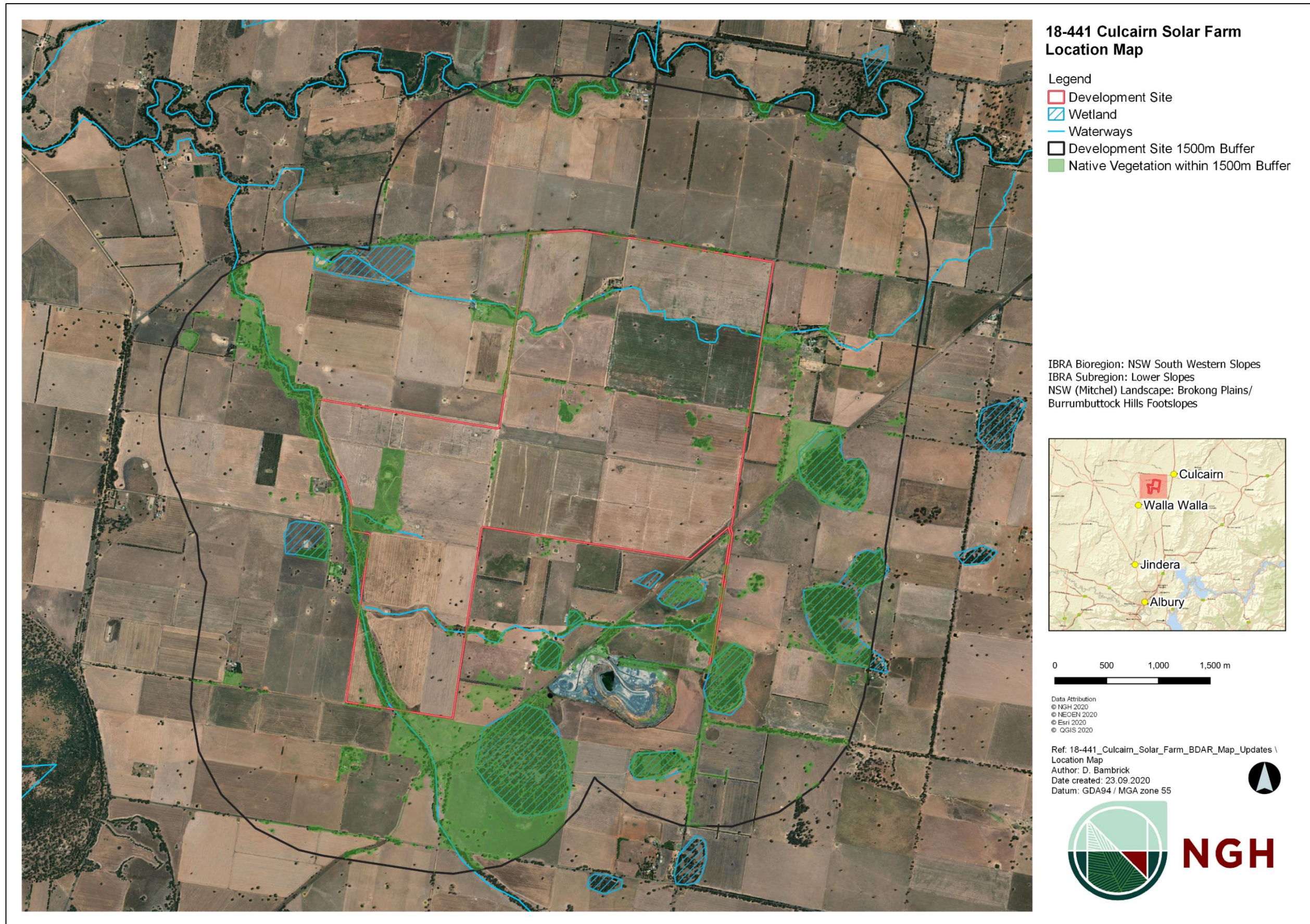


Figure 2-5 Location map



## 3 NATIVE VEGETATION

### 3.1 NATIVE VEGETATION EXTENT

Percent Native Vegetation was calculated by estimating the percent cover of native vegetation relevant to the benchmark for the PCT. PCTs were allocated based on existing vegetation mapping, field inspections and aerial imagery.

52.77 ha of native vegetation occurs within the development site. This is comprised of:

- 24.32 ha of River Red Gum herbaceous-grassy very tall open forest wetland on inner floodplains in the lower slopes sub-region of the NSW South Western Slopes Bioregion (PCT 5)
- 8.10 ha of Yellow Box - River Red Gum tall grassy riverine woodland of NSW South Western Slopes Bioregion and Riverina Bioregion (PCT 74)
- 5.52 ha of Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions (PCT 76)
- 14.83 ha of Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion (PCT 277)

Approximately 996 ha of the development site occurs as exotic grazed pasture or crops. These areas are dominated by exotic vegetation such as Wheat (*Triticum aestivum*) and Barley (*Hordeum* sp.). These areas do not provide any threatened species habitat, have been categorised as Category 1 exempt land as summarised in Appendix G and therefore do not require further assessment.

Ninety five (95) paddock trees including sixty six (66) hollow bearing trees occur within the development site (Figure 3-1 to Figure 3-4 ). Paddock trees are defined as:

- a tree or a group of up to three trees less than 50 m apart from each other, and
- over an exotic groundcover, and
- more than 50 m away from any other living tree greater than 20 cm DBH, and
- on category 2 land surrounded by category 1 land (as defined by the BAM, 2017).<sup>1</sup>

Paddock trees throughout the development site were assessed under the streamlined assessment module – clearing paddock trees (Appendix 1 of the BAM) and incorporated into this report. They are considered both in terms of ecosystem credits and as habitat for threatened species and any credits generated are additional to those created by applying the full BAM.

---

<sup>1</sup> The regulatory land mapping has not been yet been published under the new *Local Land Service Act 2016* (LLS Act). During the transitional period, land categories are to be determined in accordance with the definitions of regulated land in the LLS Act. In this case, the paddock trees are located on land with native vegetation present since January 1990, surrounded by land that has been cleared of native vegetation since January 1990.



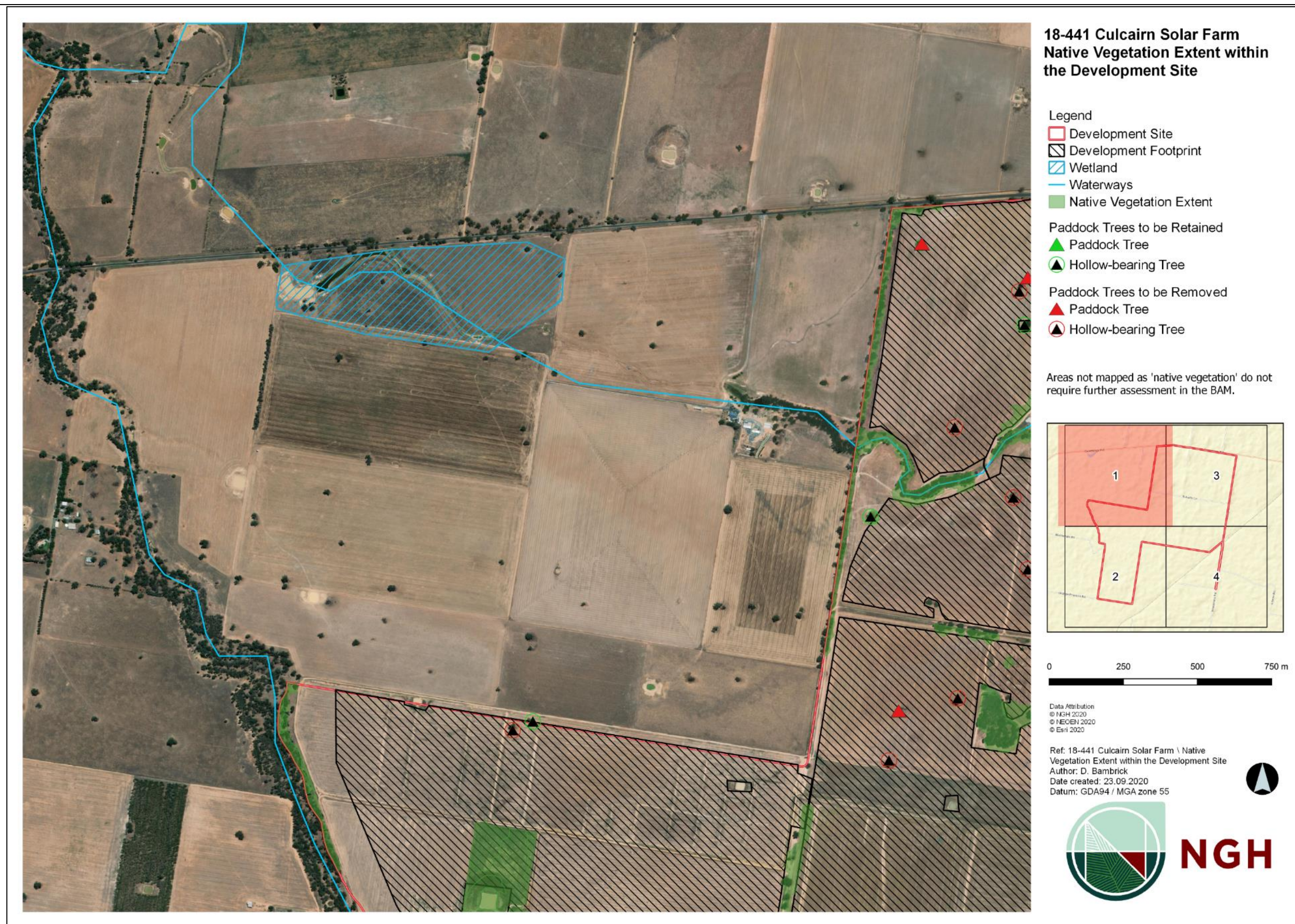


Figure 3-1 Native vegetation extent within the development site



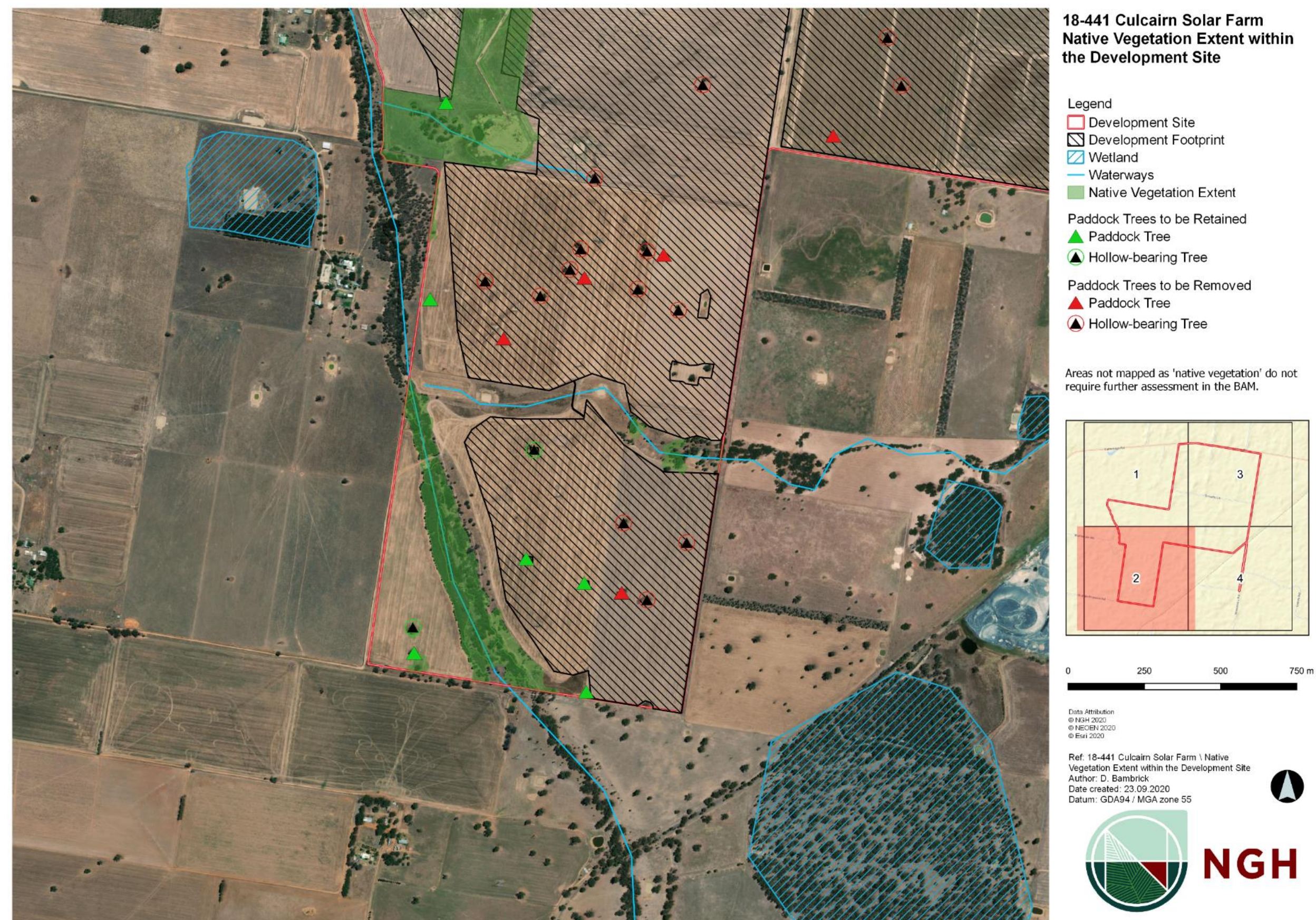


Figure 3-2 Native vegetation extent within the development site



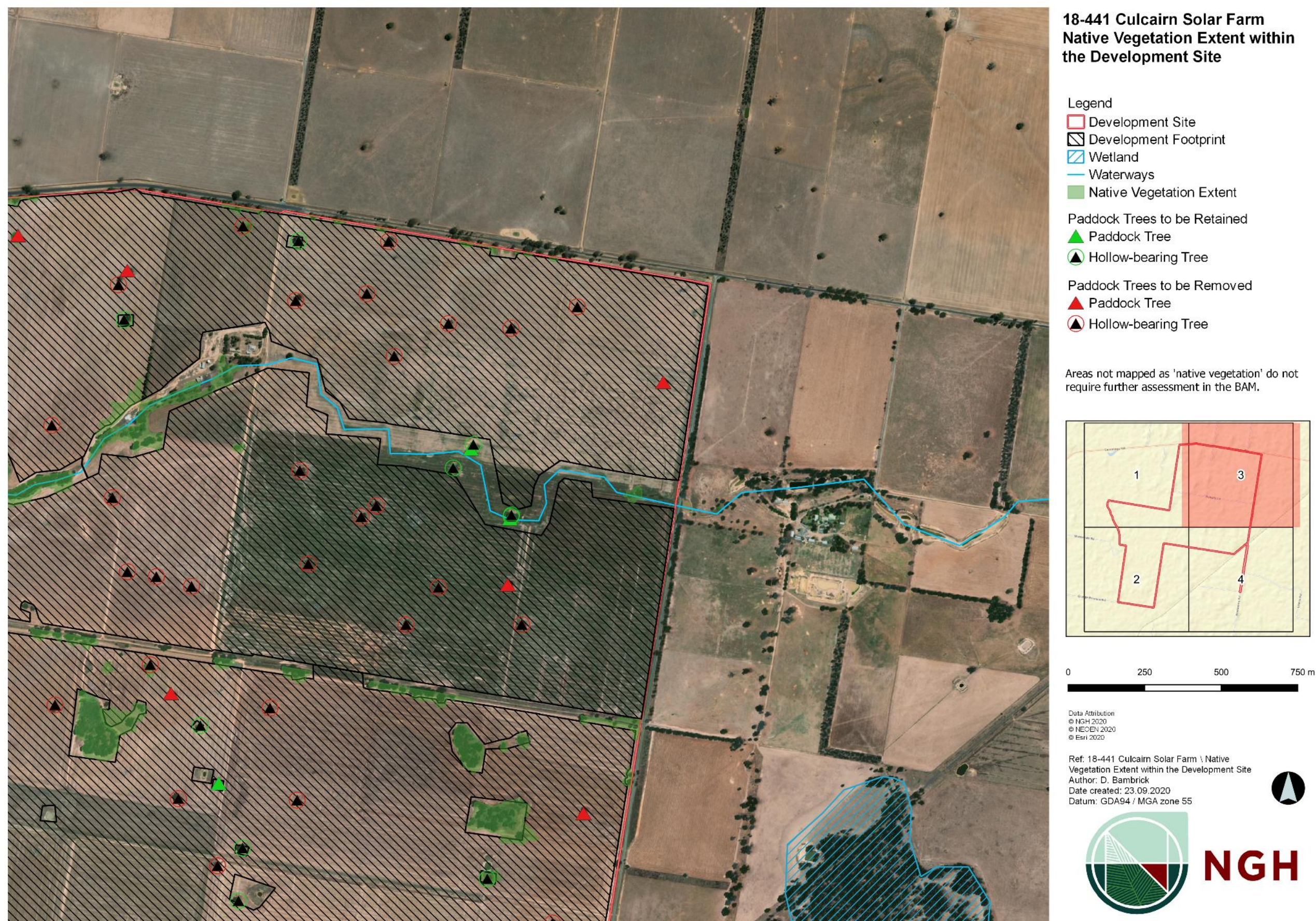


Figure 3-3 Native vegetation extent within the development site



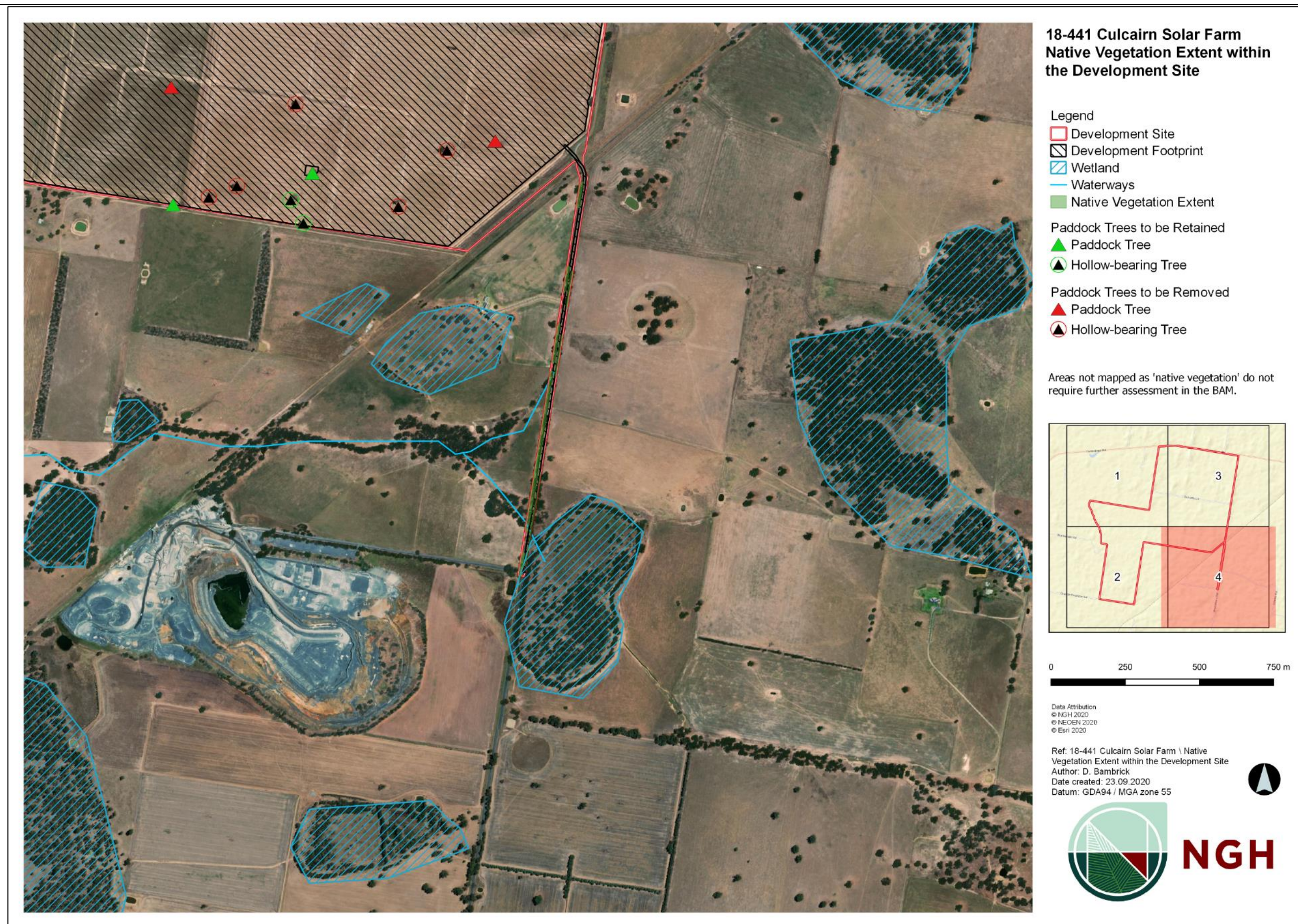


Figure 3-4 Native vegetation extent within the development site



## 3.2 LAND CATEGORY ASSESSMENT

As stated within BC Act s6.8(3), the biodiversity assessment is to exclude the assessment of any clearing of native vegetation and loss of habitat on category 1-exempt land (within the meaning of Part 5A of LLS Act. This excludes any impacts prescribed by the regulations under section 6.3. Additionally, in accordance with section 2.3.1.1 of the BAM, biodiversity values that do not need to be assessed include: (d) biodiversity values associated with the assessment of the impacts of any clearing of native vegetation and loss of habitat on category 1-exempt land (within the meaning of Part 5A of the LLS Act), other than the additional biodiversity impacts in accordance with clause 6.1 of the BC regulation.

Boundaries delineating Category 1-exempt and Category 2-regulated land on the Native Vegetation Regulatory (NVR) map are not yet publicly available. Therefore, during the transitional period (until the entire NVR map is released), accredited assessors may establish those boundaries and associated categorisation for the consent authority to consider by approximating the method used to make the NVR map under the provisions of the BC Act and the LLS Act. This is done by using the same methodology inclusive of, but not limited to:

- 2013 and 2017 Landuse mapping. A land use layer contributes to identifying land for inclusion in category 1 in the NVR map. Chapter 4 of the NVR map method statement describes the process for identifying and mapping existing and historical agricultural land use since 1 January 1990. Mapping existing and historical land use focuses on identifying patterns or evidence of agricultural land uses according to high-resolution aerial or satellite imagery and classifying land under a national land use classification system.
- Woody vegetation extent layer 2017. Contributes to identifying areas for inclusion in category 2 in the NVR map (including individual trees).
- Aerial imagery post 1990.
- Sensitive regulated land and vulnerable regulated land layer.

To meet the Category 1-exempt land requirement, land must be:

- Legally cleared at or since 1 January 1990 (Woody vegetation only).
- Significantly disturbed or modified since 1990 (Non-woody vegetation).

Based on the above data sources, there is evidence to suggest that large areas of the development site have been under regular rotational cropping or pasture improvement prior to 1990. This is supported by recent and historical imagery, as well as 2017 Land Use Mapping data. These areas include mapped areas such as:

- Exotic – Areas of cropping and horticultural plantings.
- Irrigation Dams and Channels.
- Infrastructure – Roads, dwellings and agricultural infrastructure.

These areas have been excluded from the BAM assessment, except where prescribed impacts are relevant and discussed in Section 7.3. Where in doubt, or where data sources were conflicting, a precautionary approach has been implemented for areas deemed inconclusive in terms of determining historical land use. The land category assessment can be found in Appendix G.

### 3.3 PLANT COMMUNITY TYPES (PCTS)

#### 3.3.1 Methods to assess PCTs

##### Review of existing information

A search was undertaken of OEH Vegetation Information System (VIS) database and NSW SEED mapping to access existing vegetation mapping information within the development site. Four relevant existing vegetation maps were assessed including *Terrestrial Biodiversity Map of the Greater Hume LEP 2012* plus the most up to date OEH data on the SEED Portal.

##### Floristic survey

Field surveys were completed over two periods, from the 28th and 29th November, and 18th December to the 21st December 2018. Additional surveys were undertaken on 12 August 2019 due to a modified design footprint. The entire subject land was surveyed by two ecologists by car and on foot. The aim of this survey was to determine the PCTs present in the development site and their condition and extent. Random meander searches were conducted in areas of native vegetation to determine the plant species present. PCTs were identified from the native species present, landforms and physiography and location in the IBRA subregion using the BioNet Vegetation Classification Database. The subject land was then stratified into areas of similar condition class to determine vegetation zones for each PCT.

Vegetation integrity plots of 20 m by 50 m (or 10 m by 100 m in the case of roadside verge) were established in each vegetation zone. Data was collected on the composition, structure and function of the vegetation. Data was collected utilising the methodology presented in the BAM 2017 by persons trained in the BAM and under the direction of persons accredited under the BAM including:

- a) a description of the systematic field-based floristic vegetation survey using documented and repeatable methods;
- b) a description of the systematic survey effort of the subject land, ensuring it was commensurate with the expected environmental variation;
- c) how the plot-based floristic vegetation survey intensity has sampled the expected environmental variation between stratified environmental units; and
- d) that the survey effort was targeted to fill gaps in the existing mapping and site information.

Further floristic surveys were completed from the 17th to the 19th March and on the 19<sup>th</sup> May 2020. An additional 15 vegetation integrity plots were completed in vegetation zones within the development site. PCT 249 was reassigned to PCT 5 based on evaluation of the additional plot data and characteristic species identified.

#### 3.3.2 PCTs identified on the development site

Four PCTs occur within the development site as shown in Figure 3-9 to Figure 3-11, including:

- PCT 5 – River Red Gum herbaceous-grassy very tall open forest wetland on inner floodplains in the lower slopes sub-region of the NSW South Western Slopes Bioregion and the eastern Riverina Bioregion.
- PCT 74 – Yellow Box - River Red Gum tall grassy riverine woodland of NSW South Western Slopes Bioregion and Riverina Bioregion.

- PCT 76 – Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions.
- PCT 277 – Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion.
- Patches of derived grassland communities associated with the above PCTs were also identified in low condition throughout the site.

A description of each of the PCTs identified in the development site follow in Table 3-1 to Table 3-4 below which include justification of PCT selection.

Table 3-1 River Red Gum herbaceous – grassy very tall open forest wetland on inner floodplains in the lower slopes sub-region of the NSW South Western Slopes Bioregion and the Eastern Riverina Bioregion

River Red Gum Herbaceous – grassy very tall open forest wetland on inner floodplains in the lower slopes sub-region of the NSW South Western Slopes Bioregion and the Eastern Riverina Bioregion.		
<b>Vegetation formation</b>	Forested Wetlands	
<b>Vegetation class</b>	Inland Riverine Forests	
<b>Vegetation type</b>	<b>PCT ID</b>	5
	<b>Common Community Name</b>	River Red Gum herbaceous – grassy very tall open forest wetland on inner floodplains in the lower slopes sub-region of the NSW South Western Slopes Bioregion and the Eastern Riverina Bioregion.
<b>Approximate extent within the development site</b>	The extent of this PCT within the development site is 24.32ha in vegetated riparian corridors along to Back Creek.	
<b>Species relied upon for PCT identification</b>	<b>Species name</b>	<b>Relative abundance</b>
	<i>Eucalyptus camaldulensis</i>	20%
	<i>Eryngium ovium</i>	0.5%
	<i>Rumex brownii</i>	1%
	<i>Lobelia purpurascens</i>	1%
	<i>Juncus spp.</i>	1%
	<i>Carex inversa</i>	5%
<b>Justification of evidence used to identify the PCT</b>	<p>This PCT was identified with a dominance of River Red Gum (<i>E. camaldulensis</i>). The shrub layer is absent and the ground cover is highly disturbed through frequent grazing by sheep and cattle.</p> <p>Five PCTS were considered that have River Red Gum as the dominant species in the NSW South Western Slopes. These are:</p> <p><i>PCT 2 - River Red Gum-sedge dominated very tall open forest in frequently flooded forest wetland along major rivers and floodplains in south-western NSW Based on the species.</i></p> <p><i>PCT 5 - River Red Gum herbaceous-grassy very tall open forest wetland on inner floodplains in the lower slopes sub-region of the NSW South Western Slopes Bioregion and the eastern Riverina Bioregion.</i></p> <p><i>PCT 7 - River Red Gum - Warrego Grass - herbaceous riparian tall open forest wetland mainly in the Riverina Bioregion.</i></p> <p><i>PCT 9 - River Red Gum - wallaby grass tall woodland wetland on the outer River Red Gum zone mainly in the Riverina Bioregion.</i></p> <p><i>PCT 249 --River Red Gum swampy woodland wetland on cowals (lakes) and associated flood channels in central NSW.</i></p> <p>Very little understory vegetation remains and it is difficult to distinguish between the PCTS based on understory species. PCT 5 was considered the best match for the PCT based on existing vegetation mapping and location in the landscape.</p>	

**River Red Gum Herbaceous – grassy very tall open forest wetland on inner floodplains in the lower slopes sub-region of the NSW South Western Slopes Bioregion and the Eastern Riverina Bioregion.**


	Additional surveys completed in March 2020 reassigned an area of PCT 249 to PCT 5 based on the further identification of characteristic species including <a href="#"><i>Hemarthria uncinata</i></a> and suitability in the landscape.
<b>TEC Status</b>	Not listed under either the BC Act or EPBC Act
<b>Estimate of percent cleared</b>	Current extent = 9000 ha (40% cleared)
<b>Examples</b>	 <p>Figure 3-5 River Red Gum Herbaceous – grassy very tall open forest wetland on inner floodplains in the lower slopes sub-region of the NSW South Western Slopes Bioregion and the Eastern Riverina Bioregion.</p>

Table 3-2 Yellow Box - River Red Gum tall grassy riverine woodland of NSW South Western Slopes Bioregion and Riverina Bioregion

Yellow Box - River Red Gum tall grassy riverine woodland of NSW South Western Slopes Bioregion and Riverina Bioregion		
<b>Vegetation formation</b>	Grassy Woodlands	
<b>Vegetation class</b>	Floodplain Transition Woodlands	
<b>Vegetation type</b>	<b>PCT ID</b>	74
	<b>Common Community Name</b>	Yellow Box - River Red Gum tall grassy riverine woodland of NSW South Western Slopes Bioregion and Riverina Bioregion
<b>Approximate extent within the development site</b>	The extent of this PCT within the development site is 8.09 ha in vegetated riparian corridors along to Back Creek and Billabong Creek.	
<b>Species relied upon for PCT identification</b>	<b>Species name</b>	<b>Relative abundance</b>
	<i>Eucalyptus camaldulensis</i>	1%
	<i>Eucalyptus blakelyi</i>	1%
	<i>Persicaria decipiens</i>	0.5%
	<i>Cynodon dactylon</i>	20%
	<i>Rumex brownii</i>	1%
<b>Justification of evidence used to identify the PCT</b>	This PCT was identified with a dominance of River Red Gum ( <i>E. camaldulensis</i> ) as part of a larger patch including Yellow Box ( <i>E. melliodora</i> ) and Grey Box ( <i>Eucalyptus microcarpa</i> ) along the riparian corridor of Back Creek. <i>Eucalyptus blakelyi</i> was also identified in areas of this community. Ground cover is highly disturbed through frequent grazing by sheep and cattle. PCT 74 was considered the best match for the PCT based on overstory species, existing vegetation mapping and location in the landscape.	
<b>TEC Status</b>	Listed as White Box Yellow Box Blakely's Red Gum Woodland; Critically Endangered under the BC Act. The extent within the development site does not meet the criteria for the TEC listed under the EPBC Act	
<b>Estimate of percent cleared</b>	Current extent = 8000 ha (73% cleared)	



**Yellow Box - River Red Gum tall grassy riverine woodland of NSW South Western Slopes Bioregion and Riverina Bioregion**

**Examples**



Figure 3-6 Yellow Box - River Red Gum tall grassy riverine woodland of NSW South Western Slopes Bioregion and Riverina Bioregion

Table 3-3 Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions

Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions		
<b>Vegetation formation</b>	Grassy Woodlands	
<b>Vegetation class</b>	Floodplain Transition Woodlands	
<b>Vegetation type</b>	<b>PCT ID</b>	76
	<b>Common Community Name</b>	Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions
<b>Approximate extent within the development site</b>	The extent of this PCT within the development site is 5.52 ha adjacent to riparian areas or farm dams within paddocks. A linear strip within the centre of the development site also occurs adjacent to an internal road.	
<b>Species relied upon for PCT identification</b>	<b>Species name</b>	<b>Relative abundance</b>
	<i>Eucalyptus microcarpa</i>	20%
	<i>Rytidosperma spp.</i>	1%
<b>Justification of evidence used to identify the PCT</b>	<p>This PCT was identified by a dominance of Western Grey Box (<i>E. microcarpa</i>) in the overstory. The understory has been heavily disturbed through agricultural activities of cropping and continuous grazing by livestock. The shrub layer is absent, and the groundcover is mostly comprised of exotic annuals. Some native groundcovers persist on the road reserves.</p> <p>Two PCTS were considered that have Western Grey Box as the dominant overstory species in the NSW South West Slopes. These are:</p> <ul style="list-style-type: none"> <li>PCT 76 – Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregion.</li> <li>PCT 80 – Western Grey Box – White Cypress Pine tall woodland on loam soil of alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion.</li> </ul> <p>As White Cypress Pine was not dominant in the landscape, PCT 80 was not considered a suitable PCT for the remnant Grey Box Woodland. PCT 76 was considered to be most suitable PCT based on:</p> <ul style="list-style-type: none"> <li>Dominated by Grey Box in the overstory.</li> <li>Located in the Inland Slopes IBRA Subregion.</li> <li>Occurs on flats and floodplains.</li> <li>Species listed above characteristic of this community.</li> <li>Existing Vegetation Mapping for this PCT present in the locality.</li> </ul> <p>For these reasons, PCT was selected as the most appropriate PCT.</p>	
<b>TEC Status</b>	Listed as Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Penepplain, Nandewar and Brigalow Belt South Bioregion, Endangered under the BC Act. Floristic surveys were unable to be completed therefore 0.78 ha of community with native understory was assumed to meet criteria for the EPBC listed community.	



**Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions**

***Estimate of percent cleared***

Current extent = 40 000 ha (92% cleared)

***Examples***



Figure 3-7 Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions

Table 3-4 Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion

Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion		
<b>Vegetation formation</b>	Grassy Woodlands	
<b>Vegetation class</b>	Western Slopes Grassy Woodlands	
<b>Vegetation type</b>	<b>PCT ID</b>	277
	<b>Common Community Name</b>	Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion
<b>Approximate extent within the development site</b>	The extent of this PCT within the development site is approximately 14.83 ha patches of remnant trees within paddocks or in strips along fences lines and boundaries. This PCT also occurs along Cummings Road and Weeamera Road.	
<b>Species relied upon for PCT identification</b>	<b>Species name</b>	<b>Relative abundance</b>
	<i>Eucalyptus blakelyi</i>	30%
	<i>Eucalyptus melliodora</i>	15%
	<i>Einadia nutans</i>	0 -5%
	<i>Chloris truncata</i>	0-10%
	<i>Lomandra filiformis</i>	0 – 0.3%
	<i>Desmodium varians</i>	0 -1%
<b>Justification of evidence used to identify the PCT</b>	This woodland is comprised of patches of trees within cropped paddocks that are used for heavy grazing. The PCT was assigned based on the overstory species and groundcover species where present including Blakely's Red Gum and Yellow Box that are characteristic to this PCT in the IBRA subregion.	
<b>TEC Status</b>	Listed as White Box Yellow Box Blakely's Red Gum Woodland, Critically Endangered under the BC Act. The extent within the development site does not meet the criteria for the critically endangered ecological community listed under the EPBC Act	
<b>Estimate of percent cleared</b>	Current extent = 30 000 ha (94% cleared)	

**Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion**

**Examples**



Figure 3-8 Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion



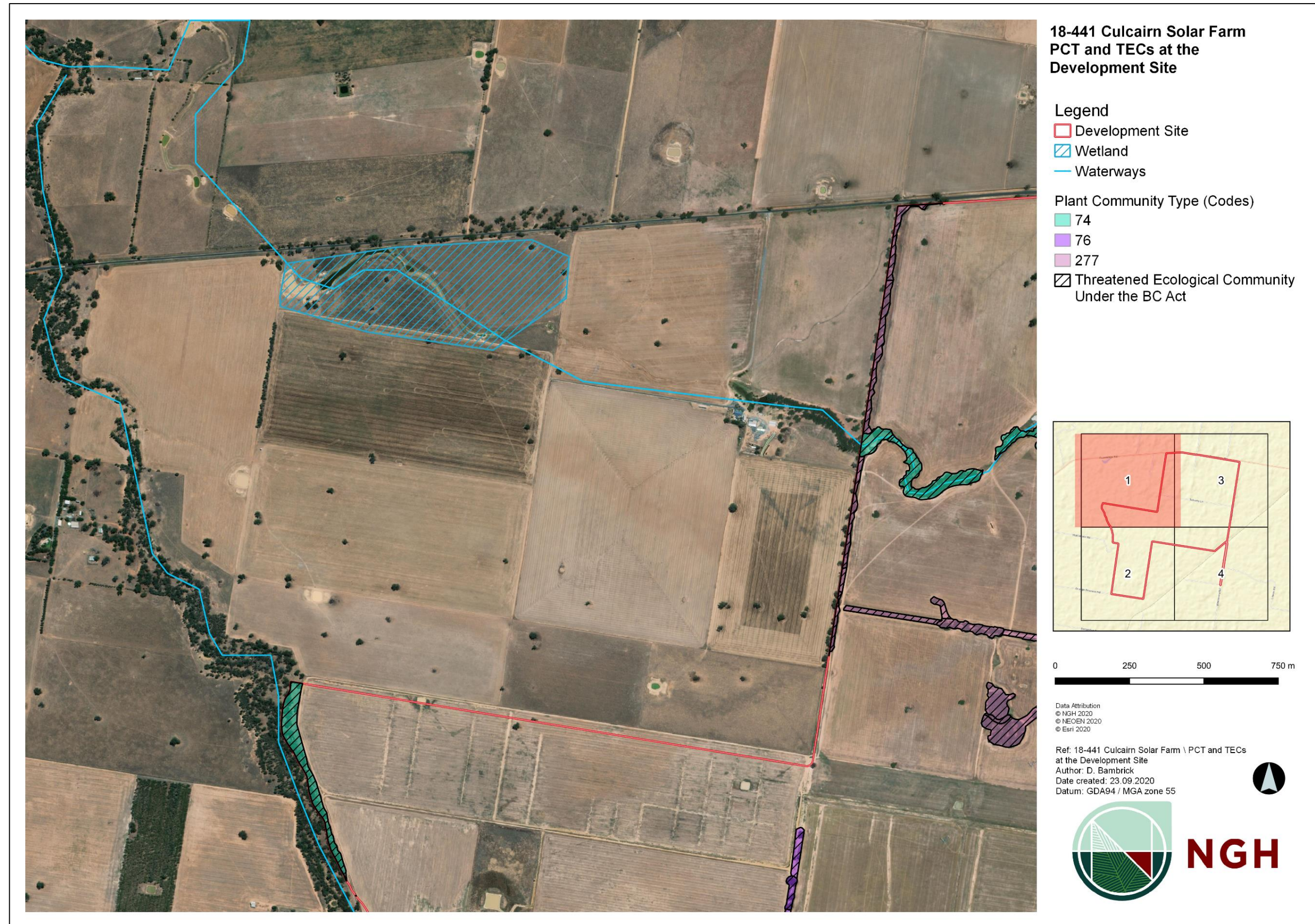


Figure 3-9 PCTs and TECs at the development site



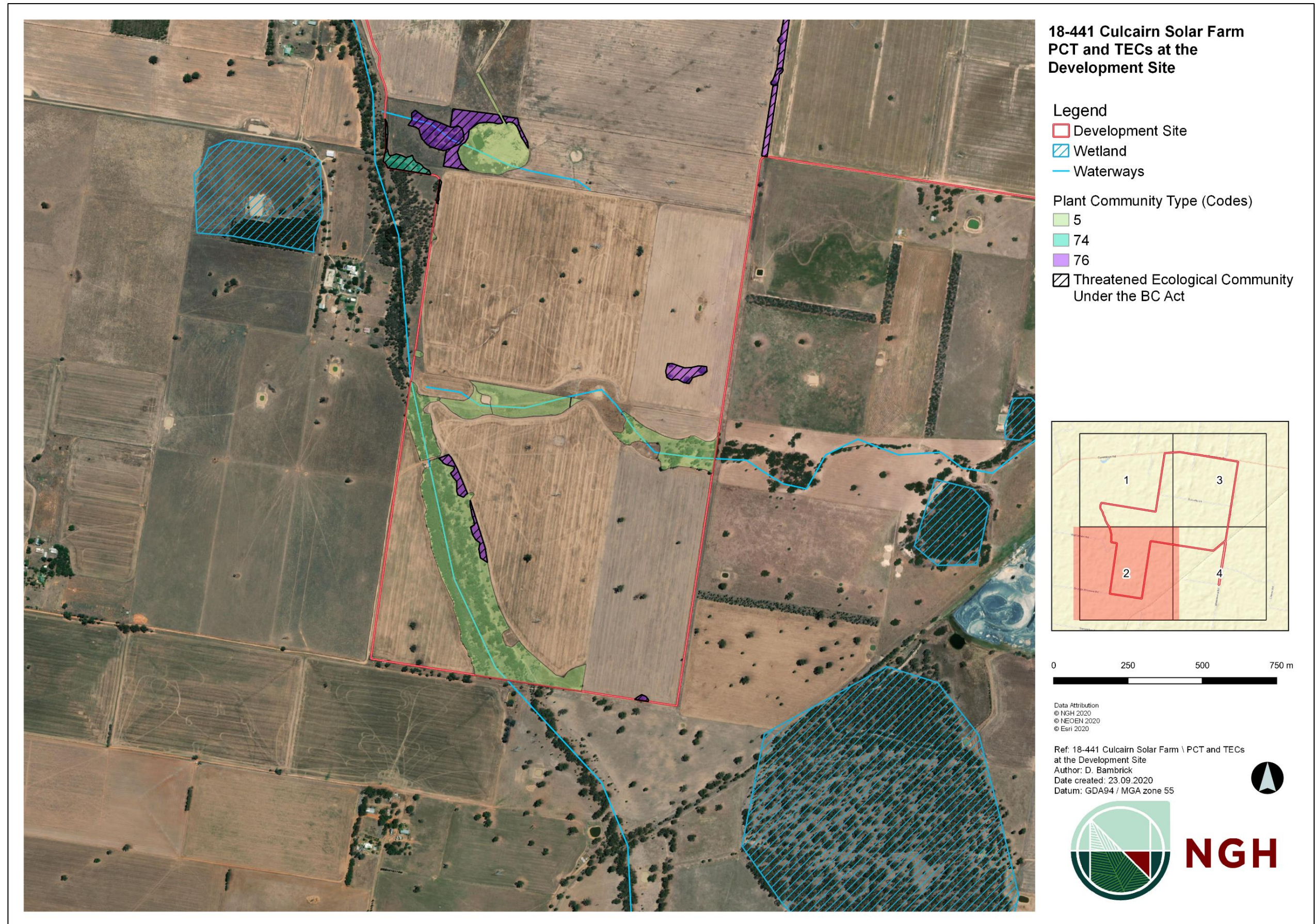


Figure 3-10 PCTs and TECs at the development site



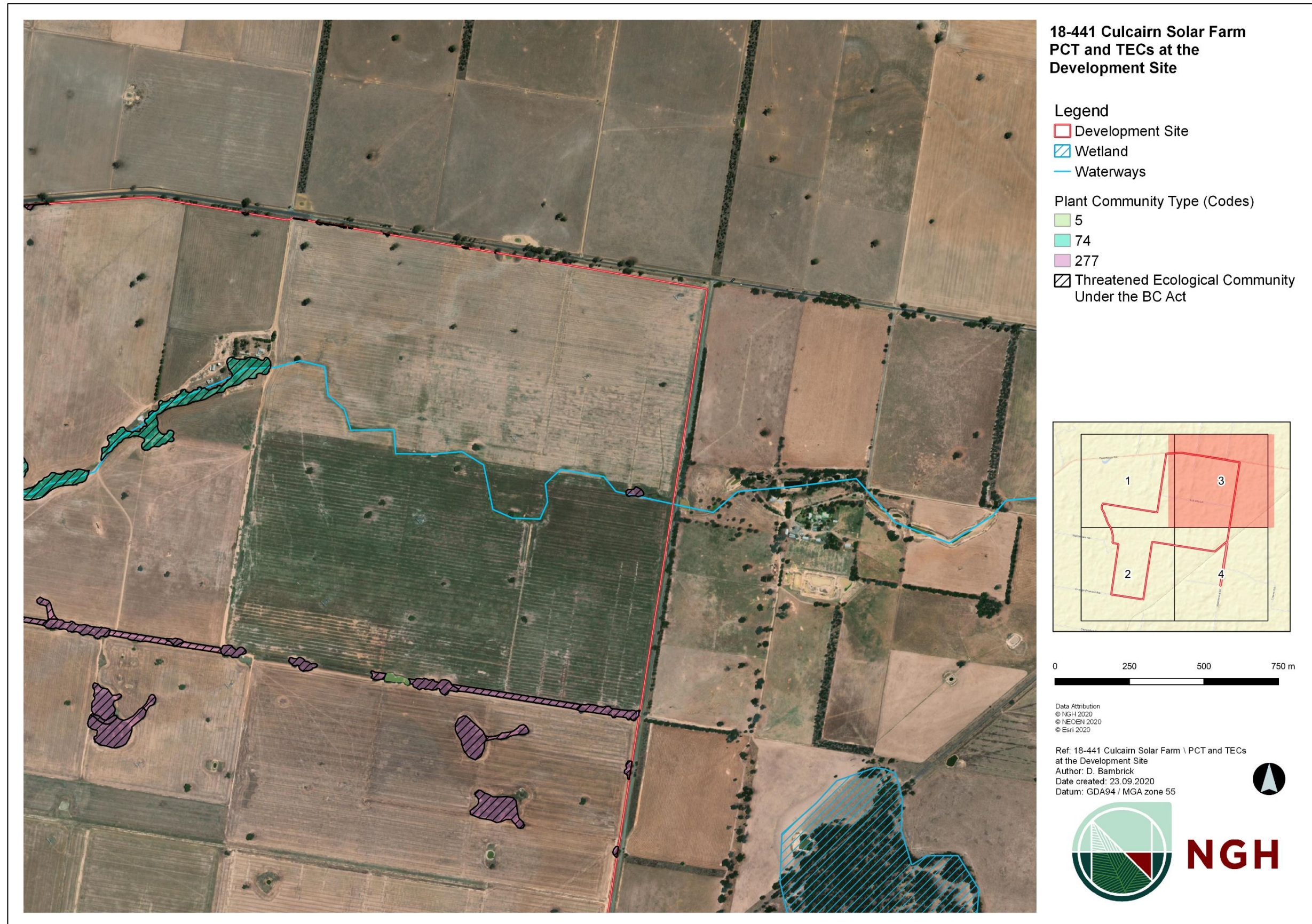


Figure 3-11 PCTs and TECs at the development site



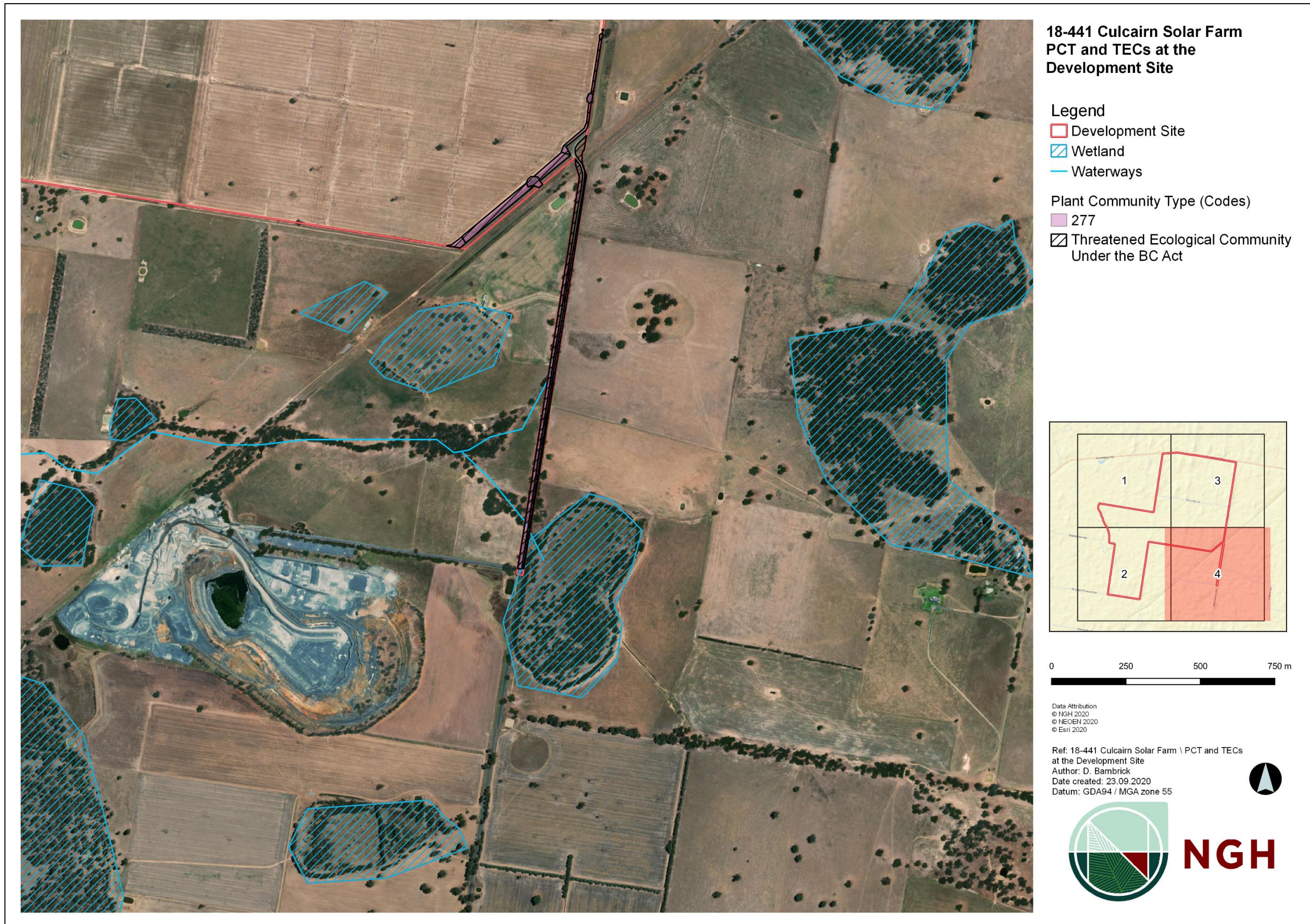


Figure 3-12 PCTs and TECs at the development site



## 3.4 VEGETATION INTEGRITY ASSESSMENT

### 3.1.1 Vegetation zones and survey effort

The random meander, overview inspection and vegetation integrity plots have been used to assist the delineation of zones. Four PCTs were identified in the development site. Each of these PCTs were stratified into zones on the basis of current condition state, vegetation structure, land management practices or other environmental variables. Twenty-eight (28) vegetation integrity plots were undertaken during the field surveys in 2019. The number of vegetation integrity plots undertaken in each zone conformed with the minimum plot requirements per zone area as specified in the BAM. Vegetation zones are detailed in Table 3-5 and mapped in Figure 3-13 to Figure 3-16 below.


An additional 15 plots were completed in March 2020. These were undertaken in areas outside of the development footprint and within the development site including Weeamera Road. A number of changes were made to the zoning as a result of the survey primarily due to improved seasonal conditions and more representative data including:


- One area of PCT 74 was rezoned from low condition to moderate condition based on seasonal variation and the emergence of native wetland forbs.
- The southern area of Weeamera Road was rezoned from PCT 277\_exotic\_understory to PCT 277\_native\_understory
- PCT 249 was reassigned to PCT 5 based on identification of characteristic species in the understory



Changes to PCTs and zoning was based on evaluation of the integrity scores of the additional plots completed.




Table 3-5 Vegetation zones for the development site.

Zone ID	PCT ID	Stratification unit / condition	Area in development site (ha)	Area in development footprint (ha)	Survey effort (# plots)	Patch size (ha)	Example
5_Native_Understory	5	<p><b>Native Understorey</b></p> <p>This zone consists of a woodland of mature River Red Gum (<i>E. camaldulensis</i>) trees occurring in small drainage depressions in the landscape. These areas would hold water in times of substantial rainfall. Grazing occurs in these areas but native understory species such as <i>Juncus</i> spp. and Swamp Dock (<i>Rumex brownii</i>). Fallen timber has been left in these areas, providing good fauna habitat.</p> <p>This zone does not form part of a TEC under the BC or EPBC act.</p>	20.92	0	7	100+ ha	



Zone ID	PCT ID	Stratification unit / condition	Area in development site (ha)	Area in development footprint (ha)	Survey effort (# plots)	Patch size (ha)	Example
5_Derived_Grassland	5	<p><b>Derived Grassland</b></p> <p>This zone consists of a disturbed grassland. It has undergone regular grazing by livestock, but there has been no evidence of cropping in the past. The grassland is dominated by a mix of exotic Barley Grass (*<i>Hordeum leporinum</i>) and native Windmill Grass (<i>Chloris truncata</i>). Some other natives such as Couch (<i>Cynodon dactylon</i>), Curly Windmill Grass (<i>Enteropogon acicularis</i>), Caustic Weed (<i>Euphorbia drummondii</i>) and Wallaby grass (<i>Rytidosperma spp.</i>) were also present in very small abundance (&lt;1% cover).</p> <p>This zone does not form part of a TEC under the BC or EPBC act.</p>	3.42	0.005	3	100+ ha	


Zone ID	PCT ID	Stratification unit / condition	Area in development site (ha)	Area in development footprint (ha)	Survey effort (# plots)	Patch size (ha)	Example
74_Low_Condition	74	<p><b>Low Condition</b></p> <p>This zone consists of mature Blakley's Red Gum (<i>E. blakelyi</i>) and Yellow Box (<i>E. melliodora</i>) trees over a disturbed understorey. Any native understorey has been eliminated through agricultural activities of cropping and grazing. This zone was considered to be of low condition.</p> <p>This zone forms part of the TEC listed under the BC Act as <i>White Box Yellow Box Blakely's Red Gum Woodland</i>.</p>	4.19	0	3	100+ ha	
74_Mod_Condition	74	<p><b>Moderate Condition</b></p> <p>This zone consists of mature Blakley's Red Gum (<i>E. blakelyi</i>) and Yellow Box (<i>E. melliodora</i>) trees over a disturbed understorey including a native component. This zone was considered to be of moderate condition.</p> <p>This zone forms part of the TEC listed under the BC Act as <i>White Box Yellow Box Blakely's Red Gum Woodland</i>.</p>	2.16	0	4	100+ ha	





Zone ID	PCT ID	Stratification unit / condition	Area in development site (ha)	Area in development footprint (ha)	Survey effort (# plots)	Patch size (ha)	Example
76_Derived_Grassland	76	<p><b>Derived Grassland</b></p> <p>This zone consists of a disturbed grassland. It has undergone regular grazing by livestock, but there has been no evidence of cropping in the past. The grassland is dominated by a mix of exotic Barley Grass (*<i>Hordeum leporinum</i>) and native Windmill Grass (<i>Chloris truncata</i>). Some other natives such as Couch (<i>Cynodon dactylon</i>), Curly Windmill Grass (<i>Enteropogon acicularis</i>), Caustic Weed (<i>Euphorbia drummondii</i>) and Wallaby grass (<i>Rytidosperma spp.</i>) were also present in very small abundance (&lt;1% cover).</p> <p>This zone is considered to form part of PCT 76 due to scattered and isolated Grey Box occurring in this paddock.</p> <p>It does not form part of the TEC <i>Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions</i> as the understory is exotic dominated and very few native grasses or forbs remain.</p>	2.81	0	2	5	





Zone ID	PCT ID	Stratification unit / condition	Area in development site (ha)	Area in development footprint (ha)	Survey effort (# plots)	Patch size (ha)	Example
76_Exotic_Understory	76	<p><b>Exotic Understorey</b></p> <p>This zone consists of mature Grey Box (<i>E. microcarpa</i>) trees over a disturbed understorey. Any native understorey has been eliminated through agricultural activities of cropping and grazing.</p> <p>This zone forms part of the TEC listed under the BC Act as <i>Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Penepplain, Nandewar and Brigalow Belt South Bioregions</i></p>	1.93	0	1	2.5	
76_Native_Understory	76	<p><b>Native Understorey</b></p> <p>This zone consists of mature Grey Box (<i>E. microcarpa</i>) trees over a disturbed understorey with some native component in small abundance.</p> <p>This zone forms part of the TEC listed under the BC Act as <i>Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Penepplain, Nandewar and Brigalow Belt South Bioregions</i></p>	0.78	0	Benchmark data used	2	

Zone ID	PCT ID	Stratification unit / condition	Area in development site (ha)	Area in development footprint (ha)	Survey effort (# plots)	Patch size (ha)	Example
277_Derived_Grassland	277	<p><b>Derived Grassland</b></p> <p>This zone consists of a disturbed grassland. It has undergone regular grazing by livestock, but there has been no evidence of cropping in the past. The grassland is dominated by a mix of exotic Barley Grass (*<i>Hordeum leporinum</i>) and native Windmill Grass (<i>Chloris truncata</i>). Some other natives such as Couch (<i>Cynodon dactylon</i>), Curly Windmill Grass (<i>Enteropogon acicularis</i>), Caustic Weed (<i>Euphorbia drummondii</i>) and Wallaby grass (<i>Rytidosperma spp.</i>) were also present in very small abundance (&lt;1% cover).</p> <p>It does not form part of the TEC listed under the BC Act as <i>White Box Yellow Box Blakely's Red Gum Woodland</i> as the understory is exotic dominated and very few native grasses or forbs remain.</p>	3.54	0.03	2	5	

Zone ID	PCT ID	Stratification unit / condition	Area in development site (ha)	Area in development footprint (ha)	Survey effort (# plots)	Patch size (ha)	Example
277_Exotic_Understory	277	<p><b>Exotic Understorey</b></p> <p>This zone consists of mature Blakley's Red Gum (<i>E. blakelyi</i>) and Yellow Box (<i>E. melliodora</i>) trees over a disturbed understorey. Any native understorey has been eliminated through agricultural activities of cropping and grazing. This zone was considered to be of low condition.</p> <p>This zone forms part of the TEC listed under the BC Act as <i>White Box Yellow Box Blakely's Red Gum Woodland</i>.</p>	8.25	0.165	6 (1 plot removed)	15	
277_Native_Understory	277	<p><b>Native Understorey</b></p> <p>This zone consists of mature Blakley's Red Gum (<i>E. blakelyi</i>) and Yellow Box (<i>E. melliodora</i>) trees with native groundcover species present.</p> <p>This zone forms part of the TEC listed under the BC Act as <i>White Box Yellow Box Blakely's Red Gum Woodland</i>.</p>	2.19	0.17	2	2	



Zone ID	PCT ID	Stratification unit / condition	Area in development site (ha)	Area in development footprint (ha)	Survey effort (# plots)	Patch size (ha)	Example
277_Regeneration	277	<p><b>Regeneration</b></p> <p>This zone consists of mature and regenerating Blakley's Red Gum (<i>E. blakelyi</i>) and Yellow Box (<i>E. melliodora</i>) trees. Native midstorey and groundcover species are largely absent due to grazing pressure.</p> <p>This zone forms part of the TEC listed under the BC Act as <i>White Box Yellow Box Blakely's Red Gum Woodland</i>.</p>	0.85	0	1	10 ha	
Exotic vegetation	N/A	<p><b>Exotic Vegetation</b></p> <p>The majority of the development site is comprised of exotic vegetation. Exotic vegetation is dominated by crops and exotic annual grasses such as Rye Grass (<i>Lolium</i> sp.) clovers (<i>Trifolium</i> sp.) and Barley Grass (<i>Hordeum</i> sp.).</p> <p>These areas were not considered to represent a PCT or TEC.</p> <p>A Land Category Assessment has been completed for this zone and can be found in Appendix G</p>	996	1081	11	N/A	



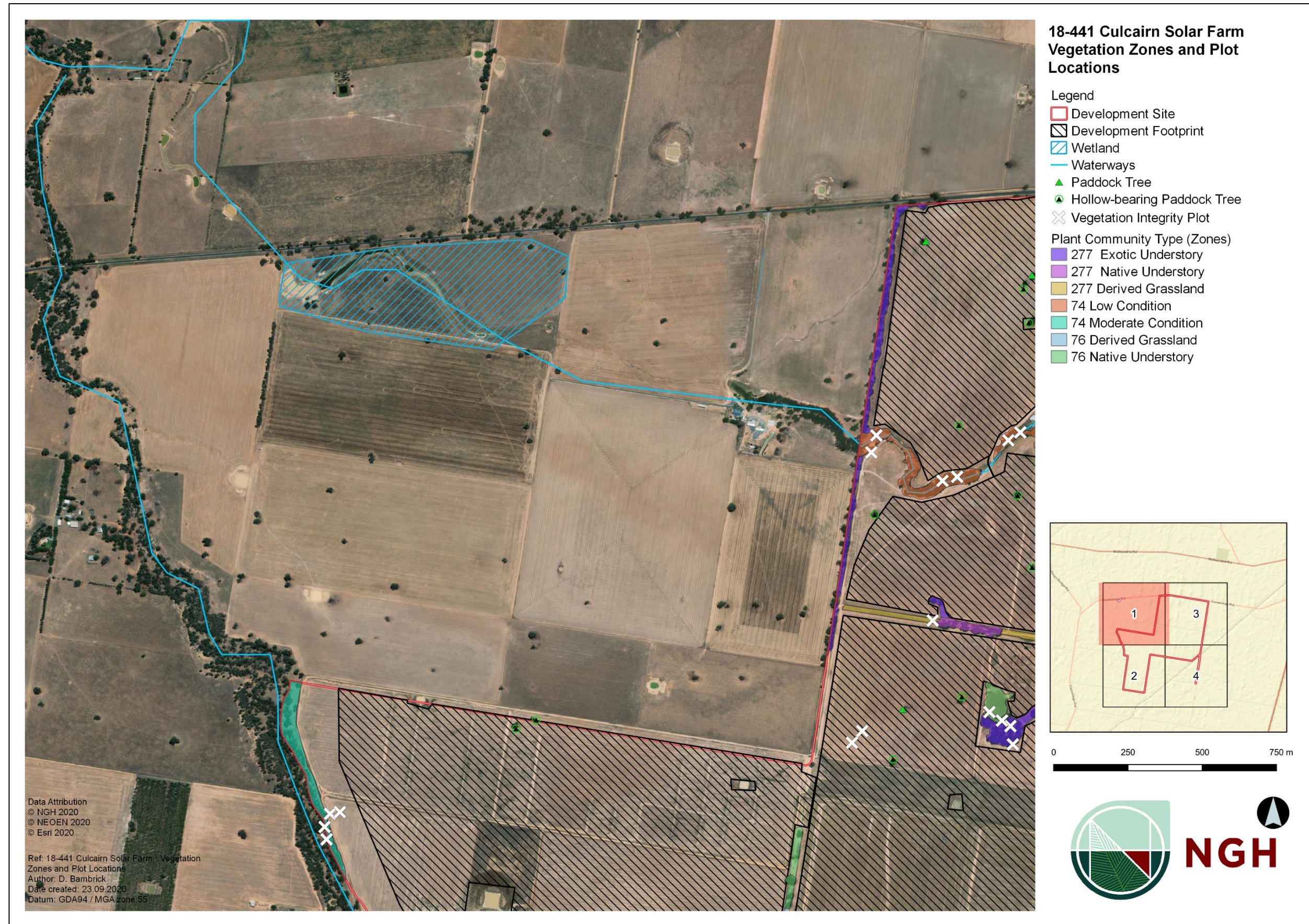


Figure 3-13 Vegetation zones at the development site



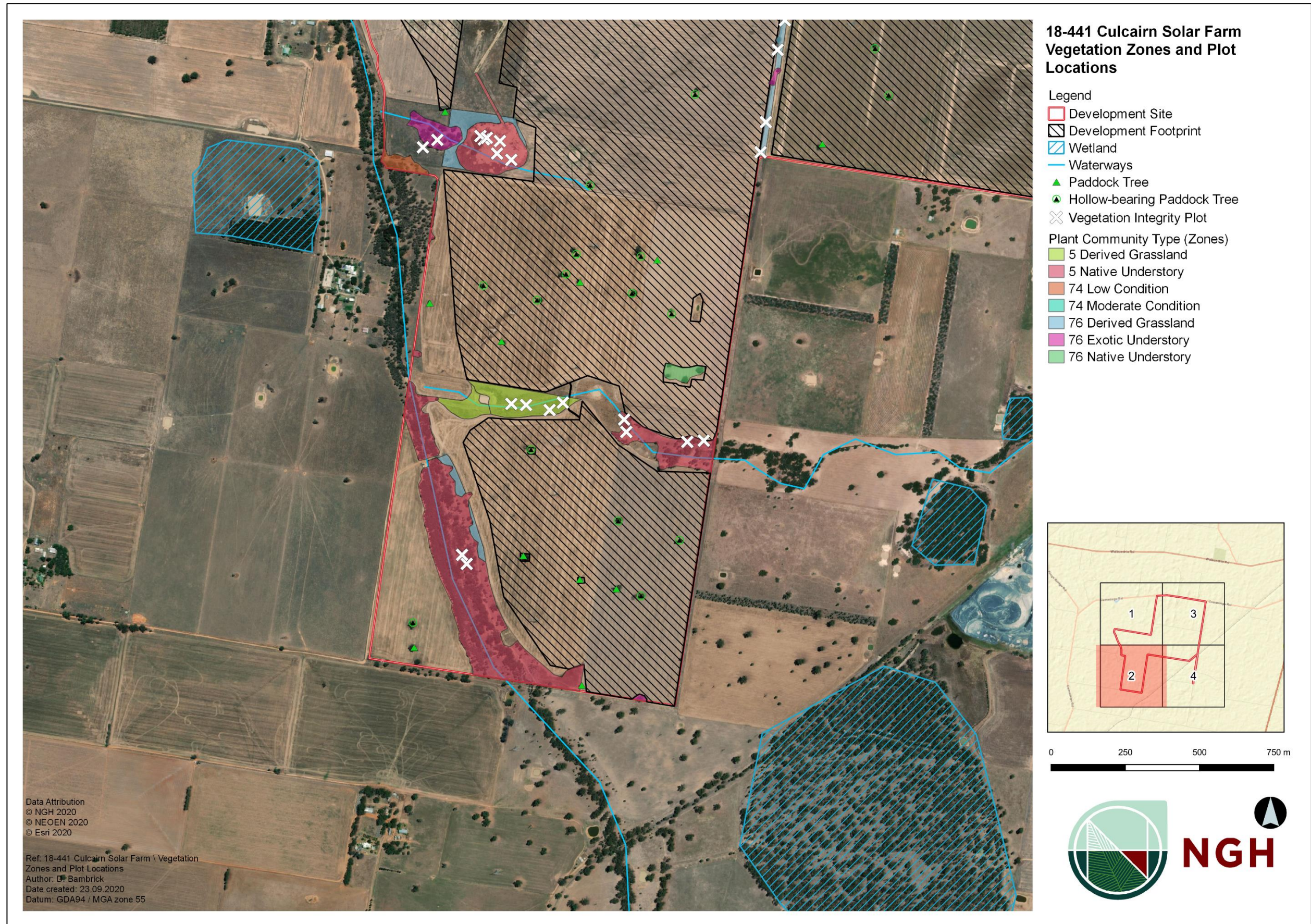


Figure 3-14 Vegetation zones at the development site



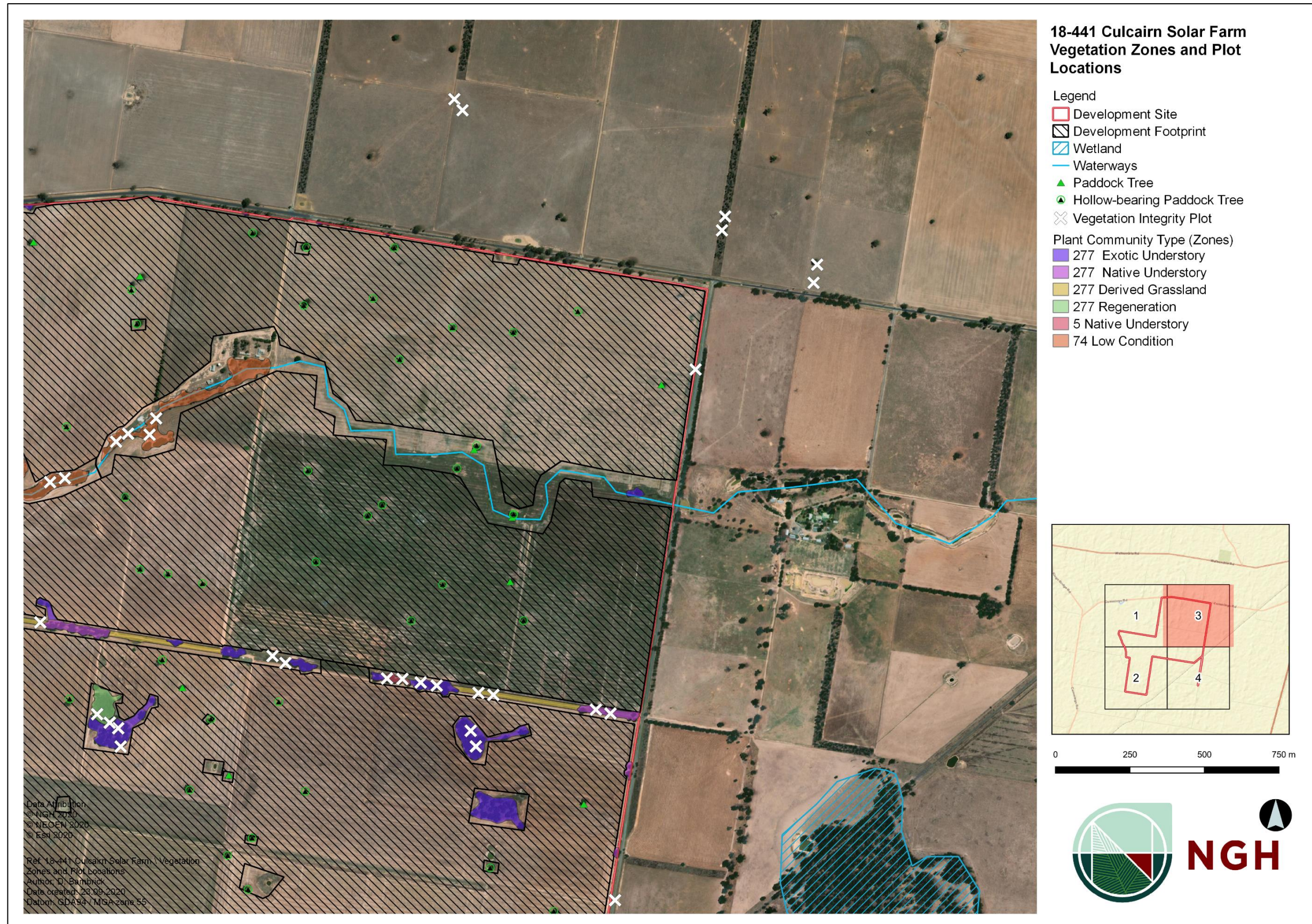


Figure 3-15 Vegetation zones at the development site



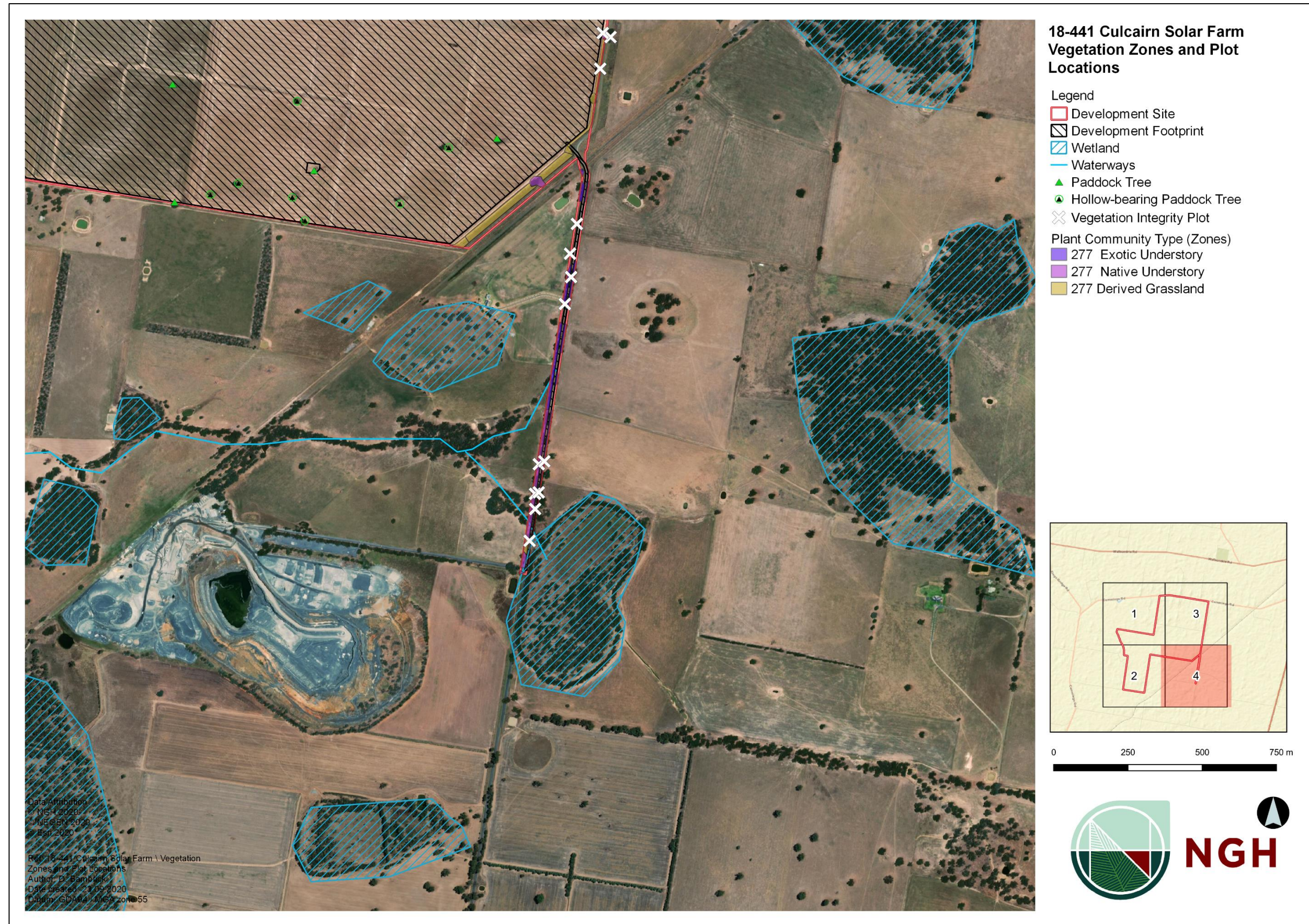


Figure 3-16 Vegetation zones at the development site



### 3.4.1 Paddock Trees

Ninety five (95) paddock trees including sixty six (66) hollow bearing trees occur within the development site. All of these are located within exotic vegetation (cropped/grazed areas) or land identified as Category 1 - Exempt Land. The paddock trees are a combination of mainly Grey Box (*E. microcarpa*), Yellow Box (*E. melliodora*), and Blakely's Red Gum (*E. blakelyi*).

According the BAM criteria, these paddock trees have been defined as Category 2 land surrounded by Category 1 land based on the Land Category Assessment in Appendix G.

The Grey Box paddock trees are most likely remnant of the surrounding Grey Box tall Grassy woodland identified in the south of the development site. As such, PCT 76 was assigned to the paddock trees comprised of Grey Box.

The Blakely's Red Gum and Yellow Box paddock trees are most likely remnant of the Blakely's Red Gum - Yellow Box grassy tall woodland identified in the development zone. As such, PCT 277 was assigned to the Paddock Trees comprised of Yellow Box and Blakely's Red Gum. Based on position in the landscape and surrounding vegetation Grey Box were also assigned to PCT 277.

Threatened species that would use the paddock trees are assumed to be the same threatened species that are returned by the BAM Calculator for the vegetation zones. Where targeted fauna surveys were required for the BAM Calculations, paddock trees were also included in the surveys. Assessments of threatened species that would use the paddock trees as habitat has been incorporated into this BDAR under sections 4 and 5.

Paddock trees were mapped in the field using a handheld GIS Tablet. Trees were identified to genus and species. The Diameter at Breast Height (DBH) of the tree was assessed and assigned a paddock tree class relevant to the large tree benchmark. The large tree benchmark for PCT277 and PCT 76 is 50 cm DBH. The trees were visually assessed from the ground to determine whether any hollows were present. Examples of paddock trees occurring in the development site are shown in Figure 3-17 and listed in Appendix C.

A number of trees were not able to be inspected due to access constraints during surveys. These trees were mapped as the most likely species, and assigned the highest class (3) within the calculator, so as to provide a worst-case scenario during the generation of credits.



Figure 3-17 Paddock trees within the development site



### 3.4.2 Vegetation integrity assessment results

A total of 99 plant species were identified within the 41 vegetation integrity survey plots comprising 40 native species and 59 exotic species. The results of the plot field data can be found in Appendix A.

The plot data from the vegetation integrity survey plots was entered into the BAM calculator by an accredited assessor. Plot X2 completed in August 2019 was removed from 277\_exotic\_understory due to rezoning. A new plot was completed In May 2020 representative of the zone in the optimum survey period. The results of the vegetation integrity assessment are provided in Table 3-6.

Table 3-6 Current vegetation integrity scores for each vegetation zone within the development site.

Zone ID	Zone Description	Patch Size	Composition score	Structure score	Function score	Vegetation Integrity Score
	5_Native_Understory	101	36	47.1	45.9	<b>42.7</b>
	5_Derived_grassland	101	39.6	36.6	7.6	<b>22.4</b>
	74_low_condition	3	7.6	48.4	80.6	<b>31</b>
	74_mod_condition	101	34.2	55.3	91.6	<b>55.8</b>
	76_derived_grassland	5	45.3	40.2	5.8	<b>22</b>
	76_exotic_understory	3	3.6	37.8	42.3	<b>18</b>
	76_native_understory	1	Benchmark threshold used in calculator			
3	277_derived_grassland	5	33.4	54.7	7.1	<b>23.5</b>
1	277_exotic_understory	15	13.1	32.2	72.6	<b>31.3</b>
2	277_native_understory	5	37.3	43	64.9	<b>47</b>
	277_planted	3	27.9	34.6	45	<b>35.2</b>
	277_regeneration	10	13.8	43.6	63.9	<b>33.7</b>

## 4 THREATENED SPECIES

### 4.1 ECOSYSTEM CREDIT SPECIES

The following ecosystem credit species were returned by the ecosystem and paddock tree calculator as being associated with the PCTs present in the development site:

Table 4-1 Ecosystem credit species.

Species	Associated PCT	NSW Listing Status	National Listing Status
<b>Fauna</b>			
<b>Black-chinned Honeyeater (eastern subspecies)</b> <i>Melithreptus gularis gularis</i>	PCT 277 – Blakely's Red Gum - Yellow Box grassy tall woodland PCT 76 – Western Grey Box tall grassy woodland	Vulnerable	Not listed
<b>Barking Owl</b> <i>Ninox connivens</i> (Foraging)	PCT 76 – Western Grey Box tall grassy woodland	Vulnerable	Not listed
<b>Brolga</b> <i>Grus rubicunda</i>	PCT 277 – Blakely's Red Gum - Yellow Box grassy tall woodland	Vulnerable	Not listed
<b>Brown Treecreeper (eastern subspecies)</b> <i>Climacteris picumnus victoriae</i>	PCT 277 – Blakely's Red Gum - Yellow Box grassy tall woodland PCT 76 – Western Grey Box tall grassy woodland	Vulnerable	Not listed
<b>Spotted Harrier</b> <i>Circus assimilis</i>	PCT 76 – Western Grey Box tall grassy woodland	Not listed	Not listed
<b>Diamond Firetail</b> <i>Stagonopleura guttata</i>	PCT 277 – Blakely's Red Gum - Yellow Box grassy tall woodland	Vulnerable	Not listed
<b>Dusky Woodswallow</b> <i>Artamus cyanopterus cyanopterus</i>	PCT 277 – Blakely's Red Gum - Yellow Box grassy tall woodland	Vulnerable	Not listed
<b>Flame Robin</b> <i>Petroica phoenicea</i>	PCT 277 – Blakely's Red Gum - Yellow Box grassy tall woodland PCT 76 – Western Grey Box tall grassy woodland	Vulnerable	Not listed



Species	Associated PCT	NSW Listing Status	National Listing Status
<b>Gang-gang Cockatoo</b> <i>Callocephalon fimbriatum</i>	PCT 277 – Blakely's Red Gum - Yellow Box grassy tall woodland	Vulnerable	Not listed
<b>Glossy Black Cockatoo</b> <i>Calyptorhynchus lathami</i>	PCT 76 – Western Grey Box tall grassy woodland	Vulnerable	Not listed
<b>Grey Falcon</b> <i>Falco hypoleucos</i>	PCT 76 – Western Grey Box tall grassy woodland	Vulnerable	Not listed
<b>Grey-crowned Babbler (eastern subspecies)</b> <i>Pomatostomus temporalis temporalis</i>	PCT 277 – Blakely's Red Gum - Yellow Box grassy tall woodland PCT 76 – Western Grey Box tall grassy woodland	Vulnerable	Not listed
<b>Grey-headed Flying-fox</b> <i>Pteropus poliocephalus</i>	PCT 277 – Blakely's Red Gum - Yellow Box grassy tall woodland	Vulnerable	Vulnerable
<b>Hooded Robin (south-eastern form)</b> <i>Melanodryas cucullata cucullata</i>	PCT 277 – Blakely's Red Gum - Yellow Box grassy tall woodland PCT 76 – Western Grey Box tall grassy woodland	Vulnerable	Not listed
<b>Koala</b> <i>Phascolarctos cinereus</i>	PCT 277 – Blakely's Red Gum - Yellow Box grassy tall woodland PCT 76 – Western Grey Box tall grassy woodland	Vulnerable	Vulnerable
<b>Little Lorikeet</b> <i>Glossopsitta pusilla</i>	PCT 277 – Blakely's Red Gum - Yellow Box grassy tall woodland	Vulnerable	Not listed
<b>Little Pied Bat</b> <i>Chalinolobus picatus</i>	PCT 277 – Blakely's Red Gum - Yellow Box grassy tall woodland	Vulnerable	Not listed
<b>Little Eagle</b> <i>Hieraaetus morphnoides</i>	PCT 277 – Blakely's Red Gum - Yellow Box grassy tall woodland PCT 76 – Western Grey Box tall grassy woodland	Vulnerable	Not listed
<b>Masked Owl</b> <i>Tyto novaehollandiae</i>	PCT 277 – Blakely's Red Gum - Yellow Box grassy tall woodland PCT 76 – Western Grey Box tall grassy woodland	Vulnerable	Not listed

Species	Associated PCT	NSW Listing Status	National Listing Status
<b>Major Mitchell's Cockatoo</b> <i>Lophochroa leadbeateri</i> (Foraging)	PCT 277 – Blakely's Red Gum - Yellow Box grassy tall woodland PCT 76 – Western Grey Box tall grassy woodland	Vulnerable	Not listed
<b>Painted Honeyeater</b> <i>Grantiella picta</i>	PCT 277 – Blakely's Red Gum - Yellow Box grassy tall woodland PCT 76 – Western Grey Box tall grassy woodland	Vulnerable	Vulnerable
<b>Regent Honeyeater</b> <i>Anthochaera phrygia</i>	PCT 277 – Blakely's Red Gum - Yellow Box grassy tall woodland	Critically Endangered	Critically Endangered
<b>Scarlet Robin</b> <i>Petroica boodang</i>	PCT 76 – Western Grey Box tall grassy woodland	Vulnerable	Not listed
<b>Speckled Warbler</b> <i>Chthonicola sagittata</i>	PCT 277 – Blakely's Red Gum - Yellow Box grassy tall woodland PCT 76 – Western Grey Box tall grassy woodland	Vulnerable	Not listed
<b>Spotted Harrier</b> <i>Circus assimilis</i>	PCT 76 – Western Grey Box tall grassy woodland	Vulnerable	Not listed
<b>Square-tailed Kite</b> <i>Lophoictinia isura</i>	PCT 277 – Blakely's Red Gum - Yellow Box grassy tall woodland	Vulnerable	Not listed
<b>Superb Parrot</b> <i>Polytelis swainsonii</i>	PCT 277 – Blakely's Red Gum - Yellow Box grassy tall woodland PCT 76 – Western Grey Box tall grassy woodland	Vulnerable	Vulnerable
<b>Swift Parrot</b> <i>Lathamus discolor</i>	PCT 277 – Blakely's Red Gum - Yellow Box grassy tall woodland PCT 76 – Western Grey Box tall grassy woodland	Endangered	Critically Endangered
<b>Turquoise Parrot</b> <i>Neophema pulchella</i>	PCT 277 – Blakely's Red Gum - Yellow Box grassy tall woodland	Vulnerable	Not listed
<b>Varied Sittella</b> <i>Daphoenositta chrysoptera</i>	PCT 277 – Blakely's Red Gum - Yellow Box grassy tall woodland PCT 76 – Western Grey Box tall grassy woodland	Vulnerable	Not listed



Species	Associated PCT	NSW Listing Status	National Listing Status
<b>White-bellied Sea-eagle</b> <i>Haliaeetus leucogaster</i>	PCT 277 – Blakely's Red Gum - Yellow Box grassy tall woodland PCT 76 – Western Grey Box tall grassy woodland	Vulnerable	Not listed
<b>Yellow-bellied Sheath-tail-bat</b> <i>Saccolaimus flaviventris</i>	PCT 277 – Blakely's Red Gum - Yellow Box grassy tall woodland PCT 76 – Western Grey Box tall grassy woodland	Vulnerable	Not listed
<b>Spotted-tailed Quoll</b> <i>Dasyurus maculatus</i>	PCT 277 – Blakely's Red Gum - Yellow Box grassy tall woodland	Vulnerable	Endangered (SE mainland population)

#### 4.1.1 Species excluded from the assessment

The Golden Sun Moth and Striped Legless Lizard were both excluded from survey as the development site is outside their geographic range.

No other ecosystem credit species were excluded from the assessment; all may occur and contribute to ecosystem credits.

## 4.2 SPECIES CREDIT SPECIES

#### 4.2.1 Candidate species to be assessed

The BAM Calculator predicted the following species credit species to occur at the development site (Table 4-2). A desktop assessment was undertaken for habitat constraints and geographic restrictions to determine which species would be included or excluded for further targeted surveys in the development site. Two species lacked suitable habitat and were excluded from further assessment. These species are highlighted in grey in Table 4-2 and discussed in Table 4-3.

An additional calculation was completed in 2020 for vegetation zones outside of the development footprint. This calculation produced an additional fourteen species associated with PCTs outside the development footprint. This calculation was initially completed in 2018 as part of the survey design for the entire development site. Many of these species were included in the candidate species survey program and were previously noted as inclusions to the calculator in Section 4.2.3.

Four species were excluded based on geographical limitations and are identified in Table 4-2. Additional species resulting from the 2020 calculations are identified as *\*BAMC additions (Revision 0)*. One species the Pine Donkey Orchid (*Diuris tricolor*) was unable to be surveyed and is assumed present in PCT 76. These species would not be directly impacted by the development however have been assessed for indirect impacts.

Table 4-2 Candidate species credit species requiring assessment

Credit species	Habitat and geographic restrictions	Sensitivity to gain class	NSW listing status	National listing status	Included or Excluded
<b>Fauna</b>					
<b>Bush Stone-curlew</b> <i>Burhinus grallarius</i>	Open forests and woodlands with a sparse, grassy ground layer and fallen timber. Known in subregion.	High	Endangered	Not listed	Included
<b>Eastern Pygmy-possum</b> <i>Cercartetus nanus</i>	Broad range of habitat from rainforest through sclerophyll forest and woodland to heath, but in most areas woodlands and heath preferred. Known in subregion.	High	Vulnerable	Not listed	Included
<b>Gang-gang Cockatoo</b> <i>Callocephalon fimbriatum</i>	In spring and summer, tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. In autumn and winter, lower altitudes in drier, more open eucalypt forests and woodlands, particularly box-gum and box-ironbark assemblages. Known in subregion.	High (breeding) / Moderate (foraging)	Vulnerable	Not listed	Included
<b>Grey-headed Flying-fox</b> <i>Pteropus poliocephalus</i>	Range of vegetation communities including rainforest, open forest, and closed and open woodland. Roost sites usually near water, including lakes, rivers, and coastlines. Known to roost in locality.	High	Vulnerable	Vulnerable	Included
<b>Koala</b> <i>Phascolarctos cinereus</i>	Temperate, subtropical and tropical eucalypt woodlands and forests where suitable food trees grow, of which there are more than 70 eucalypt species and 30 non-eucalypt species that are particularly abundant on fertile clay soils. Known in subregion.	High	Vulnerable	Not listed	Included
<b>Little Eagle</b>	Open eucalypt forest, woodland, or open woodland, and Sheoak or Acacia woodlands and riparian	Moderate	Vulnerable	Not listed	Included



Credit species	Habitat and geographic restrictions	Sensitivity to gain class	NSW listing status	National listing status	Included or Excluded
<i>Hieraetus morphnoides</i> (Breeding)	woodlands in interior NSW, where they nest in tall living trees within a remnant patch. Known in subregion.				
<b>Large-eared Pied Bat</b> <i>Chalinolobus dwyeri</i>	Found mainly in areas with extensive cliffs and caves, from Rockhampton in Queensland south to Bungonia in the NSW Southern Highlands. It is generally rare with a very patchy distribution in NSW. Roosts in caves. Found in well timbered areas containing gullies.	Very High	Vulnerable	Vulnerable	Excluded- Unsuitable habitat
<b>Masked Owl</b> <i>Tyto novaehollandiae</i> (Breeding)	Dry eucalypt forests and woodlands from sea levels to 1100 m. Hunts along the edges of forests, including roadsides. Known in subregion.	High	Vulnerable	Not listed	Included
<b>Pink-tailed Legless Lizard</b> <i>Aprasia parapulchella</i>	Inhabits sloping, open woodland areas with predominantly native grassy groundcover, particularly those dominated by Kangaroo Grass. Sites are typically well-drained, with rocky outcrops or scattered, partially-buried rocks	High	Vulnerable	Vulnerable	Excluded- Unsuitable habitat
<b>Regent Honeyeater</b> <i>Anthochaera phrygia</i> (Breeding)	Temperate woodlands and open forests of the inland slopes of south-east Australia, in particular dry open forest, woodland, Box-Ironbark woodland, and riparian forests of River Sheoak.	High	Critically Endangered	Critically Endangered	Excluded-Not in mapped important area
<b>Square-tailed Kite</b> <i>Lophoictina isura</i>	Timbered habitats including dry woodlands and open forests, particularly timbered watercourses. Known in subregion.	Moderate	Vulnerable	Not listed	Included

Credit species	Habitat and geographic restrictions	Sensitivity to gain class	NSW listing status	National listing status	Included or Excluded
<b>Squirrel Glider</b> <i>Petaurus norfolcensis</i>	Old growth box, box-ironbark woodlands, and River Red Gum forests west of the Great Dividing Range. Abundant tree hollows required for refuge and nesting. Known in subregion.	High	Vulnerable	Not listed	Included
<b>Superb Parrot</b> <i>Polytelis swainsonii</i> (Breeding)	Box-Gum, Box-Cypress, and Boree Woodlands and River Red Gum Forests. They nest in hollows of large trees in tall open forest or woodland. Recorded on site during survey.	High (breeding) / Moderate (foraging)	Vulnerable	Vulnerable	Included
<b>Swift Parrot</b> <i>Lathamus discolor</i>	On the coast and southwest slopes in areas with abundant flowering eucalypts or lerp. Feed trees include winter flowering species such as Swamp Mahogany, Spotted Gum, Red Bloodwood, Mugga Ironbark, and White Box. Known in subregion.	Moderate	Endangered	Critically Endangered	Excluded -Not in mapped important area
<b>White-bellied Sea-Eagle</b> <i>Haliaeetus morphnoides</i> (Breeding)	Large areas of open water including larger rivers, swamps, lakes, and the sea. Coastal dunes, tidal flats, grassland, heathland, woodland, and forest. Breeding habitat mature tall open forest, open forest, tall woodland, and swamp sclerophyll forest close to foraging habitat. Known in subregion.	High	Vulnerable	Not listed	Included
<b>*Southern Myotis</b> <i>Myotis macropus</i>	Habitat surrounding waterways is used for breeding and roosting. Requires hollow bearing trees or artificial shelters (caves, culverts and bridges) within 200m of riparian waterways with pools 3m wide or greater.	High	Vulnerable	Not listed	Included
<b>Flora</b>					



Credit species	Habitat and geographic restrictions	Sensitivity to gain class	NSW listing status	National listing status	Included or Excluded
<b>Ausfeld's Wattle</b> <i>Acacia ausfeldii</i>	Associated species include <i>Eucalyptus albens</i> , <i>E. blakelyi</i> and <i>Callitris</i> spp., with an understorey dominated by <i>Cassinia</i> spp. and grasses. Known in subregion.	High	Vulnerable	Not listed	Included
<b>Small Scurf-pea</b> <i>Cullen parvum</i>	Found in grassland, river Red Gum Woodland or Box-gum Woodland, sometimes on grazed land and usually on table drains or adjacent to drainage lines or watercourses.	High	Endangered	Not Listed	Included
<b>Small Purple-pea</b> <i>Swainsona recta</i>	Predominantly grassy woodlands, but sometimes extends into grassy open forest, usually with tree cover including Blakely's Red Gum, Yellow Box, and White Box. Known in subregion.	Moderate	Not listed	Endangered	Included
<b>Silky Swainson-pea</b> <i>Swainsona sericea</i>	Box-gum woodland in southern tablelands and South West Slopes. Sometimes in association with cypress pines. Known in subregion.	High	Vulnerable	Not listed	Included
<b>*Slender Darling Pea</b> <i>Swainsona murrayana</i>	Grows in a variety of vegetation types including bladder saltbush, black box and grassland communities on level plains, floodplains and depressions and is often found with <i>Maireana</i> species.	High	Vulnerable	Vulnerable	Excluded- Outside geographic limitation
<b>*Spiny Peppercross</b> <i>Lepidium aschersonii</i>	Found on ridges of gilgai clays dominated by Brigalow ( <i>Acacia harpophylla</i> ), Belah ( <i>Casuarina cristata</i> ), Buloke ( <i>Allocasuarina luehmannii</i> ) and Grey Box ( <i>Eucalyptus microcarpa</i> )	High	Vulnerable	Vulnerable	Included
<b>*Winged Peppercross</b>	Predominant vegetation is usually an open woodland dominated by <i>Allocasuarina luehmannii</i> (Bulloak)	High	Endangered	Endangered	Included

Credit species	Habitat and geographic restrictions	Sensitivity to gain class	NSW listing status	National listing status	Included or Excluded
<b><i>Lepidium monoplacoides</i></b>	and/or eucalypts, particularly <i>Eucalyptus largiflorens</i> (Black Box) or <i>Eucalyptus populnea</i> (Poplar Box).				
<b>*Pine Donkey Orchid</b> <b><i>Diuris tricolor</i></b>	The Pine Donkey Orchid grows in sclerophyll forest among grass, often with native Cypress Pine ( <i>Callitris</i> spp.). It is found in sandy soils, either on flats or small rises.	Moderate	Vulnerable	Not listed	Included
<b>*Sand-hill Spider Orchid</b> <b><i>Caladenia arenaria</i></b>	Occurs in woodland with sandy soil, especially that dominated by White Cypress Pine ( <i>Callitris glaucophylla</i> ). Occurs West of Lockhart and north of Rand.	High	Vulnerable	Vulnerable	Excluded – Outside geographic limitations
<b>*Spike Rush</b> <b><i>Eleocharis obicis</i></b>	Grows in ephemerally wet situations such as roadside mitre drains and depressions, usually in low-lying grasslands.	High	Vulnerable	Vulnerable	Excluded Outside geographic limitations
<b>*Mossgiel Daisy</b> <b><i>Brachyscome papillosa</i></b>	South and West of the Coolamon to Ardlethan Road, west of Lockhart and north of Rand	High	Vulnerable	Vulnerable	Excluded- Outside geographic limitations
<b>*A Spear Grass</b> <b><i>Austrostipa wakoolica</i></b>	Grows on floodplains of the Murray River tributaries, in open woodland on grey, silty clay or sandy loam soils;	Moderate	Endangered	Endangered	Included
<b>*Austral Pillwort</b> <b><i>Pilularia novae-hollandiae</i></b>	Semi-permanent/ephemeral wet areas  Periodically waterlogged sites (including table drains and farms dams)	High	Endangered	Not listed	Included

\*BAMC additions (Revision 0)



#### 4.2.2 Exclusions based on habitat features

The following species credit species have been excluded from further assessment based on the habitat features absent at the development site.

Table 4-3 Species credit species excluded based on absent habitat features

Credit species	Associated habitat type	Habitat Components and abundance on site
<b>Pink-tailed Legless Lizard</b> <i>Aprasia parapulchella</i>	Typically found in well-drained areas with rocky outcrops dominated by Kangaroo Grass.	No rocky outcrops on development site
<b>Large-eared Pied Bat</b> <i>Chalinolobus dwyeri</i>	Found mainly in areas with extensive cliffs and caves, from Rockhampton in Queensland south to Bungonia in the NSW Southern Highlands. It is generally rare with a very patchy distribution in NSW. Roosts in caves. Found in well timbered areas containing gullies.	No cliffs, caves or other habitat components on or near development site
<b>*Southern Myotis</b> <i>Myotis macropus</i>	Habitat surrounding waterways is used for breeding and roosting. Requires hollow bearing trees or artificial shelters (caves, culverts and bridges) within 200m of riparian waterways with pools 3m wide or greater.	The Billabong Creek north of the development site is the only suitable riparian habitat with pools 3m or wider for foraging.

#### 4.2.3 Inclusions based on habitat features

A known record of the Sloane's Froglet (*Crinia sloanei*) occurs 1km of the development site (Bionet, 2019). The Sloane's froglet habitat include periodically inundated areas in grassland, woodland and disturbed habitats. Habitat constraints listed in the Threatened Species Database collection include areas within 500m of waterbodies, swamps and wet areas containing relatively shallow sections with submergent and emergent vegetation. The 16 farm dams within the development site are considered suitable habitat for the Sloane's Froglet and this species was added to the BAM Calculator as a candidate species requiring further assessment.

An assessment was undertaken of species associated with the Plant Community Types not within the development footprint but occurring within the development site. PCT 5, 74, 76 and PCT 249 (removed) were assessed in the BAM Calculator to determine species credits associated with these PCTs. Species that are mobile that could also utilise the adjacent vegetation within the development footprint were then added to the BAM calculator as candidate species requiring targeted surveys. These species were;

- Brush-tailed Phascogale (*Phascogale tapoatafa*)
- Barking Owl (*Ninox connivens*)
- Glossy Black Cockatoo (*Calyptorhynchus lathami*)
- Major Mitchell Cockatoo (*Lophochroa leadbeateri*)
- Southern Bell Frog (*Litoria raniformis*)

An additional nine flora species were returned for areas outside of the development footprint (Table 4-2). Four of these species were excluded based on geographic limitations. The remaining five species were included in the initial targeted survey design in 2018. The Pine Donkey Orchid (*Diuris tricolor*) was unable to be surveyed and has been assumed present in PCT 76.



#### 4.2.4 Candidate species requiring confirmation of presence or absence

The species listed in Table 4-4 are those that are considered to have habitats present at the development site. Three of these species are assumed to be present on the site. Surveys have been conducted for the remaining species. The results are summarised in Table 4-4. Details of the survey methodologies and results are provided for each surveyed species in section 4.2.5 below. Species polygons have been defined for the species present on the site as mapped on Figure 4-1 to Figure 4-4.

Table 4-4 Summary of species credit species surveyed at the development site

Species credit species	Biodiversity risk rating	Survey period	Assumed to occur/survey/expert report	Present on site?	Species polygon area or count
<b>FAUNA</b>					
<b>Bush Stone-curlew</b> <i>Burhinus grallarius</i>	2.00	Jan-Dec	Surveyed November 2018	No	0
<b>Brush-tailed Phascogale</b> <i>Phascogale tapoatafa</i>	2.00	Jan - Dec	Surveyed November 2018	No	0
<b>Barking Owl</b> <i>Ninox connivens</i>	2.00	May - Dec	Surveyed November 2018	No	0
<b>Eastern Pygmy Possum</b> <i>Cercartetus nanus</i>	2.00	Oct-Mar	Surveyed November 2018	No	0
<b>Gang-gang Cockatoo</b> <i>Callocephalon fimbriatum</i>	2.00	Oct-Jan	Surveyed November 2018	No	0
<b>Glossy Black Cockatoo</b> <i>Calyptorhynchus lathami</i>	2.00	Mar - Aug	Surveyed August 2018	No	0
<b>Grey-headed Flying-fox</b> <i>Pteropus poliocephalus</i>	2.00	Oct - Dec	Surveyed November 2018	No	0
<b>Koala</b> <i>Phascolarctos cinereus</i>	2.00	Any	Surveyed November 2018	No	0
<b>Little Eagle</b> <i>Hieraetus morphnoides</i>	1.50	Aug - Oct	Surveyed August 2019	No	0
<b>Major Mitchell Cockatoo</b> <i>Lophochria leadebeateri</i>	2.00	Sept - Dec	Surveyed November 2018	No	0

Species credit species	Biodiversity risk rating	Survey period	Assumed to occur/survey/expert report	Present on site?	Species polygon area or count
<b>Masked Owl</b> <i>Tyto novaehollandiae</i>	2.00	May-Aug	Surveyed August 2019	No	0
<b>Regent Honeyeater</b> <i>Anthochaera phrygia</i>	3.00	Sep-Dec	Surveyed November 2018	No	0
<b>Southern Bell Frog</b> <i>Litoria raniformis</i>	2.00	Oct - Jan	Surveyed December 2018	No	0
<b>Southern Myotis</b> <i>Myotis macropus</i>	2.00	Oct- March	Surveyed December 2018	Yes No direct impacts to associated habitat within development footprint. Indirect impacts have been assessed in section 7.2.	0 –
<b>Sloane's Froglet</b> <i>Crinia sloanei</i>	1.50	Jul-Aug	Surveyed August 2019	No	0
<b>Square-tailed Kite</b> <i>Lophoictinia isura</i>	1.50	Sep-Jan	Surveyed November 2018	No	0
<b>Squirrel Glider</b> <i>Petaurus norfolcensis</i>	2.00	Any	Surveyed November 2018	No	0
<b>Superb Parrot</b> <i>Polytelis swainsonii</i>	2.00	Sep-Nov	Surveyed November 2018	No	0
<b>Swift Parrot</b> <i>Lathamus discolor</i>	3.00	May-Aug	Surveyed August 2019	No	0
<b>White-bellied Sea-eagle</b> <i>Haliaeetus leucogaster</i>	2.00	Jul - Dec	Surveyed November 2018	No	0
<b>FLORA</b>					
<b>Ausfeld's Wattle</b> <i>Acacia ausfeldii</i>	2.00	Any	Surveyed November 2018	No	0
<b>Small Scurf-pea</b> <i>Cullen parvum</i>	2.00	Dec - Jan	Surveyed December 2018- Assumed present along Weeamera Road	Assumed Present	0.17ha



Species credit species	Biodiversity risk rating	Survey period	Assumed to occur/survey/expert report	Present on site?	Species polygon area or count
<b>Silky Swainson-pea</b> <i>Swainsona sericea</i>	2.00	Sep-Feb	Surveyed November 2018- Assumed present along Weeamera Road	Assumed present	0.17 ha
<b>Small Purple-pea</b> <i>Swainsona recta</i>	2.00	Sept-Nov	Surveyed November 2018- Assumed present along Weeamera Road	Assumed present	0.17 ha
<b>*Pine Donkey Orchid</b> <i>Diuris tricolor</i>	1.5	Sept -Oct	Assumed present in PCT 76_native understory and PCT 76_derived grassland.	Yes No direct impacts to associated habitat within development footprint. Indirect impacts have been assessed in section 7.2.	0
<b>*A Spear Grass</b> <i>Austrostipa wakoolica</i>	2	Oct- Dec	Surveyed November 2018	No	0
<b>*Austral Pillwort</b> <i>Pilularia novae-hollandiae</i>	3	Oct- Dec	Surveyed November 2018	No	0
<b>Winged Peppercress</b> <i>Lepidium monoplacoides</i>	2	Nov- Feb	Surveyed November 2018	No	0
<b>*Spiny Peppercress</b> <i>Lepidium aschersonii</i>	2	Nov-April	Surveyed November 2018	No	0

#### 4.2.5 Species survey methods

##### Nocturnal Mammals: Eastern Pygmy Possum, Squirrel Glider, Grey-headed Flying-fox, Brush-tailed Phascogale

###### SURVEY EFFORT

A targeted spotlight survey was completed on the evenings of the 28, 29 and 30<sup>th</sup> of November 2018 for a total of approximately 12 person hours. A 100-watt spotlight was used for both vehicle-based and foot surveys of planted vegetation, remnant vegetation, and isolated paddock trees. This involved visual searches of trees for arboreal mammals and call playback surveys for Squirrel Glider. Visual searches in the canopy for Grey-headed Flying-foxes during vehicle-based and foot searches were also undertaken. Vehicle-based searches were undertaken for approximately 6 person hours, and foot surveys for 6 person hours. Weather conditions recorded for these days at the nearest weather station included minimum temperature of 24.8°C, maximum temperature of 29.0°C, and 0.0 mm of rainfall.

###### SURVEY RESULTS

No nocturnal mammals, including Eastern Pygmy-possums, Squirrel Gliders, Brush tailed Phascogales, and Grey-headed Flying-foxes, were seen during the survey. No flying fox breeding camps were observed within the development site.

##### Sloane's Froglet and Southern Bell Frog

###### SURVEY EFFORT

A targeted frog survey for the Southern Bell Frog was completed on the nights of 18<sup>th</sup> and 19<sup>th</sup> of December 2018 for a total of approximately 8 person hours (2 hours per night per species). Weather conditions recorded for these days at the nearest weather station included a minimum and maximum temperature of 33.2°C and 0.0 mm of rainfall. Survey included call playback and nocturnal surveys at the dams.

A targeted frog survey for the Sloane's Froglet was conducted on the nights of 12<sup>th</sup> and 13<sup>th</sup> of August 2019. Survey included call playback at the dams. Weather conditions recorded for these days at the nearest weather station included minimum temperature of 11.6°C, maximum temperature of 12.3°C, and 0.0 mm of rainfall.

###### SURVEY RESULTS

No Sloane's Froglets, Southern Bell Frogs, or Booroolong frogs were seen or heard during the survey.

All surveys were conducted within the respective ideal survey periods outlined.

##### Nocturnal Birds: Barking Owl, Masked Owl & Bush-stone Curlew

###### SURVEY EFFORT

A targeted species survey was completed on the nights of 28<sup>th</sup> and 29<sup>th</sup> of November 2018 for Barking Owl and Bush Stone Curlew for a total of approximately 8 person hours (2 hours per night per species). Call playback with a megaphone was used from the vehicle along planted vegetation, remnant vegetation, and isolated paddock trees, followed by a period of listening for responses. Weather conditions recorded for these days at the nearest weather station included minimum temperature of 24.8°C, maximum temperature of 29.0°C and 0.0 mm of rainfall.

A targeted species survey was conducted on the nights of 12<sup>th</sup> and 13<sup>th</sup> August 2019 for the Masked Owl. Survey method included call play back through the megaphone and spotlighting using the 100-watt spotlight.



## SURVEY RESULTS

No threatened birds were seen or heard during the survey.

The surveys occurred during the respective survey periods for all threatened nocturnal birds.

## **Koala**

### SURVEY EFFORT

A targeted search was completed on the nights of the 28<sup>th</sup> and 29<sup>th</sup> November 2018 for a total of 4 hours (2 person hours per night). Survey methods included a spotlight search. Weather conditions recorded at the nearest weather station included minimum temperature 24.8°C, maximum temperature of 29.0°C and 0.0 mm of rainfall.

### SURVEY RESULTS

No Koalas were seen during the survey.

**Woodland Birds: Regent Honeyeater, Gang-Gang Cockatoo, Major Mitchell Cockatoo, Superb Parrot, Swift Parrot, White Bellied Sea Eagle, Square-tailed Kite, Glossy Black Cockatoo, Little Eagle.**

### SURVEY EFFORT

A woodland bird census was completed on the mornings of the 27<sup>th</sup> – 30<sup>th</sup> of November 2018. Weather conditions recorded for these days at the nearest weather station included minimum temperature of 24.8°C, maximum temperature of 29.0°C, and 0.0 mm of rainfall. Four 20-minute point surveys for birds were carried out over two days, as well as opportunistic surveys throughout the site visit including traversing the site by car and on foot. Paddock trees and remnant trees were surveyed for evidence of stick nests used by raptors. Hollow-bearing tree mapping was undertaken within November and December and included inspection of all trees on site during the breeding period of the Superb Parrot.

A targeted search for the remaining woodland bird species (Glossy Black Cockatoo, Little Eagle, Swift Parrot) was conducted on the 12<sup>th</sup>, 13<sup>th</sup> and 14<sup>th</sup> of August 2019. Survey effort included diurnal bird surveys and stag watching in the evening.

### SURVEY RESULTS

No threatened bird species were observed during the survey effort. All surveys occurred during the correct survey periods for all threatened birds.

## **Microbats (Southern Myotis)**

### SURVEY EFFORT

Microbats surveys via ultrasonic detection (Anabat survey) were completed across 4 nights between the 28<sup>th</sup> November to the 2<sup>nd</sup> December. Weather during the surveys was optimal with clear nights. Two Anabat Swift units were deployed during the survey periods within riparian zones of PCT 74 Moderate including Billabong Creek. Calls were downloaded and converted from full spectrum calls to Zero-crossing calls using Wildlife Acoustics Kaleidoscope software, then analysed through AnalookW. Analysis was undertaken and assessed with reference to Bat Calls of New South Wales (Pennay, Law and Reinhold 2004). Reference calls were used for comparison and species confirmation, where available.

### SURVEY RESULTS

Numerous microbat species were identified from the Anabat recordings, including a probable recording of the Southern Myotis. A precautionary approach was applied in regards to the definition of the Southern Myotis analysis and presence onsite using the following;

- Steep, near vertical, starting at between 70 to 80 kHz, dropping to between 35 to 40 kHz. Calls have central kink around 45 kHz.
- Time between calls/pulse interval (TBC) is 41.84 ms
- Initial Slope (S1) on majority of calls is >400. Many calls are giving a 0 reading which skews the average of the call (250 across the call), but individually the pulses are predominantly >400. This is the predominant reason between a probable and definite presence.

No other threatened microbats were recorded.

### **Threatened Forbs and Grasses: Small Purple Pea, Silky Swainson-pea and Small Scurf-pea,**

#### SURVEY EFFORT

Targeted flora transects were undertaken of the woodland and grassland areas at 10 m intervals in accordance with the NSW Guide to Surveying Threatened Plants (OEH, 2016) from 27<sup>th</sup> to 30<sup>th</sup> November 2018 and 18<sup>th</sup> to 20<sup>th</sup> December 2018. The initial flora surveys also included targeted surveys for A Spear Grass (*Austrostipa wakoolica*), Austral Pillwort (*Pilularia novae-hollandiae*) and threatened *Lepidium* spp. Wet depressions including areas of PCT 5, derived grasslands, and farm dams were walked in 10m transects with potential habitat for Austral Pillwort.

#### SURVEY RESULTS

No threatened forbs or grasses were detected within the survey area. Silky Swainson Pea, Small Purple Pea and Small Scurf pea were unable to be surveyed during the correct survey period along Weeamera road and were assumed to be present along this road.

### **Threatened shrubs: Ausfeld's Wattle**

#### SURVEY EFFORT

Suitable habitat for this species could occurred throughout the whole site between the 12<sup>th</sup> to 14<sup>th</sup> August 2018.

#### SURVEY RESULTS

Ausfeld's Wattle was not detected during the site surveys. Only one Wattle species; Hickory Wattle, was detected during targeted searches.

A number of planted *Acacia* species including *Acacia montana*, *Acacia dealbata* and *Acacia implexa* were identified during these surveys. Ausfeld's wattle was not identified within the development site.



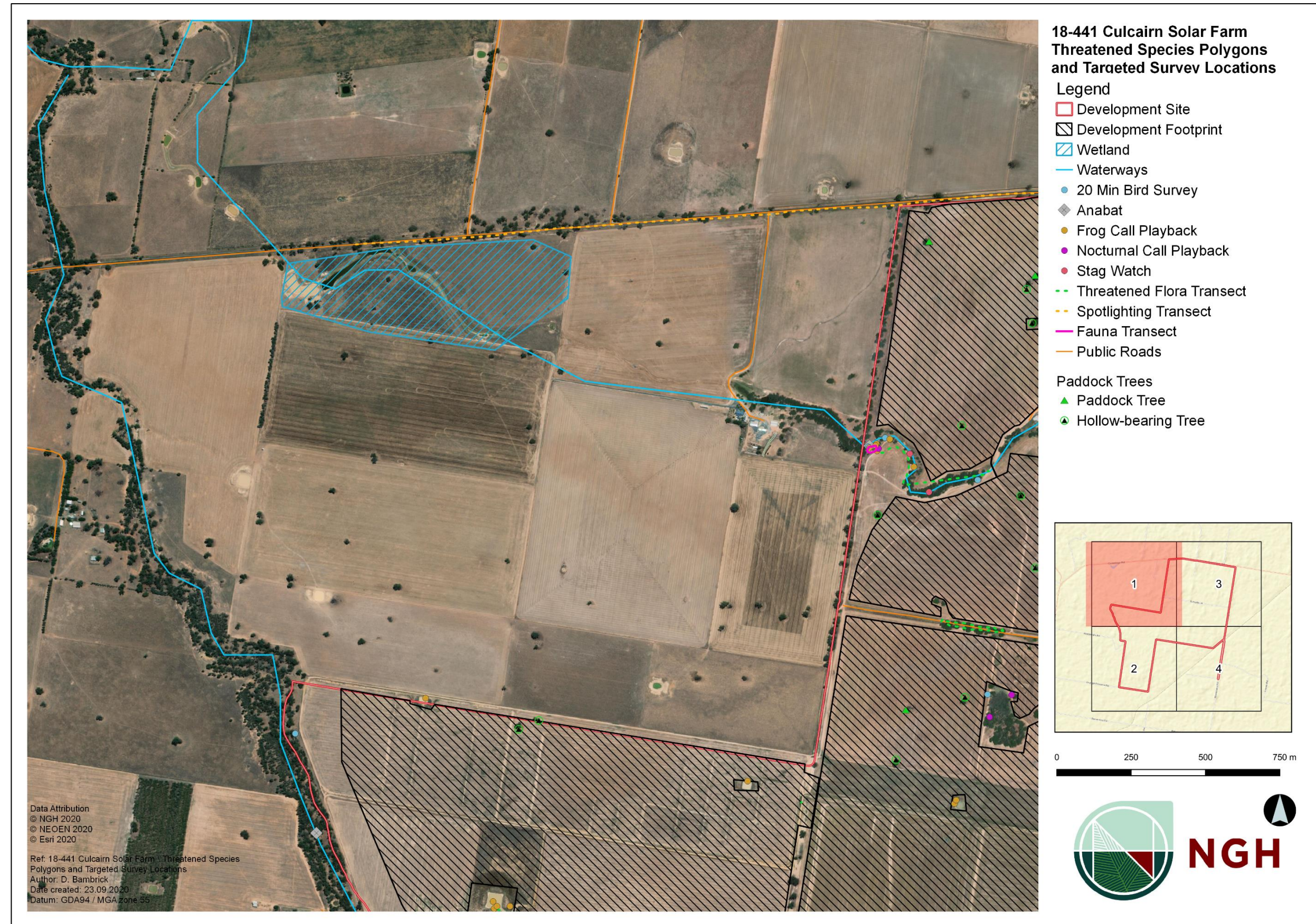


Figure 4-1 Threatened species polygons and targeted survey locations



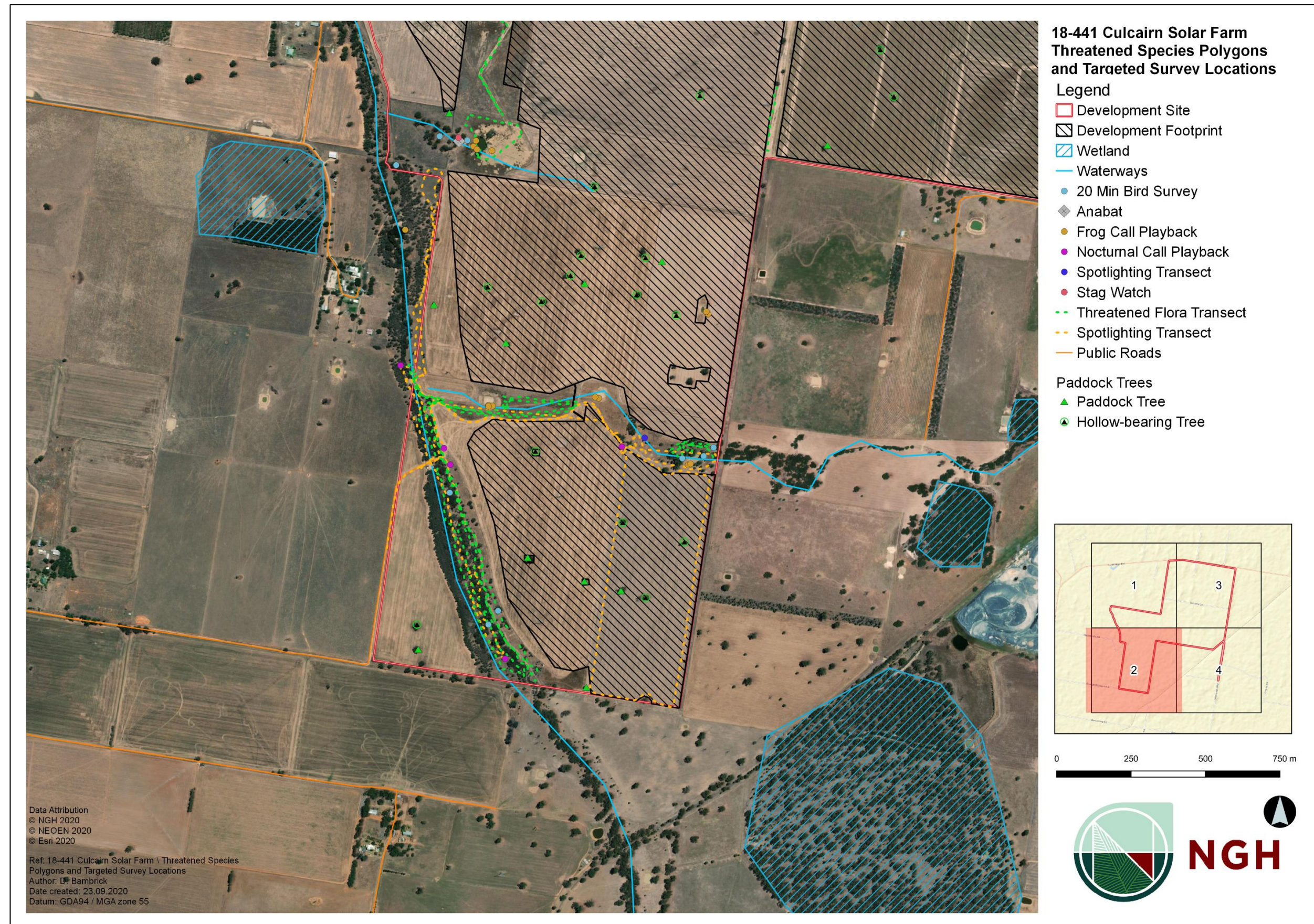


Figure 4-2 Threatened species polygons and targeted survey locations



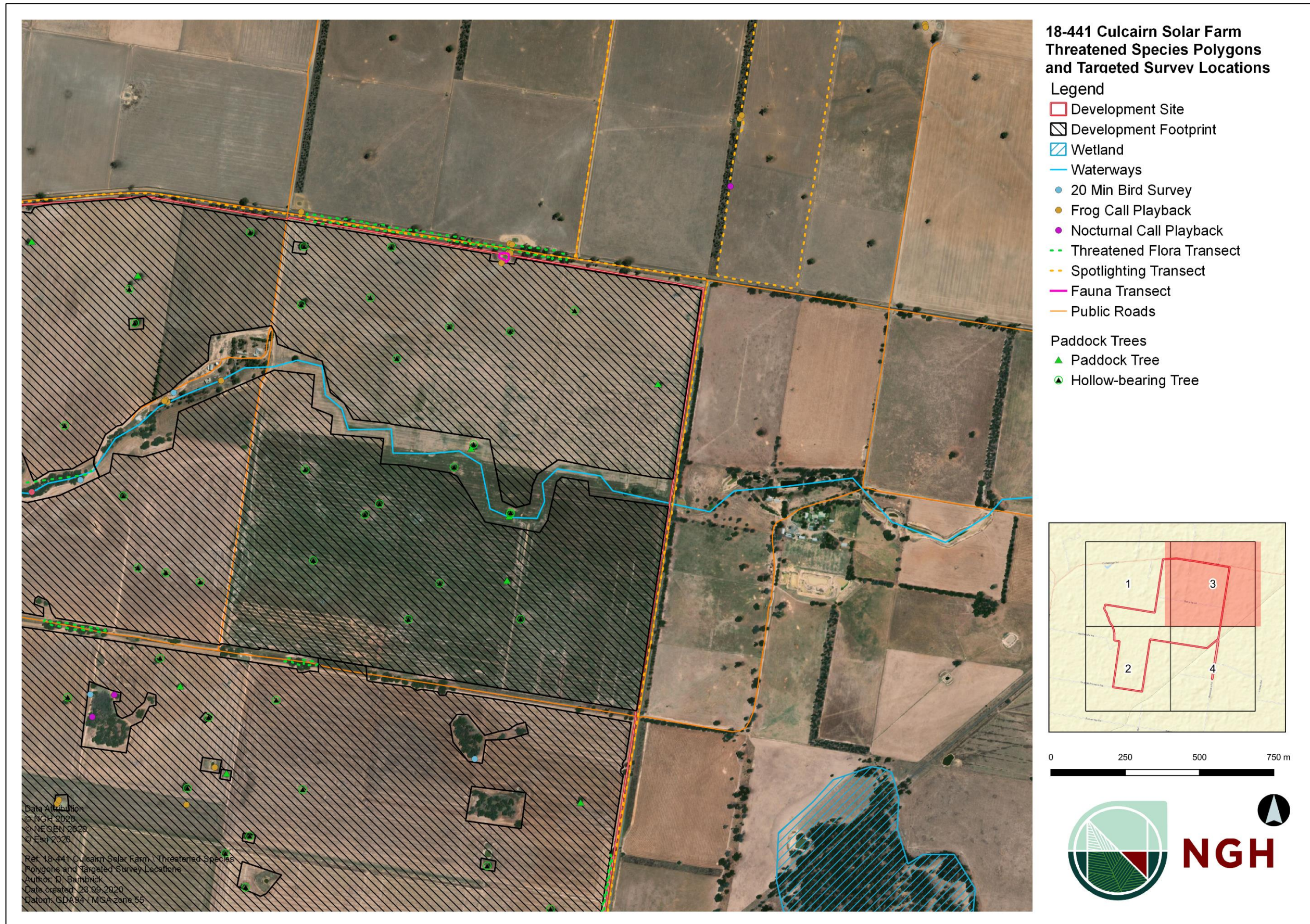


Figure 4-3 Threatened species polygons and targeted survey locations



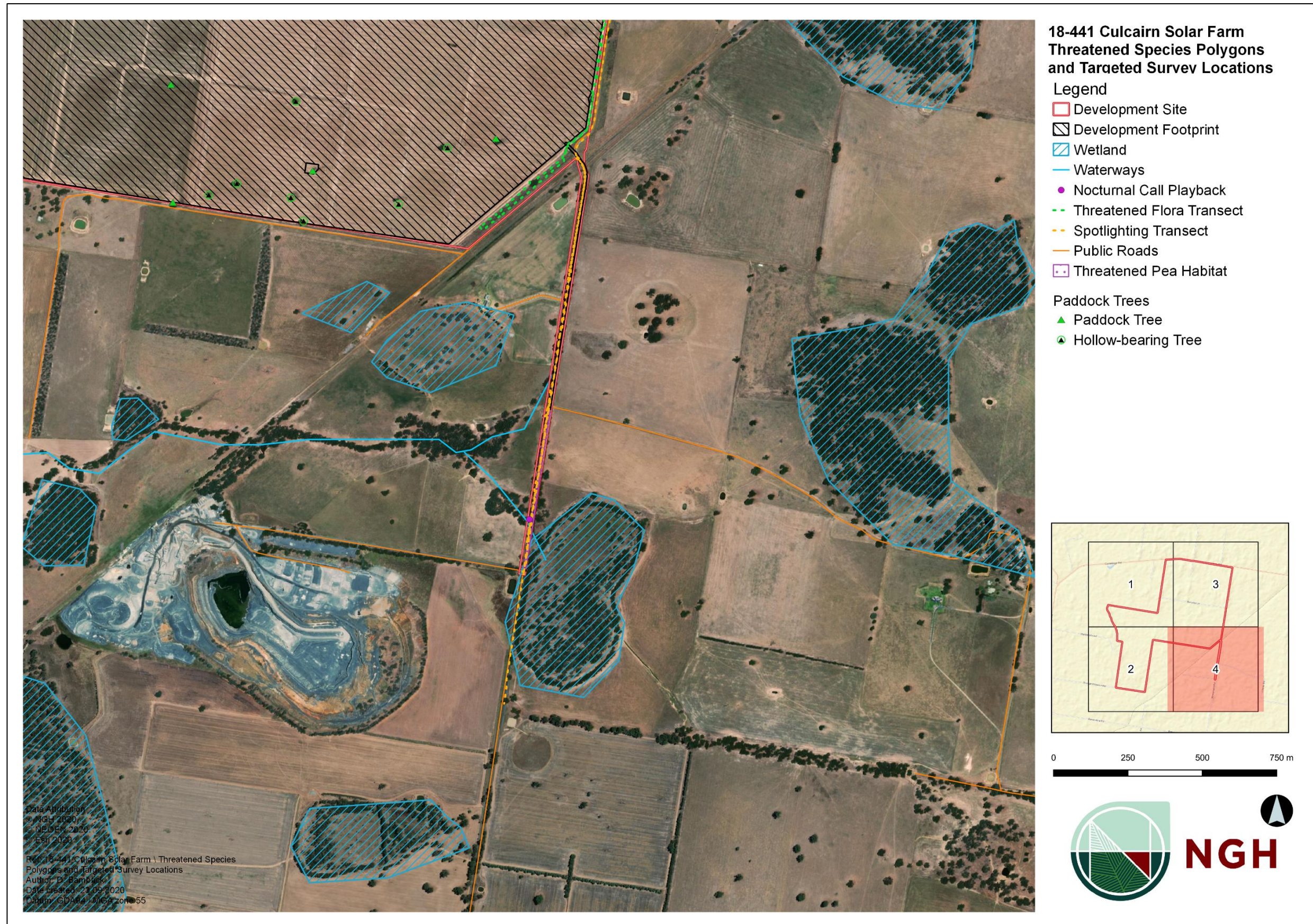


Figure 4-4 Threatened species polygons and targeted survey locations



## 4.3 ADDITIONAL HABITAT FEATURES RELEVANT TO PRESCRIBED BIODIVERSITY IMPACTS

### 4.3.1 *Occurrences of karst, caves, crevices and cliffs*

As verified by the field inspection, there are no occurrences of karst, caves, crevices, or cliffs in the development site.

### 4.3.2 *Occurrences of rock*

As verified by the field inspection, there are no occurrences of surface rock in the development site.

### 4.3.3 *Occurrences of human made structures and non-native vegetation*

As verified by the field inspection, there are no human made structures within the development site. Both parcels of land comprising the development site are cleared and currently used for cropping and pasture. The extent of productive agriculture land in the region is considerable and native animals benefiting cleared exotic vegetation environments have ample access to suitable habitat, thus only minimal impact on threatened species is anticipated from the proposal.

### 4.3.4 *Hydrological processes that sustain and interact with the rivers, streams and wetlands*

The Back Creek catchment extends into a hill range, 6 km east of the Olympic Highway. The upper catchment area drains westwards crossing the Olympic Highway and flowing north along the western boundary of the development site. The majority of Back Creek catchment has been predominantly cleared for agriculture, with the exception of the steeper hillside areas located in the upper catchment. Back Creek and its tributaries that transect the development site have been excluded from the development footprint.

The headwaters of Billabong Creek begin in the upland areas around Holbrook, NSW. The channel continues westward for approximately 320 km before its confluence with the Edward River at Moulamein, NSW. Billabong Creek occurs north of the subject land. Billabong Creek and its riparian vegetation have been excluded from the development footprint.

## 5 MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE

An EPBC protected matters report was undertaken on 9<sup>th</sup> August 2019 (10 km buffer of the development site) to identify Matters of National Environmental Significance (MNES) that have the potential to occur within the development site. Relevant to Biodiversity these include:

- Wetlands of International Importance – 4;
- Threatened Ecological Communities – 3;
- Threatened species – 24; and
- Migratory species – 11.

The potential for these MNES to occur at the site are discussed below.

### 5.1 WETLANDS OF INTERNATIONAL IMPORTANCE

Four wetlands of international importance were returned from the protected matters report. The nearest of these (within 400 km of the development site) is Hattah-kulkyne lakes. All other wetlands returned from the search are over 500 km away. The Murray River occurs approximately 45 km from the development site, though there is no indication that the proposal will impact the Murray River.

### 5.2 THREATENED ECOLOGICAL COMMUNITIES

Three threatened ecological communities were returned from the protected matters report.

These include:

- Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia
- Weeping Myall Woodlands
- White Box-Yellow Box- Blakey's Red Gum Grassy Woodland and Derived Native Grassland

The woodland vegetation and derived grasslands within the development site have been heavily modified through cultivation, regular grazing and weed encroachment. 1295 ha of the development site is classified as Category 1 exempt land which is an indication of the condition of groundcover within the development site.

0.78 ha of PCT 76\_ Native understory occurs along an internal road within the development site. Benchmark data was used for this zone as no field plots were completed. This vegetation is assumed to meet the criteria for the EPBC listed *Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia*. This vegetation has been avoided by the development; however, a Test of Significance (ToS) has been completed in Appendix F to assess indirect impacts to the community.

PCTs 277 and PCT 74 within the development site do not meet the condition thresholds for EPBC listed *White Box Yellow Box Blakey's Red Gum Woodland*. In particular, the patches do not have a predominately native understorey and there are less than 12 native understorey species present.

During the March 2020 surveys two EPBC plots were completed in areas of PCT 277 with a native component, including the area directly impacted along Weeamera Road.



No area of PCT within the development site meets the criteria for the EPBC listed *White Box-Yellow Box-Blakey's Red Gum Grassy Woodland and Derived Native Grassland*. EPBC Plot data is provided in Appendix A. Results of this analysis are provided in Table 5-1.

Table 5-1 Condition threshold assessment for the federally listed White Box - Yellow Box - Blakely's Red Gum Grassy Woodlands and derived native grasslands

EPBC Requirement	277_Derived_grassland (EPBC Plot 1 )	277_native_understory (EPBC plot 2)	74_mod_condition	277_planted 277_regeneration 74_low_condition 277_exotic_understory
Is, or was previously, at least one of the most common overstory species White Box, Yellow Box or Blakely's Red Gum.	Yes, Yellow Box and Blakely's Red Gum would have previously been common in the overstory.	Yes, Yellow Box and Blakely's Red Gum are common in the overstory.	Yes, Yellow Box and Blakely's Red Gum are common in the overstory.	Yes, Yellow Box and Blakely's Red Gum are common in the overstorey.
Does the patch have a predominantly native understory	Yes – some native understory species present which provide about 25% cover.  Exotic annuals are dominant. Perennial weeds including <i>Paspalum dillatum</i> and <i>Phalaris aquatica</i> are present but not dominant.	Yes – some native understory species present which provide about 30% cover.  <i>Paspallum dilatatum</i> and <i>Bromus diandrus</i> common dominant species in understory.  <b>Not the listed ecological community</b>	No – some native understory species present but provide less than 25% cover. <i>Bothriochloa macra</i> , <i>Chloris truncata</i> and <i>Cynodon dactylon</i> are present.  <i>Paspallum dilatatum</i> and <i>Bromus diandrus</i> occupy over 40% of the perennial cover.  <b>Not the listed ecological community</b>	No – no native understory species present. The understory is dominated by exotic weed species or less than 1% native.  <b>Not the listed ecological community</b>
Is the Patch 0.1ha or greater in size	Yes	Yes		
There are 12 or more native	No- number of native forbs identified ranges from 2 to 5.  No important species identified.	No- number of native forbs identified ranges from 2 to 9		



understory species (excluding grasses).				
Is the Patch 2 ha or greater in size	No- Not the Listed ecological community	No Not the Listed ecological community		
Does the patch have an average of 20 or more mature trees per hectare (mature trees at least 125cm DBH)				
Is there natural regeneration of Yellow Box plus mature trees at least 125cm DBH				

### 5.3 THREATENED SPECIES

Twenty-seven threatened species were returned from the EPBC protected matters report. Of these, nine are considered to have the potential to utilise the habitats at the development site:

- Superb Parrot (*Polytelis swainsonii*). - V
- Painted Honeyeater (*Grantiella picta*). – V
- Corben's Long-eared Bat (*Nyctophilus corbeni*) – V
- White-throated Needletail (*Hirundapus caudacutus*) – V
- Swift Parrot (*Lathamus discolor*). - CE
- Regent Honeyeater (*Anthochaera phrygia*). – CE
- Sloane's Froglet (*Swainsona sericea*) - E
- Koala (*Phascolarctos cinereus*) -V
- Small Purple-pea (*Swainsona recta*) - E

### 5.4 MIGRATORY SPECIES

Eleven listed migratory species were returned from the protected matters report. Two of these species are considered likely to occur at the site on a regular basis or rely on the habitats present. These are;

- Fork-tailed Swift (*Apus pacificus*) - M
- White-throated Needletail (*Hirundapus caudacutus*) - M



## 6 AVOID AND MINIMISE IMPACTS

### 6.1 AVOIDING AND MINIMISING IMPACTS ON NATIVE VEGETATION AND HABITAT

#### 6.1.1 Site selection – consideration of alternative locations/routes

During the development of the proposal, a number of alternatives were considered. These include the ‘do nothing option’ (not developing the solar farm), alternative proposal area locations, and developing different renewable technologies.

During the site selection process for the proposal, the proponent reviewed the solar generation potential of many areas in NSW using a combination of computer modelling and analysis, on the ground surveying, and observation and experience of the proponent. The proposed site was selected because it provides the optimal combination of:

- Low environmental constraints (predominantly cleared cropping and grazing land);
- Level terrain for cost effective construction;
- High quality solar resource;
- Compatible land use zoning (on the development site and considering adjacent land holdings);
- Low flood risk;
- Existing road access;
- Onsite connection to the transmission network;
- High levels of available capacity on the grid transmission system; and
- Land availability and support from the landowner.

The development site is of a scale that allows for flexibility in the design, allowing site constraints identified during the EIS process to be avoided or effectively mitigated.

The design of the proposal is the result of an iterative process. The design has been adapted progressively as information regarding site constraints, and the potential impacts and risks associated with the development of the proposal have become available.

Based on biodiversity, heritage and other investigations carried out for the EIS, the proposed layout achieves the objective of efficient electricity production while minimising environmental impacts overall.

Available grid capacity at a suitable voltage on the existing TransGrid Jindera to Wagga Wagga 330 kV transmission line west of the site was also instrumental in making Culcairn an ideal choice for a renewable energy development.

#### 6.1.2 Proposal components – consideration of alternate modes or technologies

The Australian Government’s Large-scale Renewable Energy Target (LRET) and NSW Government’s Renewable Energy Action Plan (REAP) outline the commitment by both Australia and NSW more specifically to reducing GHG emissions and have set targets for increasing the supply of renewable energy. Other forms of largescale renewable energy accounted for in the LRET include wind, hydro, biomass, and tidal energy. The feasibility of wind, solar, biomass, hydro and tidal projects depend on the availability of energy resources and grid capacity.

PV solar technology was chosen because it is cost-effective, low profile, durable and flexible regarding layout and siting. It is a proven and mature technology which is readily available for broad scale deployment at the site. Unlike wind farms, which are installed on elevated topography, solar energy farms can be effectively screened by vegetation to reduce the impact of visual disturbance, which would also provide additional habitat for local fauna. Solar energy farms also have few moving parts and are less likely to interfere with bird flight patterns.

Superior solar resources have been identified in NSW, providing excellent opportunities for solar projects.

### **6.1.3 Proposal planning phase – detailed design**

A preliminary constraints analysis was conducted by an NGH Consulting ecologist, which informed the site layout design. Vegetation constituting the highest ecological constraints, such as forming components of EECs and providing habitat for threatened flora and fauna were avoided and minimised as far as practical by amending the configuration of solar panels to avoid the removal of trees present at the project site.

For example:

- reducing the clearing footprint of the project;
- locating ancillary facilities in areas where there are no biodiversity values;
- locating ancillary facilities in areas where the native vegetation or threatened species habitat is in the poorest condition (i.e. areas that have a lower vegetation integrity score);
- locating ancillary facilities in areas that avoid habitat for species and vegetation in high threat status categories (e.g. an EEC or CEEC);
- providing structures to enable species and genetic material to move across barriers or hostile gaps;
- maintaining the landscape to allow surface water to follow existing drainage routes; and
- making provision for the demarcation, ecological restoration, rehabilitation and/or ongoing maintenance of retained native vegetation habitat on the development site.

The development footprint was updated to avoid clearing of most of the native vegetation patches within the development site. In September 2020, additional refinement of the footprint further reduced impacts to biodiversity. One TEC, Box-gum Woodland, would be impacted by the development with 0.31 ha falling within the development footprint. The majority of this area is roadside vegetation with minimal to no shrub layer and high weed groundcover incursion.

Based on biodiversity, heritage and other investigations carried out for the EIS, the proposed layout achieves the objective of efficient electricity production while minimising environmental impacts overall. The final design avoids the majority of native vegetation, habitat of threatened species and ecological communities.

The development footprint would occupy around 892 hectares of the 1049 ha development site. The proposal would involve the construction of a ground-mounted photovoltaic (PV) solar array generating around 400 megawatts (MW) (alternating current (AC)) of renewable energy and would connect into an existing 330 kV TransGrid transmission line that traverses the proposal.





## 6.2 AVOIDING AND MINIMISING PRESCRIBED BIODIVERSITY IMPACTS

The BC Regulation (clause 6.1) identifies actions prescribed as impacts to be assessed under the biodiversity offsets scheme:

- a) Impacts of development on the habitat of threatened species or ecological communities associated with:
  - i. karst, caves, crevices, cliffs and other geological features of significance, or
  - ii. rocks; or
  - iii. human made structures; or
  - iv. non-native vegetation.
- b) Impacts of development on the connectivity of different areas of habitat of threatened species that facilitates the movement of those species across their range;
- c) Impacts of development on movement of threatened species that maintains their life cycle;
- d) Impacts of development on water quality, waterbodies and hydrological processes that sustain threatened species and threatened ecological communities (including from subsidence or upsidence resulting from underground mining);
- e) Impacts of vehicle strikes on threatened species or on animals that are part of a TEC.

How these prescribed impacts have been avoided and minimised by the proposal is detailed below.

### 6.2.1 *Impacts of development on the habitat of threatened species or ecological communities associated with human made structures or non-native vegetation.*

No karsts, caves, crevices, cliffs or rocky outcrops occur within the development site.

There are twenty farm dams within the development site. Impacts to all the farm dams and riparian corridors would be avoided during construction and the final development footprint.

The current dominant land use at the of the development site is agricultural cropping and grazing, with the majority of the development site dominated by non-native vegetation.

The development was designed to avoid impacts to native vegetation and woodland areas within the development site. As a result, non- native vegetation in the development site was utilised to form the development footprint. The development would directly impact 996 ha of open pastures or cleared land within the development site. This would reduce available foraging habitat for a number of threatened fauna in the locality. Species such as Owls, Little Eagles or other birds and bats may use these cleared areas. These species are highly mobile and capable of moving through the landscape into surrounding locations. Therefore, impacts are likely to be minimal given the large abundance of open pastures in the locality.

### 6.2.2 *Impacts of development on the connectivity of different areas of habitat or threatened species that facilitates the movement of these species across their range.*

Connectivity is very limited throughout the development site, consisting of a highly cleared landscape. The main connectivity corridors for threatened species would occur along the vegetated Back Creek. This vegetated creek line has been avoided by the development footprint.

The development designs have further been refined to avoid removal of woodland patches and paddock trees where practicable. Although isolated, these local habitats may provide stepping-stones or temporary



refuges for threatened species traversing the landscape. The development has avoided direct impacts to the majority of woodland patched and committed to providing supplementary plantings to assist improving connectivity within the development site.

### ***6.2.3 Impacts of development on movement of threatened species that maintain their lifecycle.***

The development site is not a known migratory path for threatened species. The main connectivity corridors for threatened species would occur along the vegetated Back Creek and Billabong Creek. These vegetated creek lines have been avoided by the development footprint.

### ***6.2.4 Impacts of development on water quality, waterbodies and hydrological processes that sustain threatened species and threatened ecological communities.***

Drainage lines throughout the development site have been avoided by the proposal and will continue to maintain the current hydrological processes.

Sixteen (16) farm dams are present within the development site. These riparian habitats would be avoided during construction and the final development footprint.

### ***6.2.5 Impacts of vehicle strikes on threatened species or on animals that are part of a TEC***

The proposal would not directly increase impacts of vehicle strikes on animals that are part of a TEC. Threatened species would not be funnelled into transport corridors. Site management to enforce and reduce site speed limits would minimise impacts of vehicle strikes within the development site.

## 7 IMPACTS UNABLE TO BE AVOIDED

### 7.1 DIRECT IMPACTS

The construction and operational phases of the proposal has the potential to impact biodiversity values at the site that cannot be avoided. This would occur through direct impacts such as habitat clearance and installation and existence of infrastructure.

Table 7-1 Potential impacts to biodiversity during the construction and operational phases

Nature of impact	Extent	Frequency	Duration and timing	Consequence
<b>Direct impacts</b>				
Habitat clearance for permanent and temporary construction facilities (e.g. solar infrastructure, transmission lines, compound sites, stockpile sites, access tracks)	Approximately 0.31 ha of PCT 227 to be impacted by development	Once	Construction	<ul style="list-style-type: none"> <li>Direct loss of native flora and fauna habitat</li> <li>Potential over-clearing of habitat outside proposed development footprint</li> <li>Injury and mortality of fauna during clearing of fauna habitat and habitat trees</li> <li>Disturbance to stags, fallen timber, and bush rock</li> <li>Alteration of open foraging habitats through installation of solar infrastructure</li> </ul>
Removal of paddock trees	64 Trees	Once	Construction Phase: Long Term	<ul style="list-style-type: none"> <li>Injury and mortality of fauna during clearing of fauna habitat and habitat trees</li> <li>Direct Loss of native flora and fauna habitat</li> <li>Increased pressure from cumulative loss of habitat and increased competition for remaining HBTs and paddock trees</li> <li>Reduced local connectivity and increased fragmentation of woodland</li> </ul>
Displacement of resident fauna	Unknown	Regular	Construction & Operation Phase: Long Term	<ul style="list-style-type: none"> <li>Direct loss of native fauna</li> <li>Decline in local fauna populations</li> </ul>
Injury or death of fauna	Unknown	Regular	Construction Phase: Long Term	<ul style="list-style-type: none"> <li>Direct loss of native fauna</li> <li>Decline in local fauna populations</li> </ul>
Removal of habitat features e.g. HBTs	49 HBTs	Regular	Construction Phase: Long Term	<ul style="list-style-type: none"> <li>Direct loss of native fauna habitat</li> <li>Injury and mortality of fauna during clearing of habitat features</li> </ul>



Nature of impact	Extent	Frequency	Duration and timing	Consequence
Shading by solar infrastructure	787.5 ha (70% of solar array)	Regular	Operational Phase: Long-term	<ul style="list-style-type: none"> <li>Modification of native fauna habitat</li> <li>Potential loss of ground cover resulting in unstable ground surfaces and sedimentation of adjacent waterways.</li> </ul>
Existence of permanent solar infrastructure (Fencing, array infrastructure).	Total of 1126ha	Regular	Operational Phase: Long-Term	<ul style="list-style-type: none"> <li>Modification of habitat beneath array (mostly non-native)</li> <li>Reduced fauna movements across landscape due to fencing</li> <li>Collision risks to birds and microbats (fencing).</li> </ul>

### 7.1.1 Changes in vegetation integrity scores

The future value of the attributes may take into account impacts from partial clearing in a vegetation zone. The assessor must provide supporting information in the BAR that specifies how the future value of the attribute and vegetation integrity will be achieved and maintained.

The changes in vegetation integrity scores as a result of vegetation clearing are documented for each vegetation zone in Table 7-2 below.

Zones 277\_Exotic\_Understory, 277\_Native\_Understory and 277\_Derived Grassland would be impacted through the construction of a widened road and turn in bay. Zone 5\_Derived\_Grassland would also be impacted through construction of an internal road. As the detailed design has not been completed for these works, a worst-case scenario has been utilised below whereby all vegetation within the impact footprint is removed permanently.

Table 7-2 Table of current and future vegetation integrity scores for each vegetation zone within the development site.

Zone ID	PCT	TEC and/or threatened species habitat?	Area (ha)	Current vegetation integrity score	Future vegetation integrity score
277_Exotic_Understory	277	Y	0.13	31.3	0
277_Native_Understory	277	Y	0.16	47	0
277_Derived_Grassland	277	Y	0.03	23.5	0
5_Derived_Grassland	5	N	0.01	22.4	0

### 7.1.2 Loss of species credit species habitat or individuals

The loss of species credit species habitat or individuals as a result of clearing is documented in Table 7-3 below.

Table 7-3 Summary of species credit species loss at the development site.

Species Credit Species	Biodiversity risk weighting	Area of habitat / count of individuals lost
Silky Swainson-pea	2.00	0.17 ha (Assumed)

<i>Swainsona sericea</i>		
<b>Small Purple-pea</b> <i>Swainsona recta</i>	2.00	0.17 ha (Assumed)
<b>Small Scurf-pea</b> <i>Cullen parvum</i>	1.50	0.17 ha (Assumed)

### 7.1.3 Loss of hollow-bearing trees

Sixty Six (66) Hollowing bearing trees (HBTs) were recorded within the development site. Of these, 49 would be removed by the proposal (Table 7-4).

Table 7-4 Hollow Bearing Trees impacted by the proposal.

PCT	Paddock Trees Impacted	HBTs impacted
<b>76</b>	18	14
<b>277</b>	46	35
<b>TOTAL</b>	<b>64</b>	<b>49</b>

## 7.2 INDIRECT IMPACTS

Indirect impacts can occur when the proposal or activities relating to the construction or operation of the development affect native vegetation, threatened ecological communities or threatened species habitat beyond the development site. Table 7-5 below details the indirect impacts required to be assessed by the BAM.



Table 7-5 Potential impacts on biodiversity during the construction and operational phases.

Nature of impact	Impact	Duration and timing	TEC, threatened species and habitats likely to be affected	Consequence for bioregional persistence
<b>Indirect impacts (those listed below are included in the BAM)</b>				
Inadvertent impacts on adjacent habitat or vegetation	Possible – Clearing may inadvertently extend into retained vegetation patches	Construction Phase: Short-term	<ul style="list-style-type: none"> <li>• PCT 277 – Blakely's Red Gum-Yellow Box grassy tall woodland</li> <li>• PCT 76 Inland Grey Box Woodland</li> <li>• Silky Swainson Pea (assumed)</li> <li>• Small Purple-pea (assumed)</li> <li>• Small Scurf-pea (assumed)</li> <li>• Pine Donkey Orchid (assumed)</li> </ul>	<ul style="list-style-type: none"> <li>• Direct loss of native flora and fauna habitat;</li> <li>• Injury and mortality of fauna during clearing of fauna habitat and habitat trees;</li> <li>• Disturbance to stags, fallen timber; and</li> <li>• Increased edge effects.</li> </ul>
Reduced viability of adjacent habitat due to edge effects	Possible- Most retained vegetation is contiguous with vegetation adjacent to the proposal	Operational Phase: Long-term	<ul style="list-style-type: none"> <li>• PCT 277 – Blakely's Red Gum-Yellow Box grassy tall woodland</li> <li>• PCT 76 Inland Grey Box Woodland</li> <li>• Silky Swainson Pea (assumed)</li> <li>• Small Purple-pea (assumed)</li> <li>• Small Scurf-pea (assumed)</li> <li>• Pine Donkey Orchid (assumed)</li> <li>• Southern Myotis (assumed)</li> </ul>	<ul style="list-style-type: none"> <li>• Loss of connectivity between remnant 277 and PCT 76 within and around development footprint; and</li> <li>• Reduced genetic diversity within isolated populations</li> </ul>
Reduced viability of adjacent habitat due to noise, dust, heat or light spill	Possible – construction works may impact on habitat quality in retained vegetation	Operational Phase: Short-term	<ul style="list-style-type: none"> <li>• PCT 277 – Blakely's Red Gum-Yellow Box grassy tall woodland</li> <li>• PCT 76 Inland Grey Box Woodland</li> <li>• Silky Swainson Pea (assumed)</li> <li>• Small Purple-pea (assumed)</li> <li>• Small Scurf-pea (assumed)</li> <li>• Pine Donkey Orchid (assumed)</li> </ul>	<ul style="list-style-type: none"> <li>• May alter fauna activities and/or movements;</li> <li>• Loss of foraging or breeding habitat; and</li> <li>• Inhibit the function of plant species, soils and dams.</li> </ul>

Nature of impact	Impact	Duration and timing	TEC, threatened species and habitats likely to be affected	Consequence for bioregional persistence
			<ul style="list-style-type: none"> <li>Southern Myotis (assumed)</li> <li></li> </ul>	
Possible – may be brought in soils or unclean machinery	Construction & Operational Phase: Long-term	Possible – may be brought in soils or unclean machinery	<ul style="list-style-type: none"> <li>PCT 277 – Blakely's Red Gum-Yellow Box grassy tall woodland</li> <li>PCT 76 Inland Grey Box Woodland</li> <li>Silky Swainson Pea (assumed)</li> <li>Small Purple-pea (assumed)</li> <li>Small Scurf-pea (assumed)</li> <li>Pine Donkey Orchid (assumed)</li> </ul>	<ul style="list-style-type: none"> <li>Degradation of community biodiversity and integrity; a</li> <li>Weed encroachment (remnant veg); and</li> <li>Movement of weeds by water to downstream habitats.</li> </ul>
Increased risk of starvation, exposure and loss of shade or shelter	Unlikely – Food sources still available	n/a	<ul style="list-style-type: none"> <li>n/a</li> </ul>	<ul style="list-style-type: none"> <li>n/a</li> </ul>
Loss of breeding habitats	49 HBT	Construction Phase: Long-Term	<ul style="list-style-type: none"> <li>Hollow-dependent fauna</li> </ul>	<ul style="list-style-type: none"> <li>Loss of potential breeding habitat including fallen and hollow logs at height</li> </ul>
Cumulative loss of breeding habitat and competition for remaining resources	49 HBT which is 74 % of HBTs within the development site	Construction Phase: Long-Term	<ul style="list-style-type: none"> <li>Hollow-dependent fauna</li> </ul>	<ul style="list-style-type: none"> <li>Loss of breeding habitat through removal of hollow bearing trees.</li> <li>Increased pressure and competition for remaining HBT resources from native and exotic hollow dependent fauna</li> </ul>
Earthworks and mobilisation of sediments	Possible - loss of groundcover during construction may increase mobilisation of sediments.	Construction Phase – Short Term	<ul style="list-style-type: none"> <li>PCT 277 – Blakely's Red Gum-Yellow Box grassy tall woodland</li> <li>PCT 76 Inland Grey Box Woodland</li> <li>Silky Swainson Pea (assumed)</li> <li>Small Purple-pea (assumed)</li> <li>Small Scurf-pea (assumed)</li> </ul>	<ul style="list-style-type: none"> <li>Erosion and sediment deposition pollution on downstream habitats; and</li> <li>Alternation of surface watercourses (isolating high biodiversity value communities).</li> </ul>



Nature of impact	Impact	Duration and timing	TEC, threatened species and habitats likely to be affected	Consequence for bioregional persistence
			<ul style="list-style-type: none"> <li>Pine Donkey Orchid (assumed)</li> </ul>	
Trampling of threatened species	Possible- Areas of assumed flora species may be unintentionally impacted.	n/a	<ul style="list-style-type: none"> <li>Silky Swainson Pea (assumed)</li> <li>Small Purple-pea (assumed)</li> <li>Small Scurf-pea (assumed)</li> <li>Pine Donkey Orchid (assumed)</li> </ul>	n/a
Inhibition of nitrogen fixation and increased soil salinity	Unlikely – Ground water table unlikely to change. Majority of site is currently under cropping rotation.	n/a	n/a	n/a
Fertiliser drift	Unlikely – Fertilisers unlikely to be applied.	n/a	n/a	n/a
Rubbish Dumping	Unlikely – Development site will be fenced.	n/a	n/a	n/a
Wood Collection and bush rock removal and disturbance	Unlikely – Development site will be fenced. No bush Rock in development site.	n/a	n/a	n/a
Increase in predatory species populations	Possible – additional shelter habitat for predatory invasive species.	Construction & Operational Phase: Long-term	<ul style="list-style-type: none"> <li>PCT 277 – Blakely's Red Gum-Yellow Box grassy tall woodland</li> <li>PCT 76 Inland Grey Box Woodland</li> </ul>	<ul style="list-style-type: none"> <li>Injury and mortality of fauna from predatory species</li> </ul>
Increase in pest animal populations	Possible - additional shelter habitat for invasive species.	Construction & Operational Phase: Long-term	<ul style="list-style-type: none"> <li>PCT 277 – Blakely's Red Gum-Yellow Box grassy tall woodland</li> <li>PCT 76 Inland Grey Box Woodland</li> </ul>	<ul style="list-style-type: none"> <li>Injury and mortality of fauna from predatory species</li> <li>Disturbance to native flora and fauna</li> </ul>

Nature of impact	Impact	Duration and timing	TEC, threatened species and habitats likely to be affected	Consequence for bioregional persistence
				<ul style="list-style-type: none"> <li>• Loss of foraging or breeding habitat</li> <li>•</li> </ul>
Increased risk of fire	Unlikely – No battery storage in proposal	n/a	<ul style="list-style-type: none"> <li>• n/a</li> </ul>	<ul style="list-style-type: none"> <li>• n/a</li> </ul>
Disturbance to specialist breeding and foraging habitat.	Unlikely – No specialist breeding or foraging habitat.	n/a	<ul style="list-style-type: none"> <li>• n/a</li> </ul>	<ul style="list-style-type: none"> <li>• n/a</li> </ul>



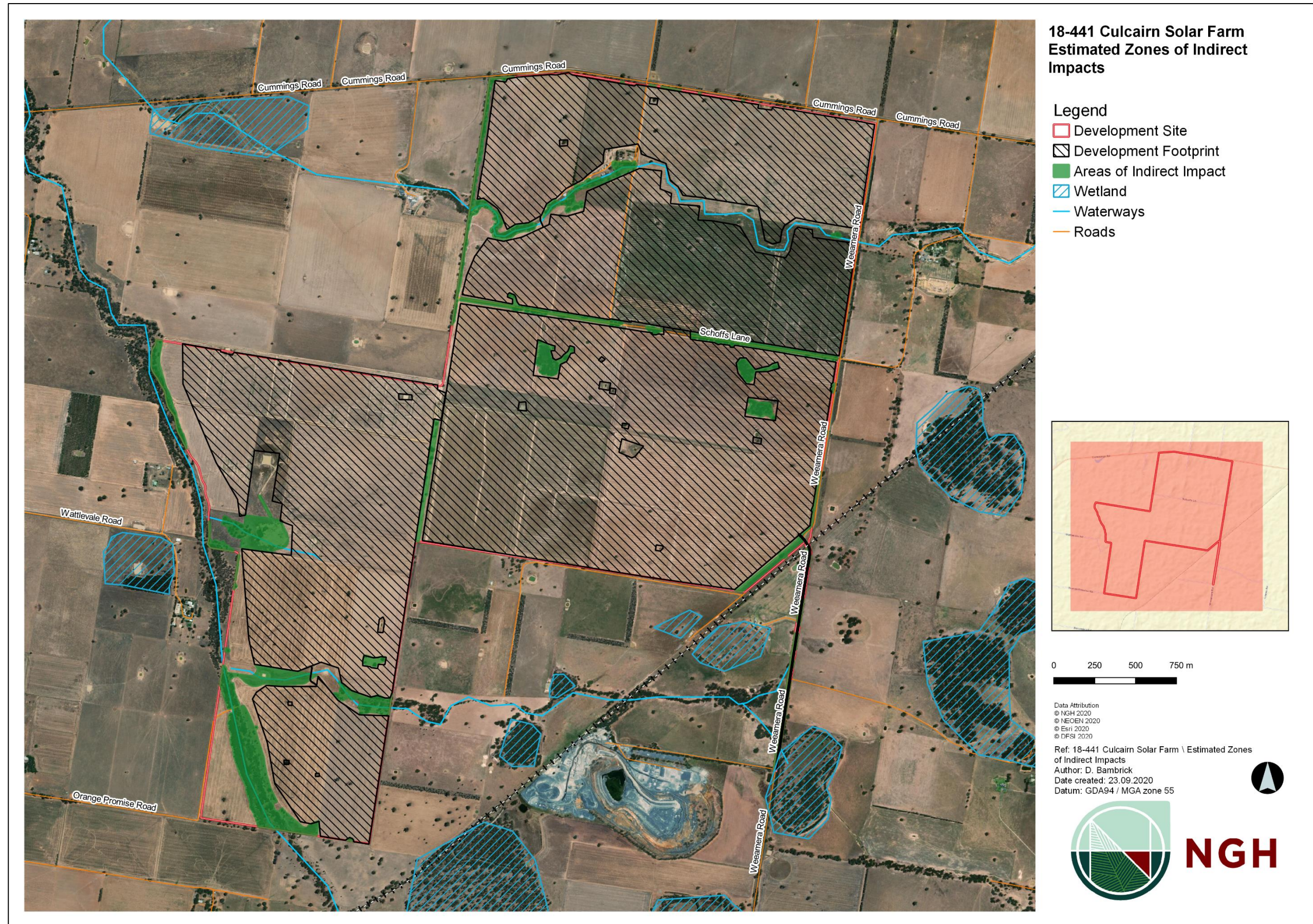


Figure 7-1 Estimated zones of indirect impact for the proposal



## 7.3 PRESCRIBED IMPACTS

The following prescribed biodiversity impacts are relevant to the proposal:

- Impacts of the development on the connectivity of different areas of habitat of threatened species that facilitates the movement of these species across their range;
- Impacts of the development on movement of threatened species that maintains their life cycle;
- Impacts of development on the habitat of threatened species or ecological communities associated with non-native vegetation;
- Impacts of development on water quality, water bodies and hydrological processes that sustain threatened species and threatened ecological communities; and
- Impacts of vehicle strikes on threatened species of animals or on animals that are part of a TEC.

These are discussed in detail below and the necessary information required by Section 9.2 of the BAM provided.

### ***7.3.1 Impacts to karst, caves, crevices, cliffs and other features of geological significance***

There are no karsts caves, crevices, cliffs or other features of geological significance in the development site or buffer area.

### ***7.3.2 Impacts of development on the habitat of threatened species or ecological communities associated with rocks***

There are no anticipated impacts on any rocks in the development site.

### ***7.3.3 Impacts of development on the habitat of threatened species or ecological communities associated with human made structures***

Sixteen (16) human made dams fall within the development area. All dams were surveyed for potential threatened species including; Southern Bell Frog, and Sloane's Froglet, with both going undetected within the development area (Dams are not suitable habitat for the Booroolong Frog). All dams will be retained in the final development design. No other human made structures will be impacted within the development site.

The installation of solar panels and high security fencing would introduce a man-made structure altering existing habitats within the development site. The design of the development has ensured high security fencing is located internally directly around panels. Connectivity and screening plantings would be bordered by farm fencing which is a common feature in the landscape. This would be less likely to restrict movement of threatened species in the development site.

### ***7.3.4 Impacts of development on the habitat of threatened species or ecological communities associated with non-native vegetation***

Non-native groundcover species occupying much of the development site will be disturbed and shaded by solar infrastructure, but this is not anticipated to impact any threatened species.



### ***7.3.5 Impacts of development on the connectivity of different areas of habitat of threatened species that facilitates the movement of those species across their range***

Retaining the vegetation along Back Creek in the development site will maintain connectivity across the landscape to facilitate movement in an east-west direction. This creek line also connects to the remnant roadside vegetation that would be retained. Due to the highly cleared and fragmented landscape within the development site the proposal is not likely to disrupt the movement of any threatened species.

Minor fragmentation of the local landscape may occur with the loss of 64 paddock trees within the development site. Although isolated, these habitats may provide local stepping-stones or temporary refuges for threatened species traversing the landscape.

To avoid connectivity losses the development has further refined the footprint to avoid the removal of woodland patches and paddock trees where practicable. In addition, vegetation screening and connectivity plantings have been proposed to further avoid potential fragmentation. In the long term, the combination of these plantings is likely to increase the existing connectivity within the development site.

### ***7.3.6 Impacts of the development on movement of threatened species that maintains their life cycle***

For migratory threatened species that may move across the landscape, retaining the revegetation along Back Creek will maintain connectivity across the landscape to facilitate movement in an east-west direction. This creek line also connects to the remnant roadside vegetation that would be retained. Due to the highly cleared and fragmented landscape within the development site the proposal is unlikely to disrupt the movement of any other threatened species that maintains their lifecycle.

### ***7.3.7 Impacts of development on water quality, waterbodies and hydrological processes that sustain threatened species and threatened ecological communities (including subsidence or upsidence resulting from underground mining or other development)***

The construction of the proposal would involve a range of activities that would disturb soils and potentially lead to sediment laden runoff affecting local waterways during rainfall events. These potential impacts are unlikely to significantly impact water quality with the implementation of recommended mitigation measures including erosion and sedimentation controls. The use of fuels and other chemicals on site during construction poses a risk of surface water contamination in the event of a spill. Mitigation measures to implement spill management procedures would minimise impacts to waterways and hydrological processes.

### ***7.3.8 Impacts of vehicle strikes on threatened species of animals or on animals that are part of a TEC***

The proposal would not directly increase impacts of vehicle strikes on threatened species. The development site is surrounded by country roads that threatened species would currently be crossing. However, an increase in vehicle traffic during construction may increase vehicle strikes along Weemera Road and outside of the study area. Site management to enforce and reduce site speed limits would minimise impacts of vehicle strikes within the subject land.

## 7.4 IMPACTS TO MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE

### 7.4.1 Wetlands of international importance

The EPBC Protected Matters search identified one wetland of international importance; Walla Walla Swamp (Gum Swamp) located approximately 2.5km West of the development site.

The *Terrestrial Biodiversity Map of the Greater Hume LEP 2012* indicates that no wetlands of international importance occur within the development site and therefore none would be impacted by the development.

### 7.4.2 Threatened Ecological Communities

No areas of federally listed Box Gum Woodland occur within the development site.

Benchmark data was used for one area of Grey Box Woodland unable to be surveyed (0.78 ha of PCT 76\_native\_understory). This vegetation was assumed to meet the criteria for the EPBC listed *Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia*. This vegetation has been avoided by the development. However, a Test of Significance (ToS) has been prepared in Appendix F to assess indirect impacts to the community.

Results of this test is summarised below:

- The development would not reduce the extent of Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia- Endangered EEC. The development has been designed to avoid direct impacts to the community.
- The development would not change the composition of the community in the locality.
- No habitat would be removed that is considered important to the long-term survival of the community within the locality it occurs in.
- Minor indirect impacts to this community including trampling of groundcover or weed encroachment are possible. However, these are existing risks to the community occurring within a disturbed agricultural landscape. With the implementation of mitigation measures including site rehabilitation and management of retained vegetation, the condition of the community is likely to increase.

It is not perceived there will be a significant impact on this community; however, referral may be undertaken for legal certainty.

### 7.4.3 Threatened Species

Based on a habitat assessment, nine (9) federally listed species could occur in the development site. These are:

- Superb Parrot (*Polytelis swainsonii*). - V
- Painted Honeyeater (*Grantiella picta*). – V
- Corben's Long-eared Bat (*Nyctophilus corbeni*) – V
- White-throated Needletail (*Hirundapus caudacutus*) – V
- Swift Parrot (*Lathamus discolor*). - CE
- Regent Honeyeater (*Anthochaera phrygia*). – CE
- Sloane's Froglet (*Swainsona sericea*) - E
- Koala (*Phascolarctos cinereus*) -V
- Small Purple-pea (*Swainsona recta*) - E



### **Superb Parrot, Painted Honeyeater, Corben's Long-eared Bat and White-throated Needletail**

These species are listed as vulnerable under the EPBC Act. Suitable Woodland habitat is present for the Superb Parrot, Painted Honeyeater, Corben's Long-eared Bat and White-throated Needletail in the development site. Surveys were undertaken for these species and they were not detected. However, it is considered these species may forage in the development site on occasion.

EPBC Assessments of Significance (AoS) was completed for these species (Appendix F) and concluded that a significant impact was unlikely, on the basis that the proposal would not:

- Lead to a reduction of the size or area of occupancy of a population, or fragment or disrupt the breeding cycle of a population
- Affect habitat critical to the survival of these species
- Affect habitat or introduce disease such that these species would decline
- Introduce invasive species harmful to the species
- Interfere with the recovery of these species.

No referral is considered necessary to the Federal Department of Environment and Energy

### **Swift Parrot and Regent Honeyeater**

These species are listed as critically endangered under the EPBC Act. Suitable woodland is present for the Swift Parrot and the Regent Honeyeater within the development site. Surveys were undertaken for these species and they were not detected. However, it is considered these species may forage in the development site on occasion.

EPBC Assessments of Significance (AoS) was completed for these species (Appendix F) and concluded that a significant impact was unlikely, on the basis that the proposal would not:

- Lead to a reduction of the size or area of occupancy of a population, or fragment or disrupt the breeding cycle of a population
- Affect habitat critical to the survival of these species
- Affect habitat or introduce disease such that these species would decline
- Introduce invasive species harmful to the species
- Interfere with the recovery of these species.

No referral is considered necessary to the Federal Department of Environment and Energy

### **Sloane's Froglet**

Suitable habitat for the Sloane's Froglet occurs in the farm dams throughout the development site. Surveys for Sloane's Froglet were undertaken at each of the dams in August 2019 using call playback. This species was not detected, and it is not considered to occur within the development site.

### **Small Purple-pea**

No EPBC listed flora species were recorded during the surveys, however one EPBC-listed endangered species, the small purple pea was assumed present based on suitable habitat. Habitat for these species within the development site is primarily limited to areas with native understory, approximately 0.17 ha of the development footprint.

EPBC Assessments of Significance (AoS) was completed for the Small Purple Pea (Appendix F) and concluded that a significant impact was unlikely, on the basis that the proposal would not:

- Lead to a reduction of the size or area of occupancy of a population, or fragment or disrupt the breeding cycle of a population
- Affect habitat critical to the survival of these species
- Affect habitat or introduce disease such that these species would decline
- Introduce invasive species harmful to the species
- Interfere with the recovery of these species.

No referral is considered necessary to the Federal Department of Environment and Energy.

#### 7.4.4 Potential Koala habitat

Habitat for Koalas within the development site is isolated and highly degraded and it is considered unlikely that the Koala would utilise the habitats available.

The EPBC Referral Guidelines for the Koala (DoE 2014) documents the 'Koala habitat assessment tool' to assist proponents in determining if a proposal may impact on habitat critical to the survival of the Koala. The tool is provided as Table 7-6 below as it applies to the proposal. Impact areas that score five or more using the habitat assessment tool contain habitat critical to the survival of the Koala. The assessment in Table 7-6 resulted in a score of 2, and so habitat within the study area is not considered to be critical to the survival of the Koala, and an assessment of significant impact according to the EPBC Act significant impact criteria is not required.

Table 7-6: Koala habitat assessment tool for inland areas (DoE 2014)

Attribute	Score	Inland	Applicable to the proposal?
Koala occurrence	+2 (high)	Evidence of one or more koalas within the last 5 years.	✓  No records of Koala within 10km of the development site. Koala not detected during site surveys.
	+1 (medium)	Evidence of one or more koalas within 2 km of the edge of the impact area within the last 10 years.	
	0 (low)	None of the above.	
Vegetation composition	+2 (high)	Has forest, woodland or shrubland with emerging trees with 2 or more known koala food tree species, <b>OR</b> 1 food tree species that alone accounts for >50% of the vegetation in the relevant strata.	✓  Red River Gum, Blakely's Red Gum and Yellow Box are food tree species in the South Western Slopes Bioregion
	+1 (medium)	Has forest, woodland or shrubland with emerging trees with only 1 species of known koala food tree present.	



Attribute	Score	Inland	Applicable to the proposal?
	0 (low)	None of the above.	
Habitat connectivity	+2 (high)	Area is part of a contiguous landscape $\geq$ 1000 ha.	✓ Development site part of linear riparian corridor along Back Creek connecting to Billabong Creek
	+1 (medium)	Area is part of a <b>contiguous landscape</b> < 1000 ha, but $\geq$ 500 ha.	
	0 (low)	None of the above.	
Key existing threats	+2 (high)	Little or no evidence of koala mortality from vehicle strike or dog attack at present in areas that score 1 or 2 for koala occurrence. Areas which score 0 for koala occurrence and have no dog or vehicle threat present	✓ No Koala mortality observed during the survey
	+1 (medium)	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, <b>OR</b> Areas which score 0 for koala occurrence and are likely to have some degree dog or vehicle threat present.	
	0 (low)	Evidence of frequent or regular koala mortality from vehicle strike or dog attack in the study area at present, <b>OR</b> Areas which score 0 for koala occurrence and have a significant dog or vehicle threat present.	
Recovery value	+2 (high)	Habitat is likely to be important for achieving the interim recovery objectives for the relevant context, as outlined in Table 1.	
	+1 (medium)	Uncertain whether the habitat is important for achieving the interim recovery objectives for the relevant context, as outlined in Table 1.	

Attribute	Score	Inland	Applicable to the proposal?
	0 (low)	Habitat is unlikely to be important for achieving the interim recovery objectives for the relevant context, as outlined in Table 1.	✓ Study area is not considered a habitat refuge nor does it provide important connectivity to large areas surrounding a habitat refuge
<b>Total</b>	<b>3</b>	<b>Decision: Habitat not critical to the survival of the Koala—assessment of significance not required</b>	

### 1.1.1 Migratory Species

Based on a habitat assessment, the development site contains habitat that could be potentially used by two federally listed migratory species could occur in the development site. These are:

- Fork-tailed Swift (*Apus pacificus*)
- White-throated Needletail (*Hirundapus caudacutus*)

An Assessment of Significance was undertaken for these species (Appendix G) and determined that the project is unlikely to cause a significant impact to any criteria. The proposal is therefore considered unlikely to significantly impact the Fork-tailed Swift or the White-throated Needletail and no referral to the Federal Department of Environment is considered necessary.

## 7.5 LIMITATIONS TO DATA, ASSUMPTIONS AND PREDICTIONS

Climatic conditions may influence the species present within the development site at any one time. Floristic surveys were undertaken during the optimal flowering time for species in Spring and Summer, and later in Autumn following improving seasonal conditions, however it is possible that not all plant species were detected that may be present at the site due to seasonal and climatic constraints. In particular, inconspicuous or geophytic species which flower outside the surveyed period may not have been recorded.

The calculation of hollow-bearings trees, in particular the size and number of hollows, was made from ground level. It is possible that some hollows are present that were not visible from ground level, which may result in underestimates of the number of hollows. However, it was noted where it was considered likely that hollows were present but not visible from ground level



## 8 MITIGATING AND MANAGING IMPACTS

### 8.1 MEASURES

A general summary of the key measures required to mitigate the impacts of the proposal is provided below. Mitigation measures proposed to manage impacts, including proposed techniques, timing, frequency, responsibility for implementing each measure, risk of failure and an analysis of the consequences of any residual impacts are provided in Table 8-1.

#### 8.1.1 *Impacts from the clearing of vegetation and habitats*

1. Time works to avoid critical life cycle events;
2. Implement clearing protocols during tree clearing works, including pre-clearing surveys, daily surveys and staged clearing, the presence of a trained ecological or wildlife handler; and
3. Relocate habitat features (fallen timber, hollow logs) from within the development site.

#### 8.1.2 *Indirect impacts*

1. Clearing protocols that identify vegetation to be retained, prevent inadvertent damage and reduce soil disturbance; for example, removal of native vegetation by chainsaw, rather than heavy machinery, is preferable in situations where partial clearing is proposed;
2. Noise barriers or daily/seasonal timing of construction and operational activities to reduce impacts of noise
3. Light shields or daily/seasonal timing of construction and operational activities to reduce impacts of light soil
4. Adaptive dust monitoring programs to control air quality;
5. Temporary fencing and signage to protect significant environmental features such as riparian zones ;
6. Hygiene protocols to prevent the spread of weeds or pathogens between infected areas and uninfected areas; and
7. Staff training and site briefing to communicate environmental features to be protected and measures to be implemented.
8. Preparation of a Biodiversity Management Plan to regulate activity in clearing of vegetation and demonstrate adaptive management to reduce indirect and cumulative impacts in retained vegetation
9. Implement erosion and sediment controls
10. Plain wire is to be used on security fencing where practicable and where it meets safety and security requirements of the Proposal. Use plain wire perimeter fencing where this intersects woodland to avoid potential entrapment of fauna on fence.

#### 8.1.3 *Prescribed impacts*

1. Sediment barriers and spill management protocols to control the quality of water runoff from the site into the receiving environment;
2. Appropriate landscape plantings of local indigenous species to replace loss of planted vegetation;

3. Appropriate supplementary plantings (as identified in Appendix I) to enhance connectivity and mitigate loss of paddock trees in the landscape
4. Hollows removed during clearing would be salvaged where possible and remounted to allow continued use by hollow dependant fauna within or adjacent to the development site. A one to one (hollows removed to hollows or nest boxes mounted) would be achieved.
5. A Rehabilitation Plan would be completed to enhance the condition of retained vegetation within the development site.
6. Staff Training and site briefing to communicate impacts of traffic strikes on native fauna



Table 8-1 Mitigation measures proposed to avoid and minimise impacts on native vegetation and habitat

Mitigation measure	Proposed techniques	Timing	Frequency	Responsibility	Risk of failure	Risk and consequences of residual impacts
<b>Displacement of resident fauna through vegetation clearing and habitat removal</b>						
Time works to avoid critical life cycle events	<ul style="list-style-type: none"> <li>Hollow-bearing trees would not be removed during breeding season (spring to summer) to mitigate impacts on hollow dependent birds</li> <li>If clearing outside of this period cannot be achieved, pre-clearing surveys would be undertaken to ensure no impacts to fauna would occur</li> </ul>	Construction	Regular	Contractor	Moderate	Species not detected during pre-clearing surveys may be impacted.
Implement clearing protocols during tree clearing works, including pre-clearing surveys, daily surveys and staged clearing, the presence of a trained ecological or wildlife handler	<ul style="list-style-type: none"> <li>Pre-clearing checklist</li> <li>Tree clearing procedure</li> </ul>	Construction	Regular	Contractor	Moderate	Species not detected during pre-clearing surveys may be impacted
Relocate habitat features (fallen timber, hollow logs) from within the development site	<ul style="list-style-type: none"> <li>Tree-clearing procedure including relocation of habitat features to adjacent area for habitat enhancement</li> </ul>	Construction	Regular	Contractor	Low	None
<b>Indirect impacts on native vegetation and habitat</b>						
Clearing protocols that identify vegetation to be retained, prevent inadvertent damage and reduce soil disturbance; for example, removal of native vegetation by chainsaw, rather than heavy machinery, is	<ul style="list-style-type: none"> <li>Approved clearing limits to be clearly delineated with temporary fencing or similar prior to construction commencing</li> <li>No stockpiling or storage within dripline of any mature trees</li> </ul>	Construction	Regular	Contractor	Low	None

Mitigation measure	Proposed techniques	Timing	Frequency	Responsibility	Risk of failure	Risk and consequences of residual impacts
preferable in situations where partial clearing is proposed	<ul style="list-style-type: none"> <li>In areas to clear adjacent to areas to be retained, chainsaws would be used rather than heavy machinery to minimise risk of unauthorised disturbance;</li> <li>Access to the Box-Gum Woodland EEC would not be permitted via vehicles to reduce understorey impacts and clearing; and</li> <li>Strict weed protocol must be observed at all times.</li> </ul>					
Noise barriers or daily/seasonal timing of construction and operational activities to reduce impacts of noise	<ul style="list-style-type: none"> <li>Construction Environmental Management Plan will include measures to avoid noise encroachment on adjacent habitats such as avoiding night works as much as possible.</li> </ul>	Construction	Regular	Contractor	Low	None
Light shields or daily/seasonal timing of construction and operational activities to reduce impacts of light spill	<ul style="list-style-type: none"> <li>Avoid night works; and</li> <li>Direct lights away from vegetation.</li> </ul>	Construction/ Operation	Regular	Contractor	Low	None
Adaptive dust monitoring programs to control air quality	<ul style="list-style-type: none"> <li>Daily monitoring of dust generated by construction activities; and</li> <li>Construction would cease if dust observed being blown from site until control measures were implemented; and</li> <li>All activities relating to the proposal would be undertaken with the objective of preventing</li> </ul>	Construction	Regularly	Contractor	Moderate	Sedimentation in ephemeral waterways and dams.



Mitigation measure	Proposed techniques	Timing	Frequency	Responsibility	Risk of failure	Risk and consequences of residual impacts
	visible dust emissions from the development site.					
Temporary fencing and signage to protect significant environmental features such as riparian zones	<ul style="list-style-type: none"> <li>Prior to construction commencing, exclusion fencing, and signage would be installed around habitat to be retained</li> </ul>	Construction	Regularly	Contractor	Low	None
Hygiene protocols to prevent the spread of weeds or pathogens between infected areas and uninfected areas	<ul style="list-style-type: none"> <li>A Weed Management Procedure would be developed for the proposal to prevent and minimise the spread of weeds. This would include: <ul style="list-style-type: none"> <li>Management protocol for declared priority weeds under the <i>Biosecurity Act 2015</i> during and after construction;</li> <li>Weed hygiene protocol in relation to plant, machinery, and fill;</li> </ul> </li> <li>Any occurrences of pathogens such as Myrtle Rust and Phytophthora would be monitored, treated, and reported; and</li> <li>The weed management procedure would be incorporated into the Biodiversity Management Plan.</li> </ul>	Construction, Operation	Regular	Contractor	Moderate	Weed encroachment
Staff training and site briefing to communicate environmental features to be protected and measures to be implemented	<ul style="list-style-type: none"> <li>Site induction; and</li> <li>Toolbox talks.</li> </ul>	Construction	Regular	Contractor	Moderate	Impacts to native vegetation or threatened species for Staff training not being followed

Mitigation measure	Proposed techniques	Timing	Frequency	Responsibility	Risk of failure	Risk and consequences of residual impacts
Preparation of a Biodiversity Management Plan to regulate activity in clearing of vegetation and demonstrate adaptive management to reduce indirect and cumulative impacts in retained vegetation	<ul style="list-style-type: none"> <li>Preparation of a Biodiversity Management Plan that would include protocols for:               <ul style="list-style-type: none"> <li>Protection , enhancement and monitoring of quality/condition of native vegetation to be retained;</li> <li>Best practice removal and disposal of vegetation;</li> <li>Staged removal of hollow-bearing trees and other habitat features such as fallen logs with attendance by an ecologist;</li> <li>Weed and pest animal management;</li> <li>Unexpected threatened species finds;</li> <li>Exclusion of vehicles through sensitive areas;</li> <li>Best practice clearing of overstorey vegetation for construction of the transmission line to avoid understorey impacts; and</li> <li>Rehabilitation of disturbed areas.</li> <li>Adaptive management practices and protocol for corrective actions</li> </ul> </li> </ul>	Construction	One-off	Contractor	Moderate	Impacts to native vegetation or threatened species for Biodiversity Management Plan not being followed.



Mitigation measure	Proposed techniques	Timing	Frequency	Responsibility	Risk of failure	Risk and consequences of residual impacts
Plain wire is to be used on security fencing where practicable and where it meets safety and security requirements of the Proposal.	<ul style="list-style-type: none"> <li>Use plain wire perimeter fencing where this intersects woodland to avoid potential entrapment of fauna on fence</li> </ul>	Construction	Regular	Client	Low	None
Implement Erosion and sediment controls	<ul style="list-style-type: none"> <li>An Erosion and Sediment Control Plan would be prepared in conjunction with the final design and implemented</li> </ul>	Construction	Regular	Contractor	Moderate	Impacts may occur if erosion and sedimentation control plan not implemented
<b>Prescribed biodiversity impacts</b>						
Sediment barriers and spill management procedures to control the quality of water runoff released from the site into the receiving environment	<ul style="list-style-type: none"> <li>An Erosion and Sediment Control Plan would be prepared in conjunction with the final design and implemented; and</li> <li>Spill management procedures would be implemented.</li> </ul>	Construction	Regular	Contractor	Moderate	Impacts may occur to waterway if erosion and sedimentation control plan not implemented
Appropriate landscape plantings of local indigenous species to replace loss of planted vegetation	<ul style="list-style-type: none"> <li>Landscape plantings will be comprised of local indigenous species</li> </ul>	Operation	Regular	Client	Moderate	Plants not surviving
Appropriate supplementary plantings (as indicated in Appendix I) plantings to enhance connectivity and mitigate loss of paddock trees across the development site	<ul style="list-style-type: none"> <li>Landscape plantings will be comprised of local indigenous species</li> <li>Plantings will be a minimum of 20 m wide</li> </ul>	Operation	Regular	Client	Moderate	Plants not surviving
Install hollows of felled trees onto younger trees or on ground in retained vegetation patches.	<ul style="list-style-type: none"> <li>Hollow tree limbs would be made into nest boxes and placed in retained vegetation patches</li> <li>Hollows removed during clearing would be salvaged where possible</li> </ul>	Construction	Once	Contractor	Moderate	Hollows may be installed incorrectly. Supervision by qualified persons required.

Mitigation measure	Proposed techniques	Timing	Frequency	Responsibility	Risk of failure	Risk and consequences of residual impacts
	<p>and remounted to allow continued use by hollow dependant fauna within or adjacent to the project site. A one to one (hollows removed to hollows or nest boxes mounted) would be achieved.</p> <ul style="list-style-type: none"> <li>The construction and placement of felled hollows/nest boxes would be managed by a suitably qualified ecologist.</li> </ul>					
A Rehabilitation Plan would be completed to enhance the condition of retained vegetation within the development site.	<ul style="list-style-type: none"> <li>A Rehabilitation Plan in conjunction with the Biodiversity Management Plan would be created to improve habitat within retained vegetation in the development site and include: <ul style="list-style-type: none"> <li>Weed control</li> <li>Replanting or regeneration</li> <li>Location of hollows from tree removal</li> <li>Location of nest boxes</li> <li>Location of logs.</li> <li>Nest box monitoring plan to ensure nest boxes are structurally maintained for the life of the solar farm.</li> </ul> </li> </ul>	Operation	Regular	Client	Moderate	Hollows become damaged and fail
Staff training and site briefing to communicate impacts of traffic strikes on native fauna	<ul style="list-style-type: none"> <li>Awareness training during site inductions regarding enforcing site speed limits; and</li> </ul>	Construction and Operation	Regular	Contractor	Moderate	Fauna strikes from vehicles



Mitigation measure	Proposed techniques	Timing	Frequency	Responsibility	Risk of failure	Risk and consequences of residual impacts
	<ul style="list-style-type: none"> <li>Site speed limits to be enforced to minimise fauna strike.</li> </ul>					

## 8.2 ADAPTIVE MANAGEMENT STRATEGY

Adaptive management during construction and operation will be receptive to any new and relevant data that may arise through ongoing assessment and monitoring and is key to the successful implementation of the relevant management plans. This will allow ongoing flexibility to manage objectives, allow for relevant feedback and modifications. Construction management plans will contain management plans for flora and fauna (biodiversity), which will have an adaptive management component. This includes measures to monitor predicted impacts of vehicle strikes, thresholds for species mortality, based on relevant literature, which will trigger adaptive management actions, and any measures proposed to mitigate potential impacts.

A Biodiversity Management Plan (BMP) would be implemented demonstrating adaptive management strategies to ensure key milestones are achieved including:

- Fauna monitoring and management protocol including identification and reporting of fauna mortalities to the relevant Biodiversity Conservation Division office;
- Protecting vegetation and fauna habitat outside the approved disturbance areas and managing the remaining remnant vegetation and fauna habitat within the Proposal toward a benchmark state;
- Next box monitoring and reporting;
- Monitoring criteria;
- Clear performance targets;
- Corrective actions;
- Timing and responsibilities.

A recommended outline of the BMP is provided below with further details demonstrated within the mitigation measures listed in Table 8.1:

- Introduction
  - Purpose and objectives
  - Description of the proposal
- Planning Requirements
- Existing environments
  - Flora and fauna values
  - Soils
  - Weeds and pests
- Environmental Impacts
- Construction and Operational activities
- Management Zones
  - Protocols, actions, and procedures
- Performance criteria, triggers, and responses
- Compliance Management
- Review and Improvement



## 9 SERIOUS AND IRREVERSIBLE IMPACTS (SAII)

The principles used to determine if a development will have serious and irreversible impacts, include impacts that:

- Will cause a further decline of the species or ecological community that is currently observed, estimated, inferred, or reasonably suspected to be in a rapid rate of decline;
- Will further reduce the population size of the species or ecological community that is currently observed, estimated, inferred, or reasonably suspected to have a very small population size;
- Impact on the habitat of a species or ecological community that is currently observed, estimated, inferred, or reasonably suspected to have a very limited geographic distribution; or
- Impact on a species or ecological community that is unlikely to respond to measures to improve habitat and vegetation integrity and is therefore irreplaceable.

### 9.1 POTENTIAL SERIOUS AND IRREVERSIBLE IMPACT ENTITIES

#### 9.1.1 *Threatened ecological communities*

One threatened ecological community will be impacted on by the proposal that is listed as a potential SAI entity in the *Guidance to assist a decision-maker to determine a serious and irreversible impact*. This is the:

- White Box - Yellow Box - Blakely's Red Gum Grassy Woodland

#### 9.1.2 *Threatened species*

No threatened species will be impacted on by the proposal that is listed as a potential SAI entity in the *Guidance to assist a decision-maker to determine a serious and irreversible impact*.

No further species were considered to be potential SAI entities.

### 9.2 ASSESSMENT OF SERIOUS AND IRREVERSIBLE IMPACTS

#### 9.2.1 *White Box - Yellow Box – Blakely's Red Gum Woodland (Box-gum Woodland)*

An assessment of the impacts to Box-gum Woodland was undertaken. Figure 9-1 shows the location of the Box-gum Woodland within the development site.

**a) the action and measures taken to avoid the direct and indirect impact on the potential entity for an SAI**

The Box-Gum Woodland within the development site is comprised of (14.8 ha) moderately contiguous patches along the roadsides of Cummings Road, Weeamera Road and Schoffs Lane. In addition, 46 isolated paddock trees associated with Box Gum Woodland are scattered across the development site. Within woodland patches the mid story is minimal to non-existent, with the understory highly disturbed and subject to high weed incursion. The groundcover surrounding the paddock trees is non-native and heavily modified.

The development has refined its footprint to avoid removal of native vegetation where practicable. The patches of woodland vegetation and derived grassland within the development site has been avoided. However due to size constraints of the solar

panels, trackers and site access requirements, the removal of 0.31 ha of woodland along Weeamera Road and 46 isolated paddock trees have been unable to be avoided.

Landscape screening and connectivity plantings would be completed as part of the development. These plantings would reduce the potential for further fragmentation due to the loss of scattered paddock trees. This would improve the local connectivity within the development site.

Other actions and measures that can be taken to avoid direct and indirect impact on Box Gum Woodland includes:

- Exclusion fencing remaining Woodland areas prior to construction
- As part of a site induction, inform construction staff these areas are exclusion zones and therefore not to be disturbed.
- Ensure the Woodland areas are periodically grazed for biomass management to encourage natural regeneration to improve the floristic diversity. The grazing should be to graze the remaining exotic grasses in early to mid-spring.
- Place logs from trees that are to be removed in the development site in the Woodland areas to be retained.
- Complete a Rehabilitation Plan for the Woodland areas to manage
  - Weed control
  - Replanting or regeneration
  - Location of hollows from tree removal
  - Location of nest boxes
  - Location of logs.

These measures will improve the vegetation quality of the Box Gum Woodland but also provide habitat for other threatened species that are known to occur in the area.

**b) the area (ha) and condition of the TEC to be impacted directly and indirectly by the proposed development. The condition of the TEC is to be represented by the vegetation integrity score for each vegetation zone**

0.31 ha of Box-Gum Woodland would be impacted by the proposal. This vegetation is comprised of mature Yellow Box, Blakely's Red gum, Grey Box with a disturbed understory due to heavy weed incursion on Weeamera Road. In addition, 46 paddock trees associated with Box Gum Woodland would be removed. The paddock trees are surrounded by highly disturbed exotic pastures and crops defined as Category 1 exempt land.

A small area (0.03 ha) of derived native grassland will be impacted through construction of the site access.

Zone ID	Zone Description	Impact area	Compositi on score	Structu re score	Function score	Vegetati on Integrity Score
277_derived_grassl and	277_derived_grassl and	0.03	33.4	54.7	7.1	23.5



<b>277_exotic_understory</b>	277_exotic_understory	0.13	13.1	32.2	72.6	<b>31.3</b>
<b>277_native_understory</b>	277_native_understory	0.16	37.3	43	64.9	<b>47</b>

- c) **a description of the extent to which the impact exceeds the threshold for the potential entity that is specified in the Guidance to assist a decision-maker to determine a serious and irreversible impact**

No threshold has yet been defined by OEH for the extent of Box-gum Woodland to be removed that constitutes a serious and irreversible impact.

- d) **the extent and overall condition of the potential TEC within an area of 1000 ha, and then 10,000 ha, surrounding the proposed development footprint**

Using GIS and State Vegetation Mapping (VIS\_4468 & 4469), it is estimated that 99.74 ha of Box-gum Woodland occurs within an area of 1000 ha surrounding the proposed development footprint, and 843 ha of Box-gum Woodland occurs within an area of 10 000 ha surrounding the proposed development footprint (Figure 9-1).

- e) **an estimate of the extant area and overall condition of the potential TEC remaining in the IBRA subregion before and after the impact of the proposed development has been taken into consideration**

Using GIS and State Vegetation Mapping (VIS\_4468 & 4469), it is estimated that 32 801ha of Box-gum Woodland occurs within the Lower Slopes IBRA Subregion. Vegetation mapped from aerial imagery is assumed to be in moderate to good condition. Up to 0.31 ha is proposed to be removed by the development, which is less than 0.001% of the estimated extent remaining.

A number of major development proposals, as well rural clearing subject to land management codes of practice and clearing certificates under the LLS Act, are present within the region and may have a cumulative impact on Box Gum Woodland in the subregion. Development proposals would be assessed under the BAM and use the principles of avoid and minimise in line with legislative requirements. Mitigation measures such as development of Biodiversity management plans with clear guidance on removal of vegetation, as well as minimising direct and indirect impacts would be conditioned to approval. Impacts are likely to be negligible given the scale and extent of the community.

- f) **an estimate of the area of the potential TEC that is in the reserve system within the IBRA region and the IBRA subregion**

In NSW, Box-gum Woodland is known to occur within at least 42 reserve systems. Around 8 000 ha of Box-gum Woodland is estimated to occur in national parks and nature reserves within the NSW South Western Slopes IBRA Region (Benson 2008). Using GIS Vegetation Mapping it is estimated that 481ha of Box-gum Woodland occurs in four reserves in the Lower Slopes Subregion.

- g) **the development, clearing or biodiversity certification proposal's impact on:**

- i. **abiotic factors critical to the long-term survival of the potential TEC; for example, how much the impact will lead to a reduction of groundwater levels or the substantial alteration of surface water patterns**

Groundwater supplies and levels are unlikely to be affected by the proposal and no groundwater is anticipated to be intercepted or extracted. During construction, the proposal would have a short-term gross impact upon soils and possibly surface water flow, within discrete areas. These impacts are manageable with the

implementation of erosion and sediment controls and would be unlikely to impact on abiotic factors critical to the long-term survival of Box-gum Woodland.

**ii. characteristic and functionally important species through impacts such as but not limited to, inappropriate fire/flooding regimes, removal of understorey species or harvesting of plants**

The proposal would remove 0.31 ha of Box-gum Woodland which would permanently remove the characteristic overstorey species of Yellow Box (*Eucalyptus melliodora*) and Blakley's Red Gum (*Eucalyptus blakelyi*) in these areas. In addition, 46 paddock trees associated with Box Gum Woodland would also be removed. These areas have minimal to no native midstorey and an understorey that is highly disturbed due to high weed incursion and regular agricultural disturbance.

**iii. the quality and integrity of an occurrence of the potential TEC through threats and indirect impacts**

Up to 0.31 ha of Box-gum Woodland would be removed reducing the vegetation quality and integrity of this patch to 0. The removal of 46 paddock trees would also reduce the local quality of TEC in the development site. With the implementation of the proposed mitigation measures including a rehabilitation plan and plantings, the quality and integrity of retained TEC is likely to be improved.

No further impacts would occur to remaining Box-gum Woodland in the locality.

**h) direct or indirect fragmentation and isolation of an important area of the potential TEC**

There are small fragmented patches of Box-gum Woodland in the development site as well as patches that are semi contiguous to larger bushland areas. The small area being removed would not cause further fragmentation to areas of Box-gum Woodland in the locality. The main connectivity corridors within the landscape along riparian corridors are being retained. The removal of 46 paddock trees associated with Box Gum Woodland has the potential to increase fragmentation on a local scale. However, the paddock trees within development site are highly isolated and may occasionally be used as stepping-stones or refuges for species traversing the development site including the Superb Parrot. The proposed development plantings for screening and connectivity would increase the existing landscape connectivity across the development site.

**i) the measures proposed to contribute to the recovery of the potential TEC in the IBRA subregion.**

The proposal will require the retirement of ecosystem credits in accordance with the BAM, which will result in the establishment of Biodiversity Stewardship Sites, leading to the long-term security of the TEC within the subregion. In addition to offsets, a rehabilitation plan to enhance the condition of existing Box Gum Woodland would be completed. Connectivity plantings and landscaping would also contribute to reducing fragmentation of the local TEC.

The proposal would remove 0.31 ha of Box-gum Woodland and 46 isolated paddock trees. Extensive areas of Box-gum Woodland occur within 1000 ha and 10 000 ha of the development site. Based on these factors, and the mitigations proposed the removal of low-quality vegetation is considered unlikely to have a serious and irreversible impact on the Box-gum Woodland EEC in the locality.



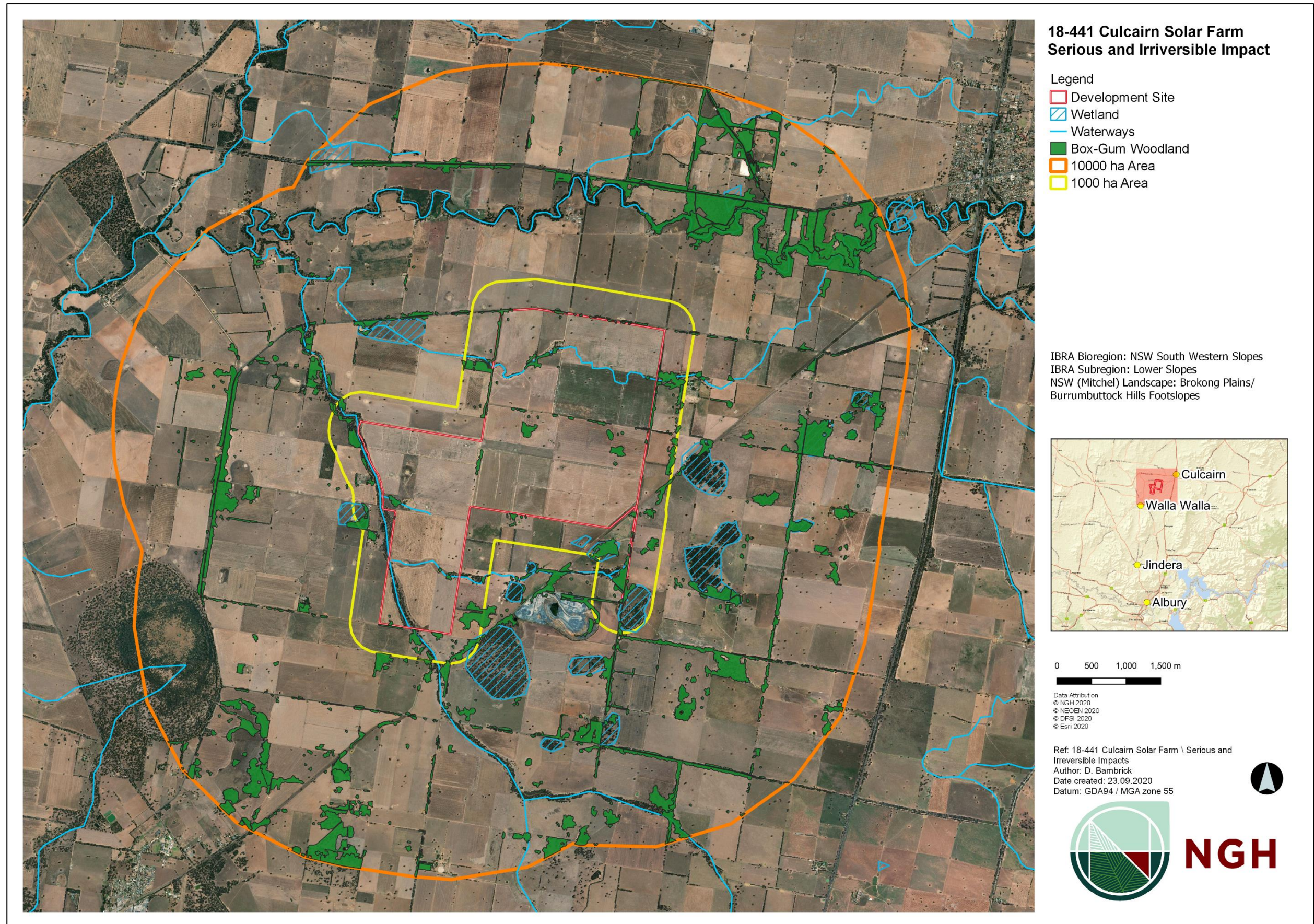


Figure 9-1 Location of serious and irreversible impacts



## 10 REQUIREMENT TO OFFSET

### 10.1 IMPACTS REQUIRING AN OFFSET

#### 10.1.1 Ecosystem credits

An offset is required for all impacts of development on PCTs that are associated with:

- a) a vegetation zone that has a vegetation integrity score  $\geq 15$  where the PCT is representative of an endangered or critically endangered ecological community, or
- b) a vegetation zone that has a vegetation integrity score of  $\geq 17$  where the PCT is associated with threatened species habitat (as represented by ecosystem credits), or is representative of a vulnerable ecological community, or
- c) a vegetation zone that has a vegetation integrity score  $\geq 20$  where the PCT is not representative of a TEC or associated with threatened species habitat.

The PCTs and vegetation zones requiring offset and the ecosystem credits required are documented in Table 10-1 and mapped on

Figure 10-1. The full Biodiversity Credit Report generated by the BAM Calculator is provided in Appendix D.

Table 10-1 PCTs and vegetation zones that require offsets.

Zone ID	PCT ID	PCT name	Zone area (ha)	Vegetation Integrity Score	Vegetation integrity loss	Ecosystem credits required
5_Derived_Grassland	5	River Red Gum herbaceous-grassy very tall open forest wetland on inner floodplains in the lower slopes sub-region of the NSW South Western Slopes Bioregion and the eastern Riverina Bioregion.	0.01	22.4	22.4	1
277_derived_grassland	277	Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion	0.03	23.5	23.5	1
277_exotic_understory	277	Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South	0.13	31.3	31.3	2



		Western Slopes Bioregion				
277_native_understory	277	Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion	0.16	47	47	4
					<b>TOTAL:</b>	<b>8</b>

### 10.1.2 Paddock tree credits

Offsets are required for the clearing of Class 2 and Class 3 paddock trees. 95 class 3 paddock trees occur within the development site. The paddock trees form part of PCT76: *Western Grey Box tall grassy Woodland on alluvial loam and clay soils in the NSW South Western Slopes Bioregion* and PCT277 *Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion*. Ecosystem credits are calculated as per the streamlined assessment defined in Appendix 1 and Table 12 of the NSW BAM. These ecosystem credits required are documented in Table 10-2. The credit profile for the paddock trees is shown in Appendix G.

61 ecosystem credits are required for the clearing of the paddock trees.

Table 10-2 Paddock trees that require offsets.

Class of Paddock Tree being cleared	PCT	Number of trees with Hollows	Number of Paddock Trees to be cleared	Ecosystem credits required
<b>Class 2</b> (>20cm DBH and < 50cm DBH)	<b>277</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>Class 2</b> (>20cm DBH and < 50cm DBH)	<b>76</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>Class 3</b> >50cm DBH	<b>277</b>	<b>35</b>	<b>46</b>	<b>44</b>
<b>Class 3</b> >50cm DBH	<b>76</b>	<b>14</b>	<b>18</b>	<b>17</b>
<b>TOTAL:</b>		<b>49</b>	<b>64</b>	<b>61</b>

### 10.1.3 Species credits

An offset is required for the threatened species impacted by the development that require species credits. These species and the species credits required are documented in Table 10-3.

The full Biodiversity Credit Report generated by the BAM Calculator is provided in Appendix G.

The species credits required for flora species along Weeamera Road has been reduced due to refinement of habitat including the removal of the hardstand area of the road from the species polygon. Perennial exotic dominated areas were also excluded.

Table 10-3 Species credit species that require offsets.

Species Credit Species	Biodiversity risk weighting	Area of habitat or count of individuals lost (ha)	Species credits required
Small Scurf-pea <i>Cullen parvum</i>	2	0.17	5
Small Purple-pea <i>Swainsona recta</i>	2	0.17	5
Silky Swainson-pea <i>Swainsona sericea</i>	2	0.17	5

#### 10.1.4 Offsets required under the EPBC Act

No species listed on the EPBC Act have been identified as having the potential to be significantly impacted by the development. As such, the proposal is not considered to require offsets in accordance with the EPBC Offsets Policy.

## 10.2 IMPACTS NOT REQUIRING AN OFFSET

Impacts to PCTs that do not meet the thresholds identified in Section 10.1.1 do not require offsets. These PCTs and vegetation zones are mapped on

Figure 10-1. 996 ha of exotic vegetation comprised of crops and pastoral grasses would be impacted by the proposal. No threatened species were observed as dependent on this habitat. Exotic vegetation is not required to be offset and does not require further assessment. Paddock trees occurring within this vegetation have been offset through the generation of ecosystem credits.

## 10.3 AREAS NOT REQUIRING ASSESSMENT

Identification of areas not requiring assessment in accordance with BAM Section 10.4 i.e. land without native vegetation (Category 1 exempt Land). These areas are mapped on

Figure 10-1. A land category assessment is provided in Appendix G.



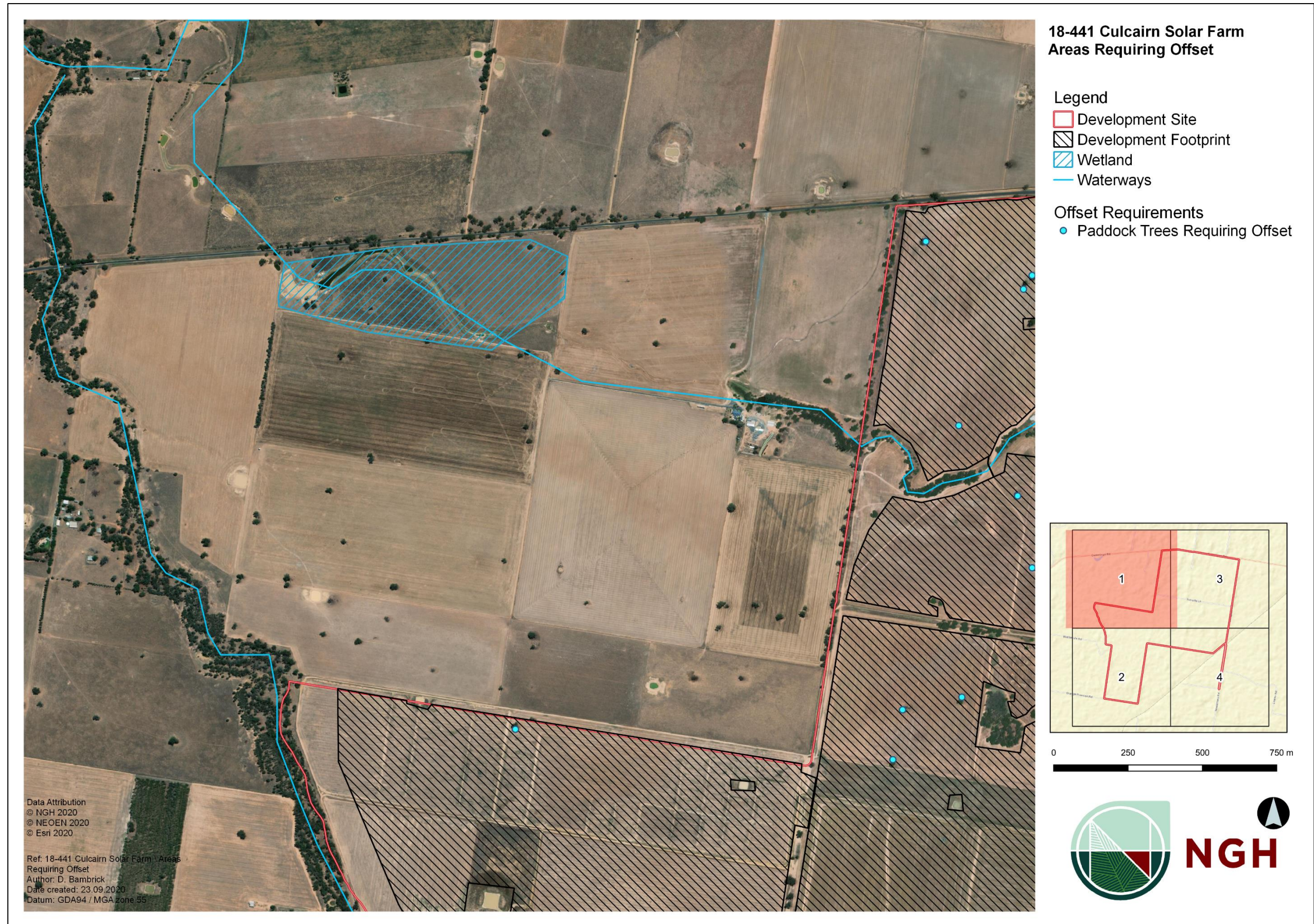


Figure 10-1 Impacts requiring offset, not requiring offset and not requiring assessment



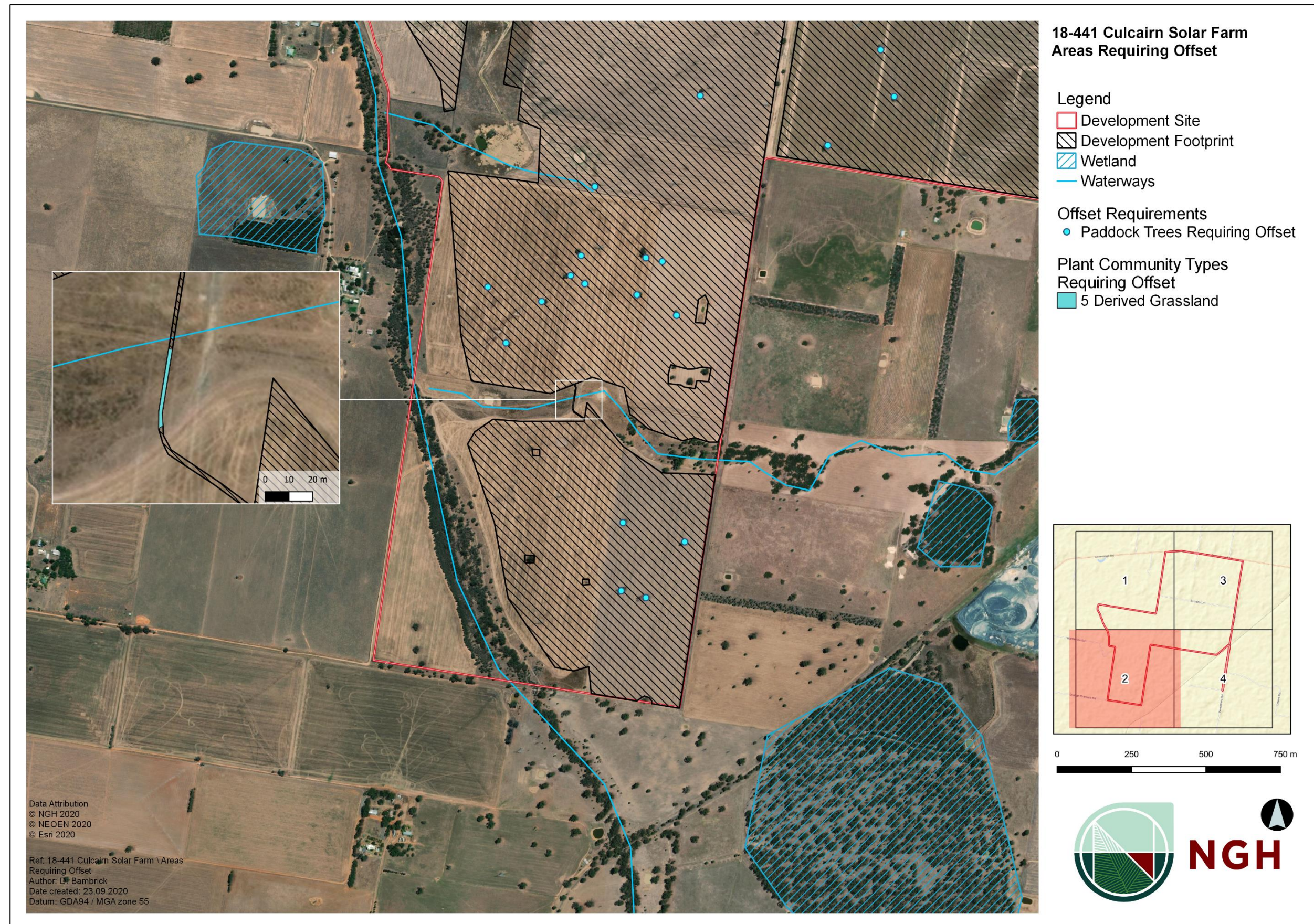


Figure 10-2: Impacts requiring offset, not requiring offset and not requiring assessment



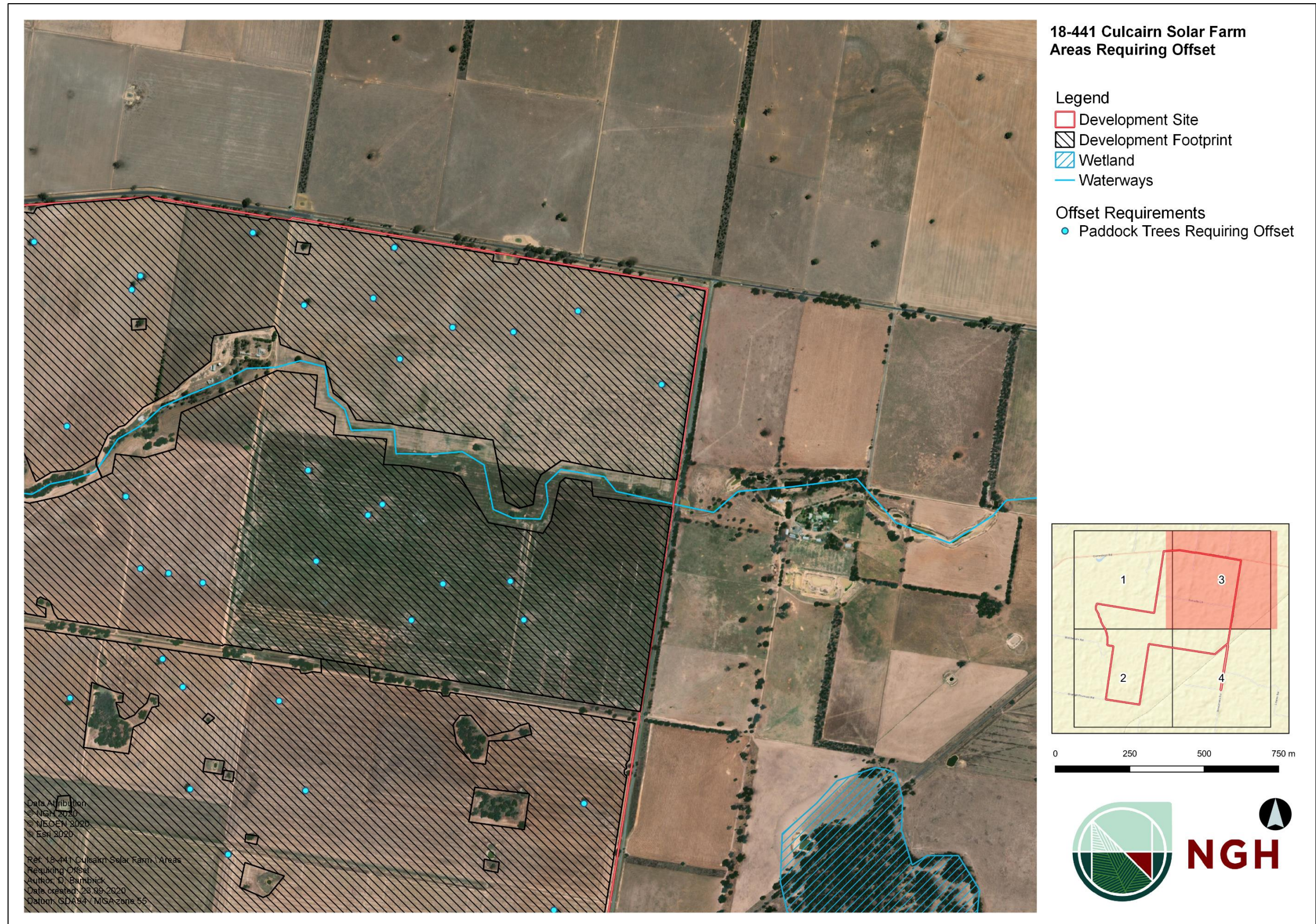


Figure 10-3: Impacts requiring offset, not requiring offset and not requiring assessment



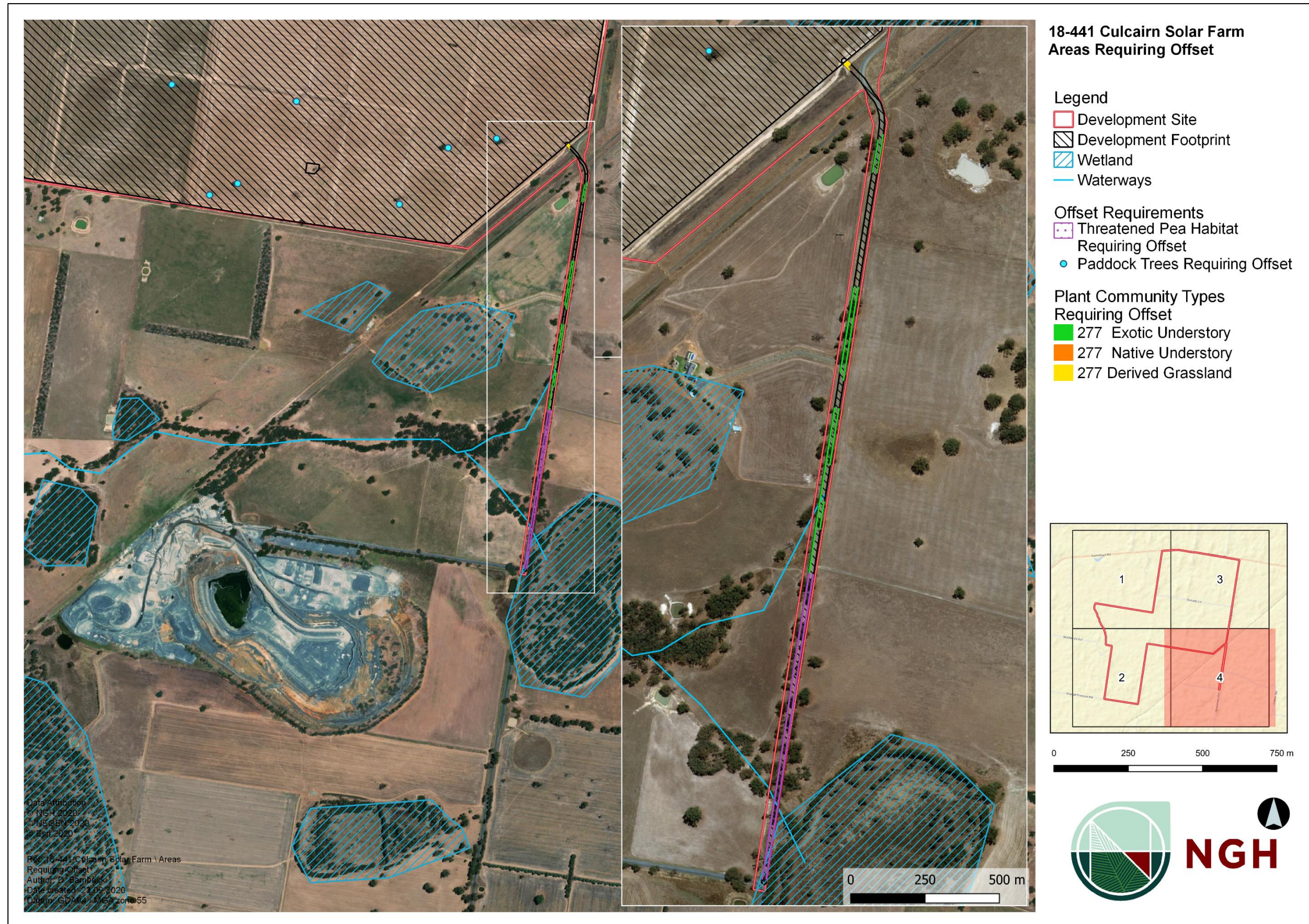


Figure 10-4: Impacts requiring offset, not requiring offset and not requiring assessment



## 10.4 SUMMARY OF OFFSET CREDITS REQUIRED

Table 10-4 Summary of offset credits required.

Ecosystem Credits	Offset credits required
277 Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion	7
5 River Red Gum herbaceous-grassy very tall open forest wetland on inner floodplains in the lower slopes sub-region of the NSW South Western Slopes Bioregion	1
277 Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion (Paddock Trees)	44
76-Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions (Paddock Trees)	17
<b>TOTAL</b>	<b>69</b>
Species Credits	Offset Credits required
Small Scurf-pea <i>Cullen parvum</i>	5
Small Purple-pea <i>Swainsona recta</i>	5
Silky Swainson-pea <i>Swainsona sericea</i>	5
<b>TOTAL</b>	<b>15</b>

## 11 CONCLUSIONS

NGH Consulting has prepared this BDAR on behalf of NEOEN for the Culcairn Solar Farm, 4.3 km northeast of Culcairn, NSW. The proposal would develop around 892 ha hectares (ha) of the 1049 ha development site.

The aim of this BDAR is to address the biodiversity matters raised in the Secretary's Environmental Assessment Requirements (SEARs) and to address the requirements of the *Biodiversity Conservation Act 2016* (NSW) (BC Act) and the *Environmental Protection and Biodiversity Conservation Act 1999* (Cwth) (EPBC Act). This BDAR forms part of an Environmental Impact Statement (EIS) for the State Significant Development (SSD), prepared under Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). The BDAR includes:

- Comprehensive mapping and assessment completed in accordance with the BAM.
- Identification of four plant community types and one threatened species within the development site, the impacts to which have been adequately assessed.
- Mitigation measures which have been outlined to reduce the impacts to biodiversity
- The generation of 69 ecosystem credits within the development site, and 15 species credits.

The retirement of these credits will be carried out in accordance with the NSW Biodiversity Offsets Scheme, and will be achieved by either:

- a) Retiring credits under the Biodiversity Offsets Scheme based on the like-for-like rules, or
- b) Making payments into the Biodiversity Conservation Fund using the offset payments calculator, or
- c) Funding a biodiversity action that benefits the threaten entity(ies) impacted by the development.



## 12 REFERENCES

- DECC (2002) Descriptions for NSW (Mitchell) Landscapes Version 2. NSW Department of Environment and Climate Change.
- DECC (2009) Threatened Species Survey and Assessment Guidelines: field survey methods for fauna, NSW Department of Environment and Climate Change
- DEE (2010) Directory of Important Wetlands in Australia – Information Sheet (Lake Hume – VIC032) [http://www.environment.gov.au/cgi-bin/wetlands/report.pl?smode=DOIW;doiw\\_refcodelist=VIC032](http://www.environment.gov.au/cgi-bin/wetlands/report.pl?smode=DOIW;doiw_refcodelist=VIC032)
- DoE (2014) EPBC Act Referral Guidelines for the vulnerable koala (combined populations of Queensland, New South Wales and the Australian Capital Territory), Commonwealth Department of Environment, 2014.
- DoE (2016). Species Profile and Threats Database, Department of Sustainability, Environment, Water, Population and Communities, Canberra. Available from: <http://www.environment.gov.au/sprat>.
- DoE (2018) National Flying-fox monitoring viewer accessed at <http://www.environment.gov.au/webgis-framework/apps/ffc-wide/ffc-wide.jsf>
- Environment Australia (2001) A Directory of Important Wetlands in Australia. 3rd Edition. Environment Australia, Canberra.
- Goulburn-Murray Water (2008) Lake Hume Land and On-water Management Plan, Tatura, Victoria <https://www.g-mwater.com.au/recreation-tourism/lowmp>
- Office of Environment and Heritage (OEH) (2016a) NSW Guide to Surveying Threatened Plants, State of NSW and Office of Environment and Heritage
- Office of Environment and Heritage (OEH) (2016b) Riverina State Vegetation Mapping VIS\_ID\_4469 Accessed online at <http://www.environment.nsw.gov.au/research/VISmap.htm>.
- Office of Environment and Heritage (OEH) (2017) Biodiversity Assessment Methodology (BAM). Office of Environment and Heritage for the NSW Government, Sydney, NSW.
- Office of Environment and Heritage (OEH) (2017) BioNet Vegetation Information System: Classification Database. Accessed online at <http://www.environment.nsw.gov.au/research/Visclassification.htm>
- Saunders & Tzaros (2011) National Recovery Plan for the Swift Parrot *Lathamus discolor* Birds Australia
- Story, Georgeanna (2019) Scatsabout, personal communication
- Thackaway and Creswell (1995) An Interim Biogeographic Regionalisation for Australia, Australian Nature Conservation Agency, Canberra
- TBDC (Threatened Biodiversity Data Collection) (2019), Office of Environment and Heritage accessed at <https://www.environment.nsw.gov.au/AtlasApp/>

## APPENDIX A PLOT FIELD DATA

	Scientific Name	Common Name	Family	Plot 1		Plot 2		Plot 3		Plot 4		Plot 5		Plot 6		Plot 7		Plot 8		Plot 9		Plot 10	
				C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A
TREES																							
	<i>Eucalyptus albens</i>	White Box	Myrtaceae									8	1										
	<i>Eucalyptus blakelyi</i>	Blakely's Red Gum	Myrtaceae													0.1	1						
	<i>Eucalyptus camaldulensis</i>	River Red Gum	Myrtaceae													8	1	15	10	30	5		
	<i>Eucalyptus melliodora</i>	Yellow Box	Myrtaceae					0.2	0														
	<i>Eucalyptus microcarpa</i>	Western Grey Box	Myrtaceae																			20	1
FORBS																							
*	<i>Acetosella vulgaris</i>	Sheep Sorrel	Polygonaceae									0.2	150	-	-								
*	<i>Cirsium vulgare</i>	Spear Thistle	Asteraceae							0.1	2					0.1	1						
*	<i>Citrullus lanatus</i>	Camel Melon	Cucurbitaceae			0.1	5	0.1	3	0.1	5	0.1	20	-	-	1	-						
*	<i>Cucumis myriocarpus</i>	Paddy Melon	Cucurbitaceae			1	500			0.5	-	0.5	1000	-	-	1	-						
	<i>Dysphania pumilio</i>	Black Crumbweed	Chenopodiaceae	0.1	80	5	500	0.2	500			0.3	250	0.1	20	0.2	50						
*	<i>Emilia sonchifolia</i>	Sow Thistle	Asteraceae															0.1	1				
*	<i>Erodium spp.</i>	Crowfoot	Geraniaceae			0.1	4	0.1	5			0.1	200										
	<i>Eryngium ovinum</i>	Blue Devil	Apiaceae															0.5	60				
	<i>Euphorbia drummondii</i>	Caustic weed	Euphorbiaceae					0.1	5														



	Scientific Name	Common Name	Family	Plot 1		Plot 2		Plot 3		Plot 4		Plot 5		Plot 6		Plot 7		Plot 8		Plot 9		Plot 10	
				C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A
*	<i>Hypericum perforatum</i>	St John's Wort	Hypericaceae	0.1	2																		
*	<i>Hypochaeris radicata</i>	Catsear	Asteraceae							0.1	3	0.1	1			0.1	1	0.1	2				
*	<i>Lactuca saligna</i>	Willow-leaved Lettuce	Asteraceae			0.1	2																
*	<i>Lactuca serriola</i>	Prickly Lettuce	Asteraceae																			1	3
*	<i>Lepidium africanum</i>	Common Peppergrass	Brassicaceae			0.5	50	0.1	20	0.1	25	0.2	100	X	X	0.1	4						
	<i>Lobelia purpurascens</i>	Whiteroot	Lobeliaceae																	0.1	20		
*	<i>Malva parviflora</i>	Small-flowered Mallow	Malvaceae	0.5	200	0.1	20	0.5	50			0.2	25			0.2	X						
	<i>Medicago sativa</i>	Lucerne	Fabaceae (Faboideae)	0.1	25																		
*	<i>Medicago spp.</i>	A Medic	Fabaceae (Faboideae)	0.1	2							0.1	8			2	1000						
*	<i>Modiola caroliniana</i>	Red-flowered Mallow	Malvaceae							0.1	5	0.3	50			0.1	10						
	<i>Oxalis perennans</i>		Oxalidaceae							0.1	20												
	<i>Persicaria decipiens</i>	Slender Knotweed	Polygonaceae							5	X					0.5	20						
*	<i>Physalis hederifolia</i>	Sticky Cape Gooseberry	Solanaceae													X	X						
*	<i>Plantago lanceolata</i>	Lamb's Tongues	Plantaginaceae															0.1	1				

	Scientific Name	Common Name	Family	Plot 1		Plot 2		Plot 3		Plot 4		Plot 5		Plot 6		Plot 7		Plot 8		Plot 9		Plot 10	
				C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A
*	<i>Polygonum aviculare</i>	Wireweed	Polygonaceae	0.5	50	0.1	1	0.1	2	30	X	0.5	100	X	X	0.2	X						
	<i>Polygonum plebeium</i>	Small Knotweed	Polygonaceae													0.1	5						
	<i>Portulaca oleracea</i>	Pigweed	Portulacaceae													0.1	340						
	<i>Rumex brownii</i>	Swamp Dock	Polygonaceae			0.1	2			0.1	1	0.1	1	0.1	10	0.1	2	0.1	1	0.1	6		
*	<i>Rumex crispus</i>	Curled Dock	Polygonaceae			0.1	1			0.1	20	0.1	20			0.1	2			0.1	4		
*	<i>Salvia verbenaca</i>	Wild Sage	Lamiaceae							0.1	20	0.1	5										
	<i>Sida cunninghamii</i>	Ridge Sida	Asteraceae															0.1	20				
*	<i>Solanum elaeagnifolium</i>	Silver-leaved Nightshade	Solanaceae																			0.2	30
*	<i>Sonchus oleraceus</i>	Sow Thistle	Asteraceae																	0.1	3		
*	<i>Trifolium spp.</i>	A Clover	Fabaceae (Faboideae)	0.1	50															0.1	1		
*	<i>Trifolium subterraneum</i>	Subterranean Clover	Fabaceae (Faboideae)							0.2	20	0.1	50	X	X								
*	<i>Vicia sativa</i>	Common vetch	Fabaceae (Faboideae)									0.01	10			0.1	5						
	<i>Wahlenbergia spp.</i>	Bluebell	Campanulaceae															0.1	1				
GRASS AND GRASS LIKE																							
*	<i>Avena fatua</i>	Wild Oats	Poaceae											0.5	X								
*	<i>Bromus diandrus</i>	Great Brome	Poaceae									0.1	10	35	1000							30	2000
*	<i>Bromus hordeaceus</i>	Soft Brome	Poaceae			5	500			5	X	35	1000	X	X	0.3	100						



	Scientific Name	Common Name	Family	Plot 1		Plot 2		Plot 3		Plot 4		Plot 5		Plot 6		Plot 7		Plot 8		Plot 9		Plot 10	
				C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A
*	<i>Cenchrus clandestinus</i>	Kikuyu Grass	Poaceae													20	X						
	<i>Chloris truncata</i>	Windmill Grass	Poaceae									0.1	X										
	<i>Cynodon dactylon</i>	Common Couch	Poaceae			10	200	0.2	30			1	50	0.1	10	20	200	0.1	30				
*	<i>Cyperus eragrostis</i>	Umbrella Sedge	Cyperaceae													0.1	2						
*	<i>Hordeum leporinum</i>	Barley Grass	Poaceae	30	2000	50	3500	30	2000	30	X	25	1000	X	X	25	100					1	X
*	<i>Lolium perenne</i>	Perennial Ryegrass	Poaceae	0.5	50	5	300			5	X	0.3	1000	X	X	10	X	2	1000	70	5000	50	X
*	<i>Phalaris aquatica</i>	Phalaris	Poaceae	60	1000													0.1	1	2	15		
*	<i>Romulea rosea</i>	Onion grass	Iridaceae															0.5	5000				
	<i>Rytidosperma spp.</i>	Wallaby Grass	Poaceae															0.1	10			0.5	25
*	<i>Vulpia myuros</i>	Rat's Tail Fescue	Poaceae			5	500					0.5	100	X	X	0.1	10						
GRAMINOIDS																							
	<i>Carex inversa</i>	Knob Sedge	Cyperaceae															5	1000				
	<i>Juncus spp.</i>	A Rush	Juncaceae							10	150					0.1	4	0.1	100				

	Scientific Name	Common Name	Family	Plot 11		Plot 12		Plot 13		Plot A		Plot B		Plot C		Plot D		Plot E		Plot F		Plot G	
				C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A
TREES																							
	<i>Eucalyptus blakelyi</i>	Blakely's Red Gum	Myrtaceae													4	2	30	250				
	<i>Eucalyptus camaldulensis</i>	River Red Gum	Myrtaceae							2	3												
	<i>Eucalyptus melliodora</i>	Yellow Box	Myrtaceae													4	1	15	150				
FORBS																							
*	<i>Acetosella vulgaris</i>	Sheep Sorrel	Polygonaceae									0.1	20									0.1	1
*	<i>Brassica rapa</i> ssp. <i>campestris</i>	Canola	Brassicaceae	40	5000																		
*	<i>Centaurium erythraea</i>	Common Centaury	Gentianaceae									0.1	2										
*	<i>Chondrilla juncea</i>	Skeleton Weed	Asteraceae																			0.1	2
*	<i>Cirsium vulgare</i>	Spear Thistle	Asteraceae					0.1	1			0.1	1					0.1	7				
*	<i>Conyza bonariensis</i>	Flaxleaf Fleabane	Asteraceae							0.1	7	0.1	20					0.1	1				
*	<i>Cucumis myriocarpus</i>	Paddy Melon	Cucurbitaceae			0.1	15																
	<i>Desmodium varians</i>	Slender Tick-trefoil	Fabaceae (Faboideae)																	1	100	0.1	2
	<i>Dysphania pumilio</i>	Black Crumbleweed	Chenopodiaceae																	0.1	1	0.1	1
*	<i>Echium plantagineum</i>	Patterson's Curse	Boraginaceae																			0.1	2
	<i>Einadia nutans</i>	Climbing Saltbush	Chenopodiaceae															6	50				



	Scientific Name	Common Name	Family	Plot 11		Plot 12		Plot 13		Plot A		Plot B		Plot C		Plot D		Plot E		Plot F		Plot G	
				C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A
*	<i>Emilia sonchifolia</i>	Sow Thistle	Asteraceae																			0.1	5
*	<i>Erodium spp.</i>	Crowfoot	Geraniaceae			0.1	4	0.1	8											0.2	25	0.1	10
	<i>Euphorbia drummondii</i>	Caustic weed	Euphorbiaceae			0.1	1	0.1	20											0.1	20		
	<i>Galium aparine</i>	Goosegrass	Rubiaceae																	0.1	10		
	<i>Goodenia spp.</i>		Goodeniaceae					0.1	20														
*	<i>Heliotropium europaeum</i>	Potato Weed	Boraginaceae																	0.1	3	0.5	50
	<i>Hydrocotyle sibthorpioides</i>		Apiaceae					2	1000														
	<i>Hypericum gramineum</i>	Small St John's Wort	Clusiaceae									0.1	0.1							0.1	0.3		
*	<i>Hypochaeris radicata</i>	Catsear	Asteraceae					0.1	15			0.1	30					0.1	1	0.2	30	0.2 1	10
*	<i>Lactuca saligna</i>	Willow-leaved Lettuce	Asteraceae					0.1	20	0.1	2							0.1	1				
*	<i>Lactuca serriola</i>	Prickly Lettuce	Asteraceae							0.1	1	0.1	1			0.1	4	0.1	3				
*	<i>Lepidium africanum</i>	Common Peppergrass	Brassicaceae															0.1	15				
	<i>Lobelia purpurascens</i>	Whiteroot	Lobeliaceae					0.1	X														
	<i>Lythrum hyssopifolia</i>	Hyssop Loosestrife	Lythraceae									0.5	200									0.1	2
*	<i>Malva parviflora</i>	Small-flowered Mallow	Malvaceae			0.1	1																
*	<i>Marrubium vulgare</i>	White Horehound	Lamiaceae													0.5	38	0.1	1				

	Scientific Name	Common Name	Family	Plot 11		Plot 12		Plot 13		Plot A		Plot B		Plot C		Plot D		Plot E		Plot F		Plot G	
				C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A
	<i>Medicago sativa</i>	Lucerne	Fabaceae (Faboideae)			0.1	2																
*	<i>Modiola caroliniana</i>	Red-flowered Mallow	Malvaceae																	0.1	10		
	<i>Oxalis perennans</i>		Oxalidaceae			0.1	15	0.2	30														
	<i>Persicaria decipiens</i>	Slender Knotweed	Polygonaceae					0.1	5														
*	<i>Persicaria prostrata</i>	Creeping Knotweed	Polygonaceae							0.1	30	0.2	500										
*	<i>Plantago lanceolata</i>	Lamb's Tongues	Plantaginaceae																	0.5	100	0.5	30
*	<i>Polygonum aviculare</i>	Wireweed	Polygonaceae			X	X					0.2	50									0.1	1
	<i>Portulaca oleracea</i>	Pigweed	Portulacaceae			0.1	2																
	<i>Pseudognaphalium luteoalbum</i>	Jersey Cudweed	Asteraceae									0.2	100	0.1	6								
*	<i>Raphanus raphanistrum</i>	Wild Radish	Brassicaceae																	0.1	1		
	<i>Rumex brownii</i>	Swamp Dock	Polygonaceae			0.1	2													0.1	100		
*	<i>Rumex conglomeratus</i>	Clustered Dock	Polygonaceae					0.2	20														
*	<i>Rumex crispus</i>	Curled Dock	Polygonaceae			0.1	1											0.1	1				
*	<i>Salvia verbenaca</i>	Wild Sage	Lamiaceae																	0.1	5	0.1	5
	<i>Sida cunninghamii</i>	Ridge Sida	Asteraceae					0.1	40														
*	<i>Solanum elaeagnifolium</i>	Silver-leaved Nightshade	Solanaceae											0.1	15	0.1	5	0.1	2	0.5	30	5	50



	Scientific Name	Common Name	Family	Plot 11		Plot 12		Plot 13		Plot A		Plot B		Plot C		Plot D		Plot E		Plot F		Plot G	
				C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A
*	<i>Solanum spp.</i>		Solanaceae													0.1	4						
*	<i>Sonchus oleraceus</i>	Sow Thistle	Asteraceae					0.1	10			0.1	30							0.1	2		
*	<i>Trifolium spp.</i>	A Clover	Fabaceae (Faboideae)																	0.1	0.1		
*	<i>Trifolium subterraneum</i>	Subterranean Clover	Fabaceae (Faboideae)			0.1	15																
*	<i>Verbascum virgatum</i>	Twiggy Mullein	Scrophulariaceae																			0.1	1
	<i>Wahlenbergia spp.</i>	Bluebell	Campanulaceae					0.1	500														
GRASS AND GRASS LIKE																							
	<i>Anthosachne scabra</i>	Native wheat	Poaceae																	0.1	1		
	<i>Austrostipa aristiglumis</i>	Plains Grass	Poaceae									1	15										
*	<i>Avena fatua</i>	Wild Oats	Poaceae																	0.5	10	5	504
*	<i>Bromus diandrus</i>	Great Brome	Poaceae							0.2	X	0.1	2			25	1000	40	1000	0.2	50	0.4	4
*	<i>Bromus hordeaceus</i>	Soft Brome	Poaceae			0.3	100			0.1	5	0.1	2									10	60
	<i>Chloris truncata</i>	Windmill Grass	Poaceae									0.1	3							10	200	0.1	2
	<i>Cynodon dactylon</i>	Common Couch	Poaceae					2	500	0.1	1					0.1	6	0.1	10	10	1000	0.1	3
*	<i>Cyperus eragrostis</i>	Umbrella Sedge	Cyperaceae									0.1	2					1	1				
*	<i>Eleusine tristachya</i>	Goose Grass	Poaceae																			0.1	2

	Scientific Name	Common Name	Family	Plot 11		Plot 12		Plot 13		Plot A		Plot B		Plot C		Plot D		Plot E		Plot F		Plot G	
				C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A
*	<i>Hordeum leporinum</i>	Barley Grass	Poaceae	0.5	X	0.2	X																
*	<i>Lolium perenne</i>	Perennial Ryegrass	Poaceae	0.1	X	1	1000	80	5000			30	1000			50	1000	40	1000				
*	<i>Panicum capillare</i>	Witchgrass	Poaceae									25	1000	20	2000					30	2000	10	1000
*	<i>Paspalum dilatatum</i>	Paspalum	Poaceae																	8	80	0.1	1
*	<i>Phalaris aquatica</i>	Phalaris	Poaceae			70	X	3	40									0.1	1				
	<i>Rytidosperma spp.</i>	Wallaby Grass	Poaceae					0.1	20			0.1	7										
	<i>Sporobolus caroli</i>	Fairy Grass	Poaceae							10	25	10	1000										
*	<i>Vulpia myuros</i>	Rat's Tail Fescue	Poaceae			0.5	100	X	X			10	1000							30	5000	40	5000
GRAMINOIDS																							
	<i>Carex inversa</i>	Knob Sedge	Cyperaceae									5	100			0.1	1						
	<i>Juncus ingens</i>	Giant Rush	Juncaceae							0.1	1												
	<i>Juncus spp.</i>	A Rush	Juncaceae					0.1	20														
	<i>Juncus subsecundus</i>	Finger Rush	Juncaceae							95	5000	30	1000										



	Scientific Name	Common Name	Family	Plot H		Plot I		Plot J		Plot K		Plot L		Plot M		Plot 2A		Plot 2B		Plot 2C		Plot 2D	
				C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A
	<i>Acacia dealbata</i>	Silver Wattle	Fabaceae													5	50			25	70	25	70
	<i>Euclayptus albens</i>	White Box	Myrtaceae															15	1				
	<i>Eucalyptus blakelyi</i>	Blakely's Red Gum	Myrtaceae			10	6									5	1	20	3	5	1	5	1
	<i>Eucalyptus camaldulensis</i>	River Red Gum	Myrtaceae	45	27															4	2	4	2
	<i>Eucalyptus melliodora</i>	Yellow Box	Myrtaceae			5	2	30	3							5	2			2	1	2	1
	<i>Eucalyptus microcarpa</i>	Western Grey Box	Myrtaceae							30	4					7	4	10	2	2	1	2	1
*	<i>Schinus molle</i>	Peppercorn	Anacardiaceae	.5	1																		
<b>SHRUBS</b>																							
	<i>Acacia buxifolia</i>	Box-leaved Wattle	Fabaceae													7	2						
	<i>Acacia implexa</i>	Hickory Wattle	Fabaceae													7	1			.1	0	.1	0
	<i>Acacia montana</i>	Mallee Wattle	Fabaceae													20	4			3	1	3	1
	<i>Callistemon sieberi</i>	River Bottlebrush	Myrtaceae															2	3	.5	2	.5	2
<b>FORBS</b>																							
	<i>Bulbine sp</i>		Asphodelaceae															.1	5				
*	<i>Carthamus lanatus</i>	Saffron Thistle	Asteraceae							0.1	0.1												
*	<i>Cirsium vulgare</i>	Spear Thistle	Asteraceae									0.1	1					.1	1				
*	<i>Conyza bonariensis</i>	Flaxleaf Fleabane	Asteraceae									0.1	1	0.5	200								

	Scientific Name	Common Name	Family	Plot H		Plot I		Plot J		Plot K		Plot L		Plot M		Plot 2A		Plot 2B		Plot 2C		Plot 2D	
				C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A
*	<i>Cucumis myriocarpus</i>	Camel Melon	Cucuritaceae															.1	1				
	<i>Desmodium varians</i>	Slender Tick-trefoil	Fabaceae (Faboideae)	0.5	50																		
*	<i>Epilobium spp.</i>		Onagraceae											0.7	50								
*	<i>Erodium spp.</i>	Crowfoot	Geraniaceae									0.1	15	0.1	10								
	<i>Euchiton spp.</i>	A Cudweed	Asteraceae											0.1	1								
	<i>Euphorbia drummondii</i>	Caustic weed	Euphorbiaceae									0.1	10	0.1	6								
	<i>Goodenia macbarronii</i>	Narrow Goodenia	Goodeniaceae									0.1	5										
*	<i>Hypochaeris radicata</i>	Catsear	Asteraceae	0.1	3							0.5	500	0.2	50								
*	<i>Lactuca serriola</i>	Prickly Lettuce	Asteraceae	0.1	2									0.1	1								
*	<i>Lepidium africanum</i>	Common Peppergrass	Brassicaceae	0.1	2			0.1	2	0.1	1												
*	<i>Lysimachia arvensis</i>	Scarlet Pimpernel	Myrsinaceae											0.2	10								
	<i>Lythrum hyssopifolia</i>	Hyssop Loosestrife	Lythraceae									0.1	6	0.1	50								
*	<i>Malva parviflora</i>	Small-flowered Mallow	Malvaceae	0.1	1																		
	<i>Oxalis perennans</i>		Oxalidaceae											0.1	30			.1	5	.1	4	.1	4
	<i>Persicaria decipiens</i>	Slender Knotweed	Polygonaceae	0.1	1													.1	10				
*	<i>Plantago lanceolata</i>	Lamb's Tongues	Plantaginaceae					0.1	1	0.1	0.1			10	500								



	Scientific Name	Common Name	Family	Plot H		Plot I		Plot J		Plot K		Plot L		Plot M		Plot 2A		Plot 2B		Plot 2C		Plot 2D	
				C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A
*	<i>Polygonum aviculare</i>	Wireweed	Polygonaceae	0.2	80																		
	<i>Pseudognaphalium luteoalbum</i>	Jersey Cudweed	Asteraceae									0.1	5	0.1	1								
*	<i>Romulea rosea</i>	Onion Grass	Iridaceae															.1	1				
	<i>Rumex brownii</i>	Swamp Dock	Polygonaceae	0.1	3			0.1	1							.1	1	.1	1				
*	<i>Rumex crispus</i>	Curled Dock	Polygonaceae	0.1	1					0.1	3			0.5	60			.1	1				
	<i>Sida cunninghamii</i>	Ridged Sida	Malvaceae																		.1	3	
*	<i>Solanum elaeagnifolium</i>	Silver-leaved Nightshade	Solanaceae	0.4	80	25	300	25	300			0.1	18	0.1	4								
*	<i>Solanum spp.</i>		Solanaceae									0.1	11										
*	<i>Sonchus oleraceus</i>	Sow Thistle	Asteraceae	0.1	20					0.1	5	0.1	50	0.1	2								
*	<i>Sonchus sp</i>	Sow Thislte	Asteraceae													.1	1	.1	1				
*	<i>Trifolium arvense</i>	Haresfoot Clover	Fabaceae (Faboideae)									0.1	20										
*	<i>Trifolium spp.</i>	A Clover	Fabaceae (Faboideae)											0.5	100	.1	1	1	100				
*	<i>Verbena sp</i>	Purpletop	Verbenaceae															3	80				
	<i>Unidentified forb</i>																	.1	10			.2 30	
GRASS AND GRASS LIKE																							
	<i>Anthosachne scabra</i>	Native wheat	Poaceae					0.1	8			0.1	5										
	<i>Austrostipa blackii</i>		Poaceae									0.1	8										
	<i>Austrostipa scabra</i>	Speargrass	Poaceae									1	20										

	Scientific Name	Common Name	Family	Plot H		Plot I		Plot J		Plot K		Plot L		Plot M		Plot 2A		Plot 2B		Plot 2C		Plot 2D	
				C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A
*	<i>Avena fatua</i>	Wild Oats	Poaceae	0.2	100					0.1	2	2	700	0.1	20			.1	2	1	50	1	50
	<i>Bothriochloa macra</i>	Red Grass	Poaceae									1	100										
*	<i>Briza minor</i>	Shivery Grass	Poaceae											0.1	3								
*	<i>Bromus catharticus</i>	Praire Grass	Poaceae	0.1	1																		
*	<i>Bromus diandrus</i>	Great Brome	Poaceae	60	5000	50	5000	60	X	2	100	0.1	1			40	1000	20	1000				
*	<i>Bromus hordeaceus</i>	Soft Brome	Poaceae							0.1	5	0.1	20	0.1	1					.1	2	.1	2
*	<i>Bromus sp</i>		Poacea															30	5000				
	<i>Chloris truncata</i>	Windmill Grass	Poaceae	0.1	10					0.1	2	15	800										
	<i>Cynodon dactylon</i>	Common Couch	Poaceae	0.2	30			0.1	4	1	80	10	1000	10	200			10	1000	.5	30	.5	30
	<i>Eragrostis spp.</i>	A Lovegrass	Poaceae									0.1	5										
*	<i>Lolium perenne</i>	Perennial Ryegrass	Poaceae			30	X	20	X			0.5	1000	0.5	600								
*	<i>Lolium rigidum</i>	Wimmera Ryegrass	Poaceae															.1	2	4	2000	4	2000
*	<i>Panicum capillare</i>	Witchgrass	Poaceae					0.1	20	0.1	30	20	1000	10	500			.1	5				
*	<i>Paspalum dilatatum</i>	Paspalum	Poaceae	5	30					20	30	40	150	50	500								
*	<i>Phalaris aquatica</i>	Phalaris	Poaceae	1	5					1	7							25	100				
	<i>Phragmites australis</i>		Poaceae															1	1000				
	<i>Poa labillardierei</i>	TussockPoaceae																3	20				



	Scientific Name	Common Name	Family	Plot H		Plot I		Plot J		Plot K		Plot L		Plot M		Plot 2A		Plot 2B		Plot 2C		Plot 2D	
				C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A
*	<i>Romulea rosea</i>	Onion Grass	Iridaceae	0.1	1									0.1	2								
	<i>Rytidosperma spp.</i>	Wallaby Grass	Poaceae	0.1	3					0.1	1												
*	<i>Vulpia myuros</i>	Rat's Tail Fescue	Poaceae									10	1000	0.1	5								
GRAMINOIDS																							
	<i>Carex appressa</i>	Tall Sedge	Cyperaceae															.1	1				
	<i>Carex inversa</i>	Knob Sedge	Cyperaceae							0.1	2			0.1	9								
*	<i>Cyperus eragrostis</i>	Umbrella Sedge	Cyperaceae															.1	6				
	<i>Juncus spp.</i>	A Rush	Juncaceae	0.1	20			0.1	1														
	<i>Juncus subsecundus</i>	Finger Rush	Juncaceae	0.1	1					0.1	15												
	<i>Lomandra filiformis</i>	Wattle Matt-rush	Lomandraceae	0.1	20							0.5	1000										

	Scientific Name	Common Name	Family	Plot 2E		Plot 2F		Plot 2G		Plot 2H		Plot 2I		Plot 2J		Plot 2K		Plot 2L		Plot 2M		Plot 2N	
				C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A
	<i>Acacia dealbata</i>	Silver Wattle	Fabaceae									.1	1										
	<i>Euclayptus albens</i>	White Box	Myrtaceae																				
	<i>Eucalyptus blakelyi</i>	Blakely's Red Gum	Myrtaceae													35	3			10	2	50	2
	<i>Eucalyptus camaldulensis</i>	River Red Gum	Myrtaceae					30	1			10	6					60	4				
	<i>Eucalyptus melliodora</i>	Yellow Box	Myrtaceae									5	1										
	<i>Eucalyptus microcarpa</i>	Western Grey Box	Myrtaceae							8	1					5	1						
*	<i>Ficus sp</i>		Fig Tree													.5	1						
*	<i>Schinus molle</i>	Peppercorn	Anacardiaceae																				
SHRUBS																							
	<i>Acacia buxifolia</i>	Box-leaved Wattle	Fabaceae																				
	<i>Acacia implexa</i>	Hickory Wattle	Fabaceae																				
	<i>Acacia montana</i>	Mallee Wattle	Fabaceae																				
	<i>Acacia rubida</i>	Red-stemmed Wattle	Fabaceae									.2	1										
	<i>Callistemon sieberi</i>	River Bottlebrush	Myrtaceae																				
FORBS																							
	<i>Alternanthera denticulata</i>	Lesser Joyweed	Amaranthaceae																	.1	5		
	<i>Bulbine sp</i>		Asphodelaceae																	.1	6		



	Scientific Name	Common Name	Family	Plot 2E		Plot 2F		Plot 2G		Plot 2H		Plot 2I		Plot 2J		Plot 2K		Plot 2L		Plot 2M		Plot 2N	
				C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A
	<i>Centipeda cunninghamii</i>	Sneezeweed	Asteraceae																	20	200		
*	<i>Chenopodium album</i>	Fat Hen	Chenopodiaceae													2	200	.1	10	.1	10		
*	<i>Cucumis myriocarpus</i>	Camel Melon	Cucuritaceae	.1	2											.1	2						
*	<i>Carthamus lanatus</i>	Saffron Thistle	Asteraceae																				
*	<i>Cirsium vulgare</i>	Spear Thistle	Asteraceae	.1	10	.1	20	.1	10											.1	3		
*	<i>Conyza bonariensis</i>	Flaxleaf Fleabane	Asteraceae																				
*	<i>Conyza sp</i>	Fleabane	Asteraceae			.1	1	.1	3											.1	1		
	<i>Desmodium varians</i>	Slender Tick-trefoil	Fabaceae (Faboideae)									.1	5										
	<i>Dysphania pumilio</i>	Black Crumbleweed	Chenopodiaceae							.1	.2					.5	100			20	200	.1	2
*	<i>Echium plantagineum</i>	Pattersons Curse	Boraginaceae							5		.1	15										
*	<i>Epilobium spp.</i>		Onagraceae																				
*	<i>Erodium spp.</i>	Crowfoot	Geraniaceae																				
	<i>Euchiton spp.</i>	A Cudweed	Asteraceae																				
	<i>Euphorbia drummondii</i>	Caustic weed	Euphorbiaceae																				
	<i>Goodenia macbarronii</i>	Narrow Goodenia	Goodeniaceae																				
*	<i>Heliotropium supinum</i>	Prostrate Heliotrope	Boraginaceae																	.1	20		
*	<i>Hypochaeris radicata</i>	Catsear	Asteraceae	.1	2					5				1								.1	2

	Scientific Name	Common Name	Family	Plot 2E		Plot 2F		Plot 2G		Plot 2H		Plot 2I		Plot 2J		Plot 2K		Plot 2L		Plot 2M		Plot 2N	
				C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A
	<i>Lobelia concolor</i>		Campanulaceae	3	50											2	100						
*	<i>Lactuca serriola</i>	Prickly Lettuce	Asteraceae	.1	2	5	200	.3	50					.1	2					.1	2	.1	5
*	<i>Lactuca sp</i>		Asteraceae	.1	8																		
*	<i>Lepidium africanum</i>	Common Peppergrass	Brassicaceae							.1	2												
*	<i>Lysimachia arvensis</i>	Scarlet Pimpernel	Myrsinaceae																				
	<i>Lythrum hyssopifolia</i>	Hyssop Loosestrife	Lythraceae																				
*	<i>Malva parviflora</i>	Small-flowered Mallow	Malvaceae																				
*	<i>Malva sp</i>	Mallow	Malvaceae													.5	200	.1	10				
*	<i>Onopordum acanthium</i>	Scotch Thistle	Asteraceae											.1	1								
	<i>Oxalis perennans</i>		Oxalidaceae							.2	10	.1	.3	1	11								
	<i>Persicaria decipiens</i>	Slender Knotweed	Polygonaceae																			.1	2
	<i>Persicaria prostrata</i>	Creeping Knotweed	Polygonaceae																			.1	2
*	<i>Plantago lanceolata</i>	Lamb's Tongues	Plantaginaceae												2								
*	<i>Polygonum aviculare</i>	Wireweed	Polygonaceae							1	30							.2	20	.1	3		
	<i>Pseudognaphalium luteoalbum</i>	Jersey Cudweed	Asteraceae			.1	1																
*	<i>Romulea rosea</i>	Onion Grass	Iridaceae															.1	30	20	5000		



	Scientific Name	Common Name	Family	Plot 2E		Plot 2F		Plot 2G		Plot 2H		Plot 2I		Plot 2J		Plot 2K		Plot 2L		Plot 2M		Plot 2N	
				C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A
	<i>Rumex brownii</i>	Swamp Dock	Polygonaceae	.1	2							.1	5					.1	3	.1	2		
*	<i>Rumex crispus</i>	Curled Dock	Polygonaceae													1	30					.1	3
*	<i>Salvia spp</i>		Lamiaceae											.5	100								
*	<i>Salvia verbenaceae</i>	Vervain	Lamiaceae	.1	3			.5	50	2													
	<i>Sida cunninghamii</i>	Ridge Sida	Malvaceae							.1	3			5	200								
*	<i>Solanum elaeagnifolium</i>	Silver-leaved Nightshade	Solanaceae							1	50									2	50		
*	<i>Solanum nigrum</i>	Nightshade	Solanaceae							.1	2					.1	2			.1	5	.1	1
*	<i>Solanum spp.</i>		Solanaceae																				
*	<i>Sonchus oleraceus</i>	Sow Thistle	Asteraceae																				
*	<i>Sonchus sp</i>	Sow Thistle	Asteraceae	.1	5									.1	1					.1	1		
*	<i>Trifolium arvense</i>	Haresfoot Clover	Fabaceae (Faboideae)											.1	30								
*	<i>Trifolium spp.</i>	A Clover	Fabaceae (Faboideae)																				
*	<i>Verbena sp</i>	Purpletop	Verbenaceae																				
	<i>Whlenbergia sp</i>		Campanulaceae							.1	5												
	<i>Unidentified forb</i>					.2	200	.1	2	.1	5									.2	21		
GRASS AND GRASS LIKE																							
	<i>Anthosachne scabra</i>	Native wheat	Poaceae																				
	<i>Austrostipa blackii</i>		Poaceae																				

	Scientific Name	Common Name	Family	Plot 2E		Plot 2F		Plot 2G		Plot 2H		Plot 2I		Plot 2J		Plot 2K		Plot 2L		Plot 2M		Plot 2N	
				C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A
	<i>Austrostipa scabra</i>	Speargrass	Poaceae																				
	<i>Austrostipa sp</i>	Spear Grass	Poaceae	40	2000																		
*	<i>Avena fatua</i>	Wild Oats	Poaceae													1							
	<i>Bothriochloa macra</i>	Red Grass	Poaceae											.1	2								
*	<i>Briza minor</i>	Shivery Grass	Poaceae																				
*	<i>Bromus catharticus</i>	Praire Grass	Poaceae																				
*	<i>Bromus diandrus</i>	Great Brome	Poaceae									20	1000										
*	<i>Bromus hordeaceus</i>	Soft Brome	Poaceae																				
*	<i>Bromus sp</i>		Poacea					5	100						10	10	500					40	
	<i>Chloris truncata</i>	Windmill Grass	Poaceae							.1	2			5	100								
	<i>Cynodon dactylon</i>	Common Couch	Poaceae									.1	10										
*	<i>Eragrostis minor</i>		Poaceae											.1	2	.2	50					.1	10
	<i>Eragrostis spp.</i>	A Lovegrass	Poaceae																				
	<i>Hemarthria uncinata</i>	Mat Grass	Poaceae			90	2000	80	5000														
*	<i>Lolium perenne</i>	Perennial Ryegrass	Poaceae																				
*	<i>Lolium rigidum</i>	Wimmera Ryegrass	Poaceae																				
*	<i>Lolium sp</i>	Ryegrass	Poaceae	50	5000			.1	20	70	5000	20	2000			70	5000	80	10000	10		30	5000



	Scientific Name	Common Name	Family	Plot 2E		Plot 2F		Plot 2G		Plot 2H		Plot 2I		Plot 2J		Plot 2K		Plot 2L		Plot 2M		Plot 2N	
				C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A
	<i>Oxalis perennans</i>		Oxalidaceae					.1	2														
*	<i>Panicum capillare</i>	Witchgrass	Poaceae	1	20					5		.1	1	50	2000	.1		2	2000	1	100	.1	3
	<i>Panicum decompositum</i>	Native Millet	Poaceae											.1	4								
*	<i>Paspalum dilatatum</i>	Paspalum	Poaceae											5	25								
*	<i>Phalaris aquatica</i>	Phalaris	Poaceae																				
*	<i>Phalaris sp</i>		Poaceae					.1	30														
	<i>Phragmites australis</i>		Poaceae																				
	<i>Poa labillardierei</i>	Tussock	Poaceae																				
*	<i>Romulea rosea</i>	Onion Grass	Iridaceae																				
	<i>Rytidosperma spp.</i>	Wallaby Grass	Poaceae	5	50	1	30			7	50	.1	20	15	500								
	<i>Sporobolus caroli</i>	Fairy Grass	Poaceae			.1	2																
*	<i>Vulpia myuros</i>	Rat's Tail Fescue	Poaceae																				
GRAMINOIDS																							
	<i>Carex appressa</i>	Tall Sedge	Cyperaceae																				
	<i>Carex inversa</i>	Knob Sedge	Cyperaceae					.1	1.	.1	4	.1	.3	1	50								
*	<i>Cyperus eragrostis</i>	Umbrella Sedge	Cyperaceae																				
	<i>Juncus ingens</i>	Giant Rush	Poaceae					.2	6														
	<i>Juncus spp.</i>	A Rush	Juncaceae					.1	1	.1	3	.5	3							.1	2		

	Scientific Name	Common Name	Family	Plot 2E		Plot 2F		Plot 2G		Plot 2H		Plot 2I		Plot 2J		Plot 2K		Plot 2L		Plot 2M		Plot 2N	
				C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A
	<i>Juncus subsecundus</i>	Finger Rush	Juncaceae																				
	<i>Lomandra filiformis</i>	Wattle Matt-rush	Lomandraceae									.1	9	.1	20								



	Scientific Name	Common Name	Family	EPBC 1		EPBC 2I		3A		3B	
				C	A	C	A	C	A	C	A
	<i>Acacia dealbata</i>	Silver Wattle	Fabaceae								
	<i>Euclayptus albens</i>	White Box	Myrtaceae								
	<i>Eucalyptus blakelyi</i>	Blakely's Red Gum	Myrtaceae								
	<i>Eucalyptus camaldulensis</i>	River Red Gum	Myrtaceae								
	<i>Eucalyptus melliodora</i>	Yellow Box	Myrtaceae			25	4			15	4
	<i>Eucalyptus microcarpa</i>	Western Grey Box	Myrtaceae	15	2	2	2				
*	<i>Schinus molle</i>	Peppercorn	Anacardiaceae								
SHRUBS											
	<i>Acacia buxifolia</i>	Box-leaved Wattle	Fabaceae								
	<i>Acacia implexa</i>	Hickory Wattle	Fabaceae								
	<i>Acacia montana</i>	Mallee Wattle	Fabaceae	.2	2						
	<i>Callistemon sieberi</i>	River Bottlebrush	Myrtaceae								
FORBS											
*	<i>Arctotheca calendula</i>	Capeweed	Asteraceae	.1	5			1	200	0.2	50
	<i>Bulbine sp</i>		Asphodelaceae								
*	<i>Carthamus lanatus</i>	Saffron Thistle	Asteraceae								
*	<i>Cirsium vulgare</i>	Spear Thistle	Asteraceae								

	Scientific Name	Common Name	Family	EPBC 1		EPBC 2I		3A		3B	
				C	A	C	A	C	A	C	A
	<i>Convolvulus graminetin</i>	Bind weed	Convolvulaceae							0.1	20
*	<i>Conyza bonariensis</i>	Flaxleaf Fleabane	Asteraceae								
*	<i>Cucumis myriocarpus</i>	Camel Melon	Cucuritaceae								
	<i>Desmodium varians</i>	Slender Tick-trefoil	Fabaceae (Faboideae)								
	<i>Dichopogon stricta</i>	Chocolate lily	Anthericaceae			.1	1				
	<i>Desmodium varians</i>	Slender Tick-trefoil	Fabaceae (Faboideae)			.5	15				
	<i>Dysphania pumilio</i>	Black Crumbweed	Chenopodiaceae	.1	1	.1	2				
*	<i>Echium plantagineum</i>	Patterson's Curse	Boraginaceae	.5	100			10	50		
*	<i>Epilobium spp.</i>		Onagraceae								
*	<i>Erodium spp.</i>	Crowfoot	Geraniaceae					0.2	30		
	<i>Euchiton spp.</i>	A Cudweed	Asteraceae								
	<i>Euphorbia drummondii</i>	Caustic weed	Euphorbiaceae			.1	5	0.1	1		
	<i>Goodenia macbarronii</i>	Narrow Goodenia	Goodeniaceae								
	<i>Goodenia gracilis</i>	Goodenia	Goodeniaceae					0.1	5		
*	<i>Hypochaeris radicata</i>	Catsear	Asteraceae							0.1	10
*	<i>Lactuca serriola</i>	Prickly Lettuce	Asteraceae	.1	3						

	Scientific Name	Common Name	Family	EPBC 1		EPBC 2I		3A		3B	
				C	A	C	A	C	A	C	A
*	<i>Lepidium africanum</i>	Common Peppergrass	Brassicaceae	.1	5	.1	2			0.1	3
*	<i>Lysimachia arvensis</i>	Scarlet Pimpernel	Myrsinaceae								
	<i>Lythrum hyssopifolia</i>	Hyssop Loosestrife	Lythraceae					0.2	20		
*	<i>Malva parviflora</i>	Small-flowered Mallow	Malvaceae								
	<i>Oxalis perennans</i>		Oxalidaceae	2		.1	5			0.1	1
	<i>Persicaria decipiens</i>	Slender Knotweed	Polygonaceae								
*	<i>Plantago lanceolata</i>	Lamb's Tongues	Plantaginaceae	1	100			4	50		
*	<i>Polygonum aviculare</i>	Wireweed	Polygonaceae	.1	1						
	<i>Pseudognaphalium luteoalbum</i>	Jersey Cudweed	Asteraceae					0.1	2		
*	<i>Romulea rosea</i>	Onion Grass	Iridaceae					0.1	1000		
	<i>Rumex brownii</i>	Swamp Dock	Polygonaceae			.1	1			0.1	6
*	<i>Rumex crispus</i>	Curled Dock	Polygonaceae	.1	6						
*	<i>Salvia verbenaca</i>	Vervain	Lamiaceae			.2				0.1	20
	<i>Sida cunninghamii</i>	Ridge Sida	Malvaceae	.1	2	.2	20				
*	<i>Solanum elaeagnifolium</i>	Silver-leaved Nightshade	Solanaceae	30				0.1	1		
*	<i>Solanum spp.</i>		Solanaceae								



	Scientific Name	Common Name	Family	EPBC 1		EPBC 2I		3A		3B	
				C	A	C	A	C	A	C	A
*	<i>Sonchus oleraceus</i>	Sow Thistle	Asteraceae					0.1	10		
*	<i>Sonchus sp</i>	Sow Thistle	Asteraceae								
*	<i>Taraxacum officinale</i>	dandelion	Asteraceae							0.5	20
*	<i>Trifolium arvense</i>	Haresfoot Clover	Fabaceae (Faboideae)					0.1	10		
*	<i>Trifolium spp.</i>	A Clover	Fabaceae (Faboideae)					0.1	10		
*	<i>Verbena sp</i>	Purpletop	Verbenaceae								
	<i>Wahlenbergia sp</i>	Bluebell	Campanulaceae			.2	50			0.1	10
	<i>Unidentified forb</i>					.2	8				
GRASS AND GRASS LIKE											
	<i>Anthosachne scabra</i>	Native wheat	Poaceae	.1	2	.1	2				
	<i>Austrostipa blackii</i>		Poaceae								
	<i>Austrostipa scabra</i>	Speargrass	Poaceae								
	<i>Austrostipa aristiglumis</i>	Spear Grass	Poacea			30	300			0.3	9
*	<i>Avena fatua</i>	Wild Oats	Poaceae	10							
	<i>Bothriochloa macra</i>	Red Grass	Poaceae					8	800	0.1	1
*	<i>Briza minor</i>	Shivery Grass	Poaceae								
*	<i>Bromus catharticus</i>	Praire Grass	Poaceae								

	Scientific Name	Common Name	Family	EPBC 1		EPBC 2I		3A		3B	
				C	A	C	A	C	A	C	A
*	<i>Bromus diandrus</i>	Great Brome	Poaceae								
*	<i>Bromus hordeaceus</i>	Soft Brome	Poaceae								
*	<i>Bromus sp</i>		Poacea			20				0.1	20
	<i>Chloris truncata</i>	Windmill Grass	Poaceae	.2							
	<i>Cynodon dactylon</i>	Common Couch	Poaceae			.1	10	2	10		
*	<i>Eragrostic minor</i>		Poacea			.1	5				
	<i>Eragrostis spp.</i>	A Lovegrass	Poaceae					0.1	5		
*	<i>Lolium perenne</i>	Perennial Ryegrass	Poaceae								
*	<i>Lolium rigidum</i>	Wimmera Ryegrass	Poaceae								
*	<i>Lolium sp</i>	Ryegrass	Poaceae			10				40	1000
*	<i>Panicum capillare</i>	Witchgrass	Poaceae	20		10		10	50		
*	<i>Paspalum dilatatum</i>	Paspalum	Poaceae			.1	2	10	30		
*	<i>Phalaris aquatica</i>	Phalaris	Poaceae								
*	<i>Phalaris sp</i>		Poaceae	25							
	<i>Phragmites australis</i>		Poaceae								
	<i>Poa labillardierei</i>	Tussock	Poaceae								
*	<i>Romulea rosea</i>	Onion Grass	Iridaceae							0.1	20

	Scientific Name	Common Name	Family	EPBC 1		EPBC 2I		3A		3B	
				C	A	C	A	C	A	C	A
	<i>Rytidosperma spp.</i>	Wallaby Grass	Poaceae	20	500	1	30			0.1	1
*	<i>Vulpia myuros</i>	Rat's Tail Fescue	Poaceae								
GRAMINOIDS											
	<i>Carex appressa</i>	Tall Sedge	Cyperaceae								
	<i>Carex inversa</i>	Knob Sedge	Cyperaceae	.1							
*	<i>Cyperus eragrostis</i>	Umbrella Sedge	Cyperaceae								
	<i>Juncus spp.</i>	A Rush	Juncaceae								
	<i>Juncus subsecundus</i>	Finger Rush	Juncaceae								
	<i>Lomandra filiformis</i>	Wattle Matt-rush	Lomandraceae			5.5	400			0.3	400



## APPENDIX B Paddock TREES

ID	Species	DBH (cm)	Hollows Present	PCT	Paddock Tree Class	Ecosystem Credits
17	Grey Box	80	No	76	3	0.75
5	Grey Box	90	No	76	3	0.75
9	Grey Box	0	No	76	3	0.75
32	Grey Box	0	No	76	3	0.75
14	Grey Box	90	Yes	76	3	1
15	Grey Box	115	Yes	76	3	1
48	Grey Box	120	Yes	76	3	1
37	Grey Box	100	Yes	76	3	1
7	Grey Box	120	Yes	76	3	1
50	Grey Box	100	Yes	76	3	1
12	Grey Box		Yes	76	3	1
31	Grey Box	1	Yes	76	3	1
35	Grey Box	0	Yes	76	3	1
36	Grey Box	0	Yes	76	3	1
44	Grey Box	0	Yes	76	3	1
79	Grey Box	110	Yes	76	3	1
61	Grey Box	100	Yes	76	3	1
3	Grey Box	90	Yes	76	3	1
52	Yellow Box	70	No	277	3	0.75
56	Yellow Box	150	No	277	3	0.75
75	Grey Box	200	No	277	3	0.75
69	Grey Box	95	No	277	3	0.75
101	Grey Box	300	No	277	3	0.75
103	Grey Box	98	No	277	3	0.75
117	Yellow Box	85	No	277	3	0.75
110	Yellow Box	200	No	277	3	0.75
112	Yellow Box	100	No	277	3	0.75
21	CHECK	0	No	277	3	0.75
11	Grey Box	0	No	277	3	0.75
58	Yellow Box	150	Yes	277	3	1
67	Grey Box	150	Yes	277	3	1
70	Grey Box	90	Yes	277	3	1
72	grey Box	100	Yes	277	3	1

ID	Species	DBH (cm)	Hollows Present	PCT	Paddock Tree Class	Ecosystem Credits
54	Yellow Box	150	Yes	277	3	1
133	Grey Box		Yes	277	3	1
134	Grey Box		Yes	277	3	1
13	Grey Box		Yes	277	3	1
135	Grey Box		Yes	277	3	1
82	Grey Box	95	Yes	277	3	1
83	Yellow Box	100	Yes	277	3	1
84	Grey Box	70	Yes	277	3	1
74	Grey Box	100	Yes	277	3	1
93	Grey Box	150	Yes	277	3	1
94	White Box	89	Yes	277	3	1
95	Grey Box	80	Yes	277	3	1
97	Grey Box	120	Yes	277	3	1
85	Grey Box	200	Yes	277	3	1
86	Grey Box	110	Yes	277	3	1
87	Grey Box	210	Yes	277	3	1
92	Grey Box	180	Yes	277	3	1
104	Grey Box	80	Yes	277	3	1
106	Grey Box	98	Yes	277	3	1
107	Grey Box	200	Yes	277	3	1
108	White Box	200	Yes	277	3	1
98	River Red Gum	100	Yes	277	3	1
100	Blakelys Red Gum	150	Yes	277	3	1
118	Grey Box	110	Yes	277	3	1
119	Grey Box	120	Yes	277	3	1
122	Blakelys Red Gum	80	Yes	277	3	1
109	Grey Box	150	Yes	277	3	1
116	Blakelys Red Gum	110	Yes	277	3	1
123	Blakelys Red Gum	90	Yes	277	3	1
125	Blakelys Red Gum	300	Yes	277	3	1
129	Grey Box	130	Yes	277	3	1

## APPENDIX C FAUNA SPECIES

Common Name	Scientific Name	Habitat	Coordinates
Australian Pelican	<i>Pelicanus conspicillatus</i>	Farm dam	
Little Pied Cormorant (in vicinity)	<i>Microcarbo melanoleucos</i>	Farm dam	
Red-capped Plover	<i>Charadrius ruficapillus</i>	Mudflats around farm dam	E 494973 N 6048587 GDA94 Z55
Black-fronted Dotterel	<i>Eseyornis melanops</i>	Mudflats around farm dam	E 494973 N 6048587 GDA94 Z55
Spur-winged Plover	<i>Vanellus miles</i>	Mudflats around farm dam	
Australian Wood Duck	<i>Chenonetta jubata</i>	Farm dams	
Grey Teal	<i>Anas gracilis</i>	Farm dams	
Pacific Black Duck	<i>Anas superciliosa</i>	Farm dams	
White-faced Heron	<i>Egretta novaehollandiae</i>	Drainage channel	
Yellow-billed Spoonbill (in vicinity)	<i>Platalea flavipes</i>	Farm dam	
Straw-necked Ibis	<i>Threskiornis spinicollis</i>	Farmland	
Wedge-tailed Eagle	<i>Aquila audax</i>	At height over farmland	E498738 N6051889 GDA94 Z55
Nankeen Kestrel	<i>Falco cenchroides</i>	At height over farmland	
Tawny Frogmouth	<i>Podargus strigoides</i>	Remnant roadside woodland	
Galah	<i>Eolophus roseicapilla</i>	Farmland and woodland	
Sulphur-crested Cockatoo	<i>Cacatua galerita</i>	Farmland	
Eastern Rosella	<i>Platycercus eximius</i>	Farmland and woodland	
Red-rumped Parrot	<i>Psephotus haematonotus</i>	Farmland	
Crested Pigeon	<i>Ocyphaps lophotes</i>	Remnant roadside woodland	
Laughing Kookaburra	<i>Dacelo novaeguineae</i>	Remnant riparian woodland	
Welcome Swallow	<i>Hirundo neoxena</i>	Farm sheds	
Martin sp.	<i>Petrochelidon sp.</i>	Remnant riparian woodland	



Common Name	Scientific Name	Habitat	Coordinates
<b>Yellow-rumped Thornbill</b>	<i>Acanthiza chrysorrhoa</i>	Farmland	
<b>Superb Blue Wren</b>	<i>Malurus cyaneus</i>	Farmland and woodland	
<b>White-plumed Honeyeater</b>	<i>Ptilotula penicillata</i>	Farmland and woodland	
<b>Noisy Miner</b>	<i>Manorina melanocephala</i>	Remnant roadside woodland	
<b>White-throated Treecreeper</b>	<i>Cormobates leucophaea</i>	Remnant riparian woodland	
<b>Brown Treecreeper</b>	<i>Climacteris picumnus</i>	Remnant riparian and roadside woodland	E498198 N6046934 GDA94 Z55 1 heard E494770 N6047911 GDA94 Z55 1 heard
<b>Black-faced Cuckoo-shrike</b>	<i>Coracina novaehollandiae</i>	Remnant riparian woodland	
<b>Pied Currawong</b>	<i>Strepera graculina</i>	Farmland	
<b>Pied Butcherbird</b>	<i>Cracticus nigrogularis</i>	Farmland	
<b>Australian Magpie</b>	<i>Cracticus tibicen</i>	Farmland	
<b>White-winged Chough</b>	<i>Corcorax melanorhamphos</i>	Remnant roadside woodland	
<b>Australian Raven</b>	<i>Corvus coronoides</i>	Farmland	
<b>Little Raven</b>	<i>Corvus mellori</i>	Farmland	
<b>Peewee</b>	<i>Grallina cyanoleuca</i>	Farmland	
<b>Restless Flycatcher</b>	<i>Myiagra inquieta</i>	Remnant riparian woodland	E494952 N6046934 GDA94 Z55
<b>Willie Wagtail</b>	<i>Rhipidura leucophrys</i>	Farmland	
<b>Flame Robin</b>	<i>Petroica phoenicea</i>	Farmland	E495913 N6047771 GDA94 Z55 2 M 1 F E498363 N 6048147 GDA94 Z55 1 M 1 F E498967 N6051586 GDA94 Z55

Common Name	Scientific Name	Habitat	Coordinates
<b>Grey Shrike-thrush</b>	<i>Colluricincla harmonica</i>	Remnant woodland riparian	
<b>Brown Songlark</b>	<i>Cincloramphus cruralis</i>	Farmland	
<b>Australian Pipit</b>	<i>Anthus australis</i>	Farmland	
<b>*Common Starling</b>	<i>Sturnus vulgaris</i>	Farmland	
<b>Common Brushtail Possum</b>	<i>Trichosurus vulpecula</i>	Remnant woodland riparian	
<b>Common Ringtail Possum</b>	<i>Pseudocheirus peregrinus</i>	Remnant woodland riparian	
<b>Eastern Grey Kangaroo</b>	<i>Macropus giganteus</i>	Farmland	
<b>*Red Fox</b>	<i>Vulpes vulpes</i>	Farmland	
<b>White-striped Mastiff-bat</b>	<i>Austronomus australis</i>	Farmland	
<b>Eastern Sign-bearing Froglet</b>	<i>Crinia parinsignifera</i>	Farm dams	

## APPENDIX D PROTECTED MATTERS SEARCH RESULTS



## APPENDIX E EPBC SPECIES HABITAT ASSESSMENT

The tables in this appendix present the habitat evaluation for threatened species, ecological communities and endangered populations listed from the EPBC Act Protected Matters Report.

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

### **Presence of habitat:**

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

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

### **Likelihood of occurrence**

Unlikely: Species known or predicted within the locality but unlikely to occur in the study area

Possible: Species could occur in the study area

Present: Species was recorded during the field investigations

### **Possible to be impacted**

No: The proposal would not impact this species or its habitats. No further assessment would be necessary at this stage of the project.

Yes: The proposal could impact this species or its habitats. Further investigation into the likelihood and consequence of the impact of the proposal on these species would be considered under the EPBC Act for the EIS.

## F.1 FLORA SPECIES

	Habitat requirements	Presence Of habitat	Likelihood Of occurrence	Potential Impact
<b>Flora</b>				
<i>Ammobium craspediodes</i> Yass Daisy EPBC- V BC-	Found in moist or dry forest communities, Box-Gum Woodland and secondary grassland derived from clearing of these communities. Grows in association with a large range of eucalypts <i>Eucalyptus blakelyi</i> , <i>E. bridgesiana</i> , <i>E. dives</i> , <i>E. goniocalyx</i> , <i>E. macrorhyncha</i> , <i>E. mannifera</i> , <i>E. melliadora</i> , <i>E. polyanthemos</i> , <i>E. rubida</i> . Found from near Crookwell on the Southern Tablelands to near Wagga Wagga on the South Western Slopes. Most populations are in the Yass region.	<b>Present</b>  Box-Gum Woodland and derived grasslands occur within the development site	<b>Unlikely</b>  Understory highly degraded from intense grazing and cropping. Species was not identified during vegetation surveys.	<b>No</b>  No suitable habitat would be impacted by the proposal
<i>Amphibromus fluitans</i> River Swamp Wallaby Grass EPBC – V BC - V IBRA Sub-region: Inland Slopes, Lower Slopes	<i>Amphibromus fluitans</i> grows mostly in permanent swamps. The species needs wetlands which are at least moderately fertile and which have some bare ground, conditions which are produced by seasonally-fluctuating water levels. Habitats in south-western NSW include swamp margins in mud, dam and tank beds in hard clay and in semi-dry mud of lagoons with <i>Potamogeton</i> and <i>Chamaeraphis</i> species. Flowering time is from spring to autumn or November to March. Disturbance regimes are not known, although the species requires periodic flooding of its habitat to maintain wet conditions. Wetlands inhabited by this species that are converted to deep, permanent dams are unsuitable for continued habitation by this species. The species has shown a level of resistance to salinization of habitat in experimental tests. Has been observed covering several hectares	<b>Absent</b>  No permanent swamps or waterbodies with vegetation in study area.	<b>Unlikely</b>  Species was not detected during vegetation surveys	<b>No</b>  No suitable habitat would be impacted by the proposal.

	Habitat requirements	Presence Of habitat	Likelihood Of occurrence	Potential Impact
	in area. The species is also recorded as occasional to common in populations.			
<i>Brachyscome muelleroides</i> Mueller Daisy EPBC - V	The species occurs in seasonally wet depressions in the landscape and appears to rely on seasonal inundation to survive.	<b>Absent</b>  No permanent swamps or waterbodies with vegetation in study area.	<b>Unlikely</b>  Species was not detected during vegetation surveys	<b>No</b>  No suitable habitat would be impacted by the proposal.
<i>Caladenia arenaria</i> Sand-hill Spider Orchid EPBC – E BC – E IBRA Sub-region: Inland Slopes, Lower Slopes	Found mostly on the south west plains and western south west slopes. The Sand-hill Spider Orchid is currently only known to occur in the Riverina between Urana and Narranderra. Occurs in woodland with sandy soil, especially that's dominated by White Cypress Pine ( <i>Callitris glaucophylla</i> ). Many of the associated species in the understorey are different at each of the populations, or are species that are widespread and occur in a range of habitats. It is apparent that <i>C. arenaria</i> has fairly broad habitat tolerances, occurring in <i>Callitris glaucophylla</i> - <i>Eucalyptus melliodora</i> (Yellow Box) woodlands, <i>Callitris glaucophylla</i> – <i>Allocasuarina luehmannii</i> woodlands and woodlands dominated by a mixture of <i>Callitris glaucophylla</i> , <i>E. dwyeri</i> (Dwyer's Redgum) and <i>Acacia doratoxylon</i> (Currawang). Soils vary from skeletal soils over sandstone to clay loams.	<b>Absent</b>  No sandy soils or White Cypress Pine within development site	<b>Unlikely</b>  Understorey highly degraded from intense grazing and cropping. Associated white Cypress absent from development site.	<b>No</b>  No suitable habitat would be impacted by the proposal.
<i>Swainsona recta</i> Small Purple-pea	Occurs in grassland and open woodland, often on stony hillsides, dominated by one or more of the following: <i>Callitris endichleri</i> , <i>C. glaucophylla</i> , <i>Eucalyptus blakelyi</i> , <i>E. bridgesiana</i> , <i>E. dives</i> , <i>E. melliodora</i> , <i>E. microcarpa</i> , <i>E. nortonii</i> and <i>E. polyanthemus</i> . Requires a forb-rich grassy	<b>Present</b>  Woodland present but understorey	<b>Possible</b>  Species assumed present in areas	<b>Yes</b>  AoS Required



	Habitat requirements	Presence Of habitat	Likelihood Of occurrence	Potential Impact
EPBC – E BC – E IBRA Sub-region: Inland Slopes, Lower Slopes	groundlayer dominated by <i>Themeda triandra</i> , <i>Poa sieberiana</i> var. <i>sieberiana</i> or <i>Austrostipa</i> spp. Resprouts in autumn and winter from a woody root. It flowers in spring, peaking over two to three weeks in October.	heavily grazed and degraded in most areas.	where native understorey is present.	
<i>Prasophyllum petilum</i> Tarengo Leek Orchid EPBC – E BC – E IBRA Sub-region: Inland Slopes	The flower-spike emerges in mid spring to early summer from a hole near the base of the leaf. Natural populations are known from a total of four sites in NSW: Boorowa, Captains Flat, Ilford and Delegate. Also occurs at Hall in the Australian Capital Territory. Grows in patchy woodland in fertile soils. Grows in open sites within Natural Temperate Grassland at the Boorowa and Delegate sites. Also grows in grassy woodland in association with River Tussock <i>Poa labillardieri</i> Black Gum <i>Eucalyptus aggregata</i> and tea-trees <i>Leptospermum</i> spp. at Captains Flat and within the grassy groundlayer dominated by Kangaroo Grass under Box-Gum Woodland at Ilford (and Hall, ACT). Apparently highly susceptible to grazing, being retained only at little-grazed travelling stock reserves (Boorowa & Delegate) and in cemeteries (Captains Flat, Ilford and Hall). Co-occurring species include <i>Pentapogon quadrifidus</i> , <i>Schoenus apogon</i> , <i>Drosera peltata</i> , <i>Sebaea ovata</i> and <i>Haloragis heterophylla</i> .	<b>Present</b>  Woodland present but understorey heavily grazed and degraded in most areas	<b>Unlikely</b>  Species was not detected during vegetation surveys	<b>No</b>  No suitable habitat would be impacted by the proposal.
<i>Prasophyllum validum</i> Sturdy Leek-orchid EPBC – V	The Sturdy Leek-orchid tends to grow in drier woodland habitats, generally with a low sparse understorey. In Victoria, it occurs in box and box-ironbark woodland with overstorey trees including <i>Eucalyptus polyanthemus</i> , <i>Eucalyptus albens</i> , <i>Eucalyptus macrorhyncha</i> , <i>Eucalyptus viminalis</i> and <i>Callitris glaucophylla</i> , and an open grassy to sparsely shrubby understorey including <i>Themeda triandra</i> , <i>Joycea pallida</i> , <i>Arthropodium</i>	<b>Absent</b>  Species absent from species candidate list generated from Biodiversity Assessment	<b>Unlikely</b>  Species was not detected during vegetation surveys	<b>No</b>  No suitable habitat would be impacted by the proposal.

	Habitat requirements	Presence Of habitat	Likelihood Of occurrence	Potential Impact
IBRA Sub-region: Inland Slopes	strictum, <i>Acacia verniciflua</i> , <i>Bursaria spinosa</i> , <i>Grevillea alpine</i> and <i>Grevillea dryophylla</i> . Soils vary from heavy clays to sandy loams.	Methodology Calculator		
EEC				
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland BC – E EPBC – CE IBRA Sub-region: Inland Slopes, Lower Slopes	Characterised by the presence or prior occurrence of White Box, Yellow Box and/or Blakely's Red Gum.  The trees may occur as pure stands, mixtures of the three species or in mixtures with other trees, including wattles.	<b>Present</b>  Characteristic tree species present in development site	<b>Likely</b>  Development site within known distribution	<b>Yes</b>  Assessment against EPBC Vegetation threshold required
Grey Box ( <i>Eucalyptus microcarpa</i> ) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia EPBC- E IBRA Sub-region: Inland Slopes	Generally occurs in landscapes of low-relief such as flat to undulating plains, low slopes and rises and, to a lesser extent, drainage depressions and flats. The tree canopy is dominated ( $\geq 50\%$ canopy crown cover) by <i>Eucalyptus microcarpa</i> (Grey Box). Widespread associated tree species that may be present include: <i>Allocasuarina luehmannii</i> (Buloke), <i>Brachychiton populneus</i> (Kurrajong), <i>Callitris glaucophylla</i> (White Cypress Pine), <i>Eucalyptus albens</i> (White Box), <i>E. camaldulensis</i> (River Red Gum), <i>E. conica</i> (Fuzzy Box), <i>E. leucoxylon</i> (Yellow Gum, SA Blue Gum), <i>E. melliodora</i> (Yellow Box) and <i>E. populnea</i> (Bimble Box, Poplar Box). The ground layer also is highly variable in development and composition, ranging from almost absent to mostly grassy to forb-rich. Derived grasslands are a special state of the ecological community, whereby the canopy and mid	<b>Present</b>  Characteristic tree species present in development site	<b>Likely</b>  Development site within known distribution	<b>Yes</b>  Assessment against EPBC Vegetation threshold required

	Habitat requirements	Presence Of habitat	Likelihood Of occurrence	Potential Impact
	layers have been mostly removed to <10% crown cover but the native ground layer remains largely intact, with 50% or more of the total vegetation cover being native.			
Weeping Myall Woodlands EPBC – E	The Weeping Myall Woodlands occurs on the inland alluvial plains west of the Great Dividing Range in NSW and Queensland, with one small outlying patch in northern Victoria.. Occurs in a range from open woodlands to woodlands, generally 4-12 m high, in which Weeping Myall ( <i>Acacia pendula</i> ) trees are the sole or dominant overstorey species Weeping Myall trees often occur in monotypic stands, however other vegetation may also occur in the ecological community, though not as dominant species. These include: Western Rosewood ( <i>Alectryon oleifolius</i> subsp. <i>elongatus</i> ); Poplar Box ( <i>Eucalyptus populnea</i> ); or Black Box ( <i>Eucalyptus largiflorens</i> ). Grey Mistletoe ( <i>Amyema quandang</i> ) commonly occurs on the branches of Weeping Myall trees throughout the ecological community's range.	<b>Absent</b>  No Weeping Myall ( <i>Acacia pendula</i> ) in study area.	<b>Unlikely</b>  No suitable habitat present.	<b>No</b>  No suitable habitat would be impacted by the proposal.



## F.1 FAUNA SPECIES

Species	Habitat requirements	Presence of habitat	Likelihood of occurrence	Potential impact
Fauna				
<b>Aves</b>				
<i>Anthochaera phrygia</i> Regent Honeyeater BC - CE EPBC – CE IBRA Sub-region: Inland Slopes, Lower Slopes	A semi-nomadic species occurring in temperate eucalypt woodlands and open forests. Most records are from box-ironbark eucalypt forest associations and wet lowland coastal forests (NPWS, 1999 177 /id)(Pizzey, 1997). A semi-nomadic species occurring in temperate eucalypt woodlands and open forests. Most records are from box-ironbark eucalypt forest associations and wet lowland coastal forests (NPWS, 1999 177 /id)(Pizzey, 1997).	<b>Present</b> River Red Gum Forests and Box-Gum Woodland present in development site	<b>Unlikely</b> Species was not detected during fauna surveys	<b>Yes</b> AoS required
<i>Botaurus poiciloptilus</i> Australasian Bittern EPBC – E BC - E IBRA Sub-region: Inland Slopes, Lower Slopes	In NSW, this species occurs along the coast and is frequently recorded in the Murray-Darling Basin, notably in floodplain wetlands of the Murrumbidgee, Lachlan, Macquarie and Gwydir Rivers. Occurs in permanent freshwater wetlands with tall, dense vegetation. Favours permanent and seasonal freshwater habitats, particularly those dominated by sedges, rushes and/or reeds (e.g. <i>Phragmites</i> , <i>Cyperus</i> , <i>Eleocharis</i> , <i>Juncus</i> , <i>Typha</i> , <i>Baumea</i> , , <i>Bolboschoenus</i> ) or cutting grass ( <i>Gahnia</i> ) growing over muddy or peaty substrate. Hides during the day amongst dense reeds or rushes and feed mainly at night on frogs, fish, yabbies, spiders, insects and snails.	<b>Absent</b> No permanent wetlands in study area.	<b>Unlikely</b> No suitable habitat present.	<b>No</b> No suitable habitat would be impacted by the proposal.

Species	Habitat requirements	Presence of habitat	Likelihood of occurrence	Potential impact
<i>Calidris ferruginea</i> Curlew Sandpiper EPBC – CE BC - E IBRA Sub-region: Inland Slopes, Lower Slopes	Curlew Sandpipers mainly occur on intertidal mudflats in sheltered coastal areas, such as estuaries, bays, inlets and lagoons, and also around non-tidal swamps, lakes and lagoons near the coast, and ponds in saltworks and sewage farms. They are also recorded inland, though less often, including around ephemeral and permanent lakes, dams, waterholes and bore drains, usually with bare edges of mud or sand. They occur in both fresh and brackish waters. Curlew Sandpipers generally roost on bare dry shingle, shell or sand beaches, sandspits and islets in or around coastal or near-coastal lagoons and other wetlands, occasionally roosting in dunes during very high tides and sometimes in saltmarsh. This species does not breed in Australia. This species forages mainly on invertebrates, including worms, molluscs, crustaceans, and insects, as well as seeds.	<b>Absent</b>  No permanent wetlands in study area.	<b>Unlikely</b>  No suitable habitat present.	<b>No</b>  No suitable habitat would be impacted by the proposal.
<i>Hirundapus caudacutus</i> White-throated Needletail EPBC – V	This migratory terrestrial species occurs in Australia from late spring to early autumn. Found across a range of habitats more often over woodland areas, where it is almost exclusively aerial. Large tracts of native vegetation may be a key habitat requirement for this species. Found to roost in tree hollows in tall trees on ridge-tops, on bark or rock faces	<b>Present</b>  Some paddock trees and native vegetation patches are present in the study area	<b>Unlikely</b>  Species was not detected during fauna surveys	<b>No</b>  No suitable habitat would be impacted by the proposal.
<i>Polytelis swainsonii</i> Superb Parrot EPBC - V BC – V	The Superb Parrot is found throughout eastern inland NSW. On the South-western Slopes their core breeding area is roughly bounded by Cowra and Yass in the east, and Grenfell, Cootamundra and Coolac in the west. Birds breeding in this region are mainly absent during winter, when they migrate north to the region of the upper Namoi and Gwydir Rivers. Inhabits Box-Gum, Box-Cypress-pine and Boree Woodlands and River Red Gum Forest.	<b>Present</b>  Box-Gum Woodland, River Red Gum Forest patches present in study area.	<b>Possible</b>  Known records within 10 km of development site.	<b>Yes</b>  AoS required

Species	Habitat requirements	Presence of habitat	Likelihood of occurrence	Potential impact
IBRA Sub-region: Inland Slopes, Lower Slopes				
<i>Rostratula australis</i> Australian Painted Snipe BC - E EPBC – E IBRA Sub-region: Inland Slopes, Lower Slopes	Little is known of the ecology, habitat requirements and reproductive biology of Australian Painted Snipe. They feed in shallow water or at the waters' edge and on mudflats, taking seeds and invertebrates such as insects, worms, molluscs and crustaceans. Females, which are larger and more brightly coloured than males, are thought to sometimes be polyandrous, mating with several males and leaving each one to incubate and raise chicks. Inhabits inland and coastal shallow freshwater wetlands. The species occurs in both ephemeral and permanent wetlands, particularly where there is a cover of vegetation, including grasses, Lignum and Samphire. Individuals have also been known to use artificial habitats, such as sewage ponds, dams and waterlogged grassland. Nests on the ground amongst tall vegetation, such as grass tussocks or reeds. Forages nocturnally on mud flats and in shallow water. Breeding is often in response to local conditions; generally, occurs from September to December.	<b>Absent</b>  No mudflats in study area.	<b>Unlikely</b>  No suitable habitat present.	<b>No</b>  No suitable habitat would be impacted by the proposal.
<i>Grantiella picta</i> Painted Honeyeater BC – V EPBC – V IBRA Sub-region: Inland Slopes, Lower Slopes	The greatest concentrations of the bird and almost all breeding occurs on the inland slopes of the Great Dividing Range in NSW, Victoria and southern Queensland. During the winter it is more likely to be found in the north of its distribution. Inhabits Boree, Brigalow and Box-Gum Woodlands and Box-Ironbark Forests. A specialist feeder on the fruits of mistletoes growing on woodland eucalypts and acacias. Prefers mistletoes of the genus <i>Amyema</i> . Insects and nectar from mistletoe or eucalypts are occasionally eaten. Nest from spring to autumn in a small, delicate nest hanging within the outer canopy of drooping eucalypts, she-oak, paperbark or mistletoe branches.	<b>Present</b>  Associated vegetation types of Box-Gum Woodland present in development sites	<b>Possible</b>  Development site within known distribution	<b>Yes</b>  AoS required



Species	Habitat requirements	Presence of habitat	Likelihood of occurrence	Potential impact
<i>Lathamus discolor</i> Swift Parrot EPBC – CE IBRA Sub-region: Inland Slopes, Lower Slopes	Breeds in Tasmania during spring and summer, migrating in the autumn and winter months to south-eastern Australia from Victoria and the eastern parts of South Australia to south-east Queensland. In NSW mostly occurs on the coast and south west slopes. On the mainland they occur in areas where eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations. Favoured feed trees include winter flowering species such as Swamp Mahogany <i>Eucalyptus robusta</i> , Spotted Gum <i>Corymbia maculata</i> , Red Bloodwood <i>C. gummifera</i> , Mugga Ironbark <i>E. sideroxylon</i> , and White Box <i>E. albens</i> . Commonly used lerp infested trees include Grey Box <i>E. microcarpa</i> , Grey Box <i>E. moluccana</i> and Blackbutt <i>E. pilularis</i> and Yellow Box <i>E. melliodora</i> . Return to home foraging sites on a cyclic basis depending on food availability.	<b>Present</b>  Feed trees of Yellow Box present in development site	<b>Possible</b>  Development site within known distribution. May forage in development site on occasion.	<b>Yes</b>  AoS required
<i>Numenius madagascariensis</i> Eastern Curlew, Far Eastern Curlew EPBC – CE	The Eastern Curlew is most commonly associated with sheltered coasts, especially estuaries, bays, harbours, inlets and coastal lagoons, with large intertidal mudflats or sandflats, often with beds of seagrass. The Eastern Curlew mainly forages on soft sheltered intertidal sandflats or mudflats, open and without vegetation or covered with seagrass, often near mangroves, on saltflats and in saltmarsh, rockpools and among rubble on coral reefs, and on ocean beaches near the tideline. The Eastern Curlew roosts on sandy spits and islets, especially on dry beach sand near the high-water mark, and among coastal vegetation including low saltmarsh or mangroves. It occasionally roosts on reef-flats, in the shallow water of lagoons and other near-coastal wetlands.	<b>Absent</b>  Study area is not within coastal landforms.	<b>Unlikely</b>  No suitable habitat present.	<b>No</b>  No suitable habitat would be impacted by the proposal.
<b>Mammals</b>				
<i>Dasyurus maculatus maculatus</i> (SE)	Tiger Quolls are found in a range of forest habitats, from rainforest to open forest, coastal heath and inland riparian forest. They require forest with suitable den sites such as rock crevices, small caves, rocky-cliff faces, hollow logs,	<b>Absent</b>  No forests, rock crevices, caves,	<b>Unlikely</b>  No suitable habitat present.	<b>No</b>  No suitable habitat would be

Species	Habitat requirements	Presence of habitat	Likelihood of occurrence	Potential impact
<i>mainland population)</i> Spotted-tailed Quoll BC - V EPBC – E IBRA Sub-region: Inland Slopes, Lower Slopes	burrows and tree hollows. The Tiger Quoll has a large home range and can cover considerable distances (more than 6km) overnight. It is largely nocturnal and solitary.	cliff faces in study area. Very few hollow logs.		impacted by the proposal.
<i>Nyctophilus corbeni</i> Corben's Long-eared Bat, South-eastern Long-eared Bat EPBC – V BC - V IBRA Sub-region: Inland Slopes, Lower Slopes	Corben's Long-eared Bat occurs from the south eastern side of the Murray Darling Basin with the Pilliga Scrub region being the distinct stronghold for this species. The Species inhabits a variety of vegetation types, including mallee, bullocke <i>Allocasuarina leuhmanni</i> and box eucalypt dominated communities, but it is distinctly more common in box/ironbark/cypress-pine vegetation that occurs in a north-south belt along the western slopes and plains of NSW and southern Queensland. The species roosts in tree hollows, crevices, and under loose bark, and breeds in autumn with one or two young born in late spring to early summer.	<b>Present</b> Hollow-bearing trees in study area.	<b>Possible</b> Study area within known distribution of species.	<b>Yes</b> AoS Undertaken
<i>Pteropus poliocephalus</i> Grey-headed Flying-fox	Grey-headed Flying-foxes are found within 200 km of the eastern coast of Australia, from Bundaberg in Queensland to Melbourne in Victoria. Occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are generally located within 20 km of a regular food source, often in	<b>Absent</b> No riparian rainforest, gullies or vegetation with dense	<b>Unlikely</b> No breeding camps in development site. suitable habitat present.	<b>No</b> No suitable habitat would be impacted by the proposal.

Species	Habitat requirements	Presence of habitat	Likelihood of occurrence	Potential impact
EPBC – V IBRA Sub-region: Inland Slopes, lower slopes	stands of riparian rainforest, Paperbark or Casuarina forest, and are commonly found in gullies, close to water, or in vegetation with a dense canopy. Forage on the nectar and pollen of native trees, in particular <i>Eucalyptus</i> , <i>Melaleuca</i> and <i>Banksia</i> , and fruits of rainforest trees and vines. Travel up to 50 km to forage. Annual mating commences in January and a single young is born each October or November. Site fidelity to camps is high with some camps being used for over a century.	canopies, in study area.		
<i>Phascolarctos cinereus</i> <i>Koala</i> BC - V EPBC - V IBRA Sub-region: Inland Slopes, Lower Slopes	Occurs in eastern Australia, from north-eastern Queensland to south-eastern South Australia and to the west of the Great Dividing Range. In NSW it mainly occurs on the central and north coasts with some populations in the western region. It was historically abundant on the south coast of NSW, but now occurs in sparse and possibly disjunct populations. The koala inhabits a range of eucalypt forest and woodland communities, including coastal forests, the woodlands of the tablelands and western slopes, and the riparian communities of the western plains.	<b>Present</b>  Eucalypt Woodlands in study area.	<b>Possible</b>  Suitable habitat present.	<b>No</b>  See EPBC Koala habitat assessment
<b>Amphibians</b>				



Species	Habitat requirements	Presence of habitat	Likelihood of occurrence	Potential impact
<i>Litoria raniformis</i> Southern Bell Frog EPBC – V BC – E IBRA Sub-region: Inland Slopes, Lower Slopes	Currently, the species is known to exist only in isolated populations in the Coleambally Irrigation Area, the Lowbidgee floodplain and around Lake Victoria. Usually found in or around permanent or ephemeral Black Box/Lignum/Nitre Goosefoot swamps, Lignum/Typha swamps and River Red Gum swamps or billabongs along floodplains and river valleys. They are also found in irrigated rice crops, particularly where there is no available natural habitat. Breeding occurs during the warmer months and is triggered by flooding or a significant rise in water levels. During the breeding season animals are found floating amongst aquatic vegetation (especially cumbungi or Common Reeds) within or at the edge of slow-moving streams, marshes, lagoons, lakes, farm dams and rice crops. Outside the breeding season animals disperse away from the water and take shelter beneath ground debris such as fallen timber and bark, rocks, grass clumps and in deep soil cracks.	<b>Absent</b>  No aquatic vegetation in farm dams.	<b>Unlikely</b>  No suitable habitat	<b>No</b>  No suitable habitat would be impacted by the proposal.

Species	Habitat requirements	Presence of habitat	Likelihood of occurrence	Potential impact
<i>Crinia sloanei</i> <i>Sloane's Froglet</i> EPBC- E	<p>Sloane's Froglet has been recorded from widely scattered sites in the floodplains of the Murray-Darling Basin, with the majority of records in the Darling Riverine Plains, NSW South Western Slopes and Riverina bioregions in New South Wales. It has not been recorded recently in the northern part of its range and has only been recorded infrequently in the southern part of its range in NSW. At a number of sites where records are verified by museum specimens, the species has not been subsequently detected during more recent frog surveys in the vicinity (e.g. Holbrook, Nyngan, Wagga Wagga and Tocomwal). The low number of sites, low number of recorded individuals per site, and the low proportion of records of this species in regional surveys all indicate that a moderately low number of mature individuals exist. The apparent loss from previous recorded sites and decline in recording rates indicates that this is not just a rare or uncommonly encountered species, but that there has been a reduction in population size and range. It is typically associated with periodically inundated areas in grassland, woodland and disturbed habitats.</p>	<p><b>Absent</b></p> <p>No vegetated permanent waterbodies occurred in the development site</p>	<p><b>Unlikely</b></p> <p>Species was not detected during fauna surveys</p>	<p><b>No</b></p> <p>No suitable habitat would be impacted by the proposal.</p>
<b>Reptiles</b>				
<i>Aprasia parapulchella</i> Pink-tailed Worm-lizard, Pink-tailed Legless Lizard EPBC – V BC – V	<p>Only known from the Central and Southern Tablelands, and the South Western Slopes. There is a concentration of populations in the Canberra/Queanbeyan Region. Other populations have been recorded near Cooma, Yass, Bathurst, Albury and West Wyalong. This species is also found in the Australian Capital Territory. Inhabits sloping, open woodland areas with predominantly native grassy groundlayers, particularly those dominated by Kangaroo Grass (<i>Themeda australis</i>). Sites are typically well-drained, with rocky outcrops or scattered, partially-buried rocks. Commonly found beneath small, partially-embedded rocks and appear to spend considerable time in burrows below these rocks; the burrows have been constructed by and are often still inhabited by small black</p>	<p><b>Absent</b></p> <p>No predominantly native grassy groundlayer or rocky outcrops in study area.</p>	<p><b>Unlikely</b></p> <p>No suitable habitat present.</p>	<p><b>No</b></p> <p>No suitable habitat would be impacted by the proposal.</p>

Species	Habitat requirements	Presence of habitat	Likelihood of occurrence	Potential impact
IBRA Sub-region: Inland Slopes, Lower Slopes	ants and termites. Feeds on the larvae and eggs of the ants with which it shares its burrows. It is thought that this species lays 2 eggs inside the ant nests during summer; the young first appear in March. Best detected from September to February.			
<i>Delma impar</i>  Striped Legless Lizard  EPBC - V BC – V  IBRA Sub-region: Inland Slopes	The Striped Legless Lizard occurs in the Southern Tablelands, the South West Slopes and possibly on the Riverina. Populations are known in the Goulburn, Yass, Queanbeyan, Cooma and Tumut areas. Also occurs in the ACT, Victoria and south-eastern South Australia. Found mainly in Natural Temperate Grassland but has also been captured in grasslands that have a high exotic component. Also found in secondary grassland near Natural Temperate Grassland and occasionally in open Box-Gum Woodland. Habitat is where grassland is dominated by perennial, tussock-forming grasses such as Kangaroo and Wallaby. Sometimes found in grasslands with significant amounts of surface rocks, which are used for shelter. Actively hunts for spiders, crickets, moth larvae and cockroaches. Animals have been recorded moving at least 20m in one day, and up to 50m over several weeks.	<b>Absent</b>  No tussock grasslands or surface rocks in study area.	<b>Unlikely</b>  No suitable habitat present.	<b>No</b>  No suitable habitat would be impacted by the proposal.
<b>Fish</b>				
<i>Maccullochella peelii</i>  Murray Cod  EPBC – V  IBRA Sub-region: Inland Slopes	Grow up to a maximum size of 1200mm. Found extensively throughout the Murray Darling Basin in the south-eastern region of Australia. Murray cod are able to live in a wide range of habitats from clear, rocky streams in the upper western slopes regions of New South Wales to the slow flowing, turbid rivers and billabongs of the western plains. Generally, they are found in waters up to 5m deep and in sheltered areas with cover from rocks, timber or overhanging banks. The most common components of adult cod's diet include crustaceans such as yabbies, shrimp and crayfish, and fish such as the introduced common carp, goldfish and redfin perch, and the native fishes bony herring, catfish,	<b>Absent</b>  No deep streams with shelter	<b>Unlikely</b>  No suitable habitat present.	<b>No</b>  No suitable habitat would be impacted by the proposal.



Species	Habitat requirements	Presence of habitat	Likelihood of occurrence	Potential impact
	golden perch, western carp gudgeon and even other cod. It appears that Murray cod prefer protected spawning sites, and typically spawn large (3.0-3.5mm diameter) adhesive eggs onto firm substrates such as hollow logs, rocks, pipes and clay banks, from spring to early summer.			
<i>Macquaria australasica</i> Macquarie Perch EPBC – E IBRA Sub-region: Inland Slopes	Macquarie perch grow to a maximum size of 400mm. They are found in the Murray-Darling Basin (particularly upstream reaches) of the Lachlan, Murrumbidgee and Murray rivers, and parts of south-eastern coastal NSW, including the Hawkesbury and Shoalhaven catchments. The conservation status of the different populations is not well known, but there have been long-term declines in their abundance. Macquarie perch are found in both river and lake habitats, especially the upper reaches of rivers and their tributaries. They are quiet, furtive fish that feed on aquatic insects, crustaceans and molluscs. Sexual maturity occurs at two years for males and three years for females. Macquarie perch spawn in spring or summer in shallow upland streams or flowing parts of rivers. Females produce around 50,000-100,000 eggs which settle among stones and gravel of the stream or riverbed.	<b>Absent</b>  No deep rocky holes with plenty of cover	<b>Unlikely</b>  No suitable habitat in study area.	<b>No</b>  No suitable habitat would be impacted by the proposal.
Flathead Galaxias <i>Galaxias rostratus</i> CE EPBC CE FM IBRA Sub-region: Inland Slopes	Below 150 m in altitude. Billabongs, lakes, swamps, and rivers, with preference for still or slow-flowing waters.	<b>Absent</b>  Above 150 m in altitude.	<b>Unlikely</b>  No suitable habitat in study area.	<b>No</b>  No suitable habitat would be impacted by the proposal.
<b>Migratory Species</b>				

Species	Habitat requirements	Presence of habitat	Likelihood of occurrence	Potential impact
<i>Apus pacificus</i> Fork-tailed Swift EPBC – M	This migratory marine species is a non-breeding visitor to Australia and has been recorded in all regions of NSW. Found across a range of habitats from inland open plains to wooded areas. They are mainly exclusively aerial flying from < 1m to 300 m above ground.	<b>Marginal</b>  Aerial species. Minimal woodland within development site	<b>Possible</b>  Study area within known distribution of species.	<b>Yes</b>  AoS Required
<i>Haliaeetus leucogaster</i> White-bellied Sea Eagle EPBC - M	White-bellied Sea-Eagles are normally seen perched high in a tree or soaring over waterways and adjacent land. Birds form permanent pairs that inhabit territories throughout the year.	<b>Absent</b>  No open waterways in the study area.	<b>Unlikely</b>  No suitable habitat present.	<b>No</b>  No suitable habitat would be impacted by the proposal.
<i>Hirundapus caudacutus</i> White- throated Needletail EPBC - V	White-throated Needletails often occur in large numbers over eastern and northern Australia. They arrive in Australia from their breeding grounds in the northern hemisphere in about October each year and leave somewhere between May and August. They are aerial birds and for a time it was commonly believed that they did not land while in Australia. It has now been observed that birds will roost in trees, and radio-tracking has since confirmed that this is a regular activity. The White-throated Needletail feeds on flying insects, such as termites, ants, beetles and flies. They catch the insects in flight in their wide gaping beaks. Birds usually feed in rising thermal currents associated with storm fronts and bushfires and they are commonly seen moving with wind fronts. White-throated Needletails are non-breeding migrants in Australia.	<b>Marginal</b>  Aerial species. Minimal woodland within development site	<b>Possible</b>  Study area within known distribution of species.	<b>Yes</b>  AoS Required
<i>Myiagra cyanoleuca</i>	The Satin Flycatcher is found along the east coast of Australia from far northern Queensland to Tasmania, including south-eastern South Australia. It is also	<b>Absent</b>	<b>Unlikely</b>	<b>No</b>

Species	Habitat requirements	Presence of habitat	Likelihood of occurrence	Potential impact
Satin Flycatcher EPBC - M	found in New Guinea. The Satin Flycatcher is not a commonly seen species, especially in the far south of its range, where it is a summer breeding migrant. The Satin Flycatcher is found in tall forests, preferring wetter habitats such as heavily forested gullies, but not rainforests. The Satin Flycatcher is a migratory species, moving northwards in winter to northern Queensland and Papua New Guinea, returning south to breed in spring.	No forests or gullies in study area.	No suitable habitat in study area.	No suitable habitat would be impacted by the proposal.
<i>Rhipidura rufifrons</i> Rufous Fantail EPBC - M	The Rufous Fantail is found in northern and eastern coastal Australia, being more common in the north. The Rufous Fantail is found in rainforest, dense wet forests, swamp woodlands and mangroves, preferring deep shade, and is often seen close to the ground. During migration, it may be found in more open habitats or urban areas. Strongly migratory in the south of its range, it moves northwards in winter, and virtually disappears from Victoria and New South Wales at this time.	<b>Absent</b>  No wet forests, woodlands, mangroves or swamps in study area.	<b>Unlikely</b>  No suitable habitat in study area.	<b>No</b>  No suitable habitat would be impacted by the proposal.
<i>Actitis hypoleucos</i> Common Sandpiper EPBC - CE	This migratory wetland species is found along all Australian coastlines and many inland areas. They are active birds that will pursue invertebrates over rocks. Breeding habitat is mainly in Europe.	<b>Absent</b>  No wetlands, mangroves or coastal landforms in study area.	<b>Unlikely</b>  No suitable habitat in study area.	<b>No</b>  No suitable habitat would be impacted by the proposal.
<i>Calidris acuminata</i> Sharp-tailed Sandpiper EPBC - M	This migratory wetland species wades mud in estuarine habitats feeding on invertebrates. They are widespread throughout much of NSW but are sparse in the south-central and lower western regions. Breeding habitat is in Northern Siberia.	<b>Absent</b>  No mangroves or coastal landforms in study area.	<b>Unlikely</b>  No suitable habitat in study area.	<b>No</b>  No suitable habitat would be impacted by the proposal.



Species	Habitat requirements	Presence of habitat	Likelihood of occurrence	Potential impact
<i>Calidris ferruginea</i> Curlew Sandpiper EPBC - M	Curlew Sandpipers mainly occur on intertidal mudflats in sheltered coastal areas, such as estuaries, bays, inlets and lagoons, and also around non-tidal swamps, lakes and lagoons near the coast, and ponds in saltworks and sewage farms. They are also recorded inland, though less often, including around ephemeral and permanent lakes, dams, waterholes and bore drains, usually with bare edges of mud or sand. They occur in both fresh and brackish waters. Curlew Sandpipers generally roost on bare dry shingle, shell or sand beaches, sandspits and islets in or around coastal or near-coastal lagoons and other wetlands, occasionally roosting in dunes during very high tides and sometimes in saltmarsh. This species does not breed in Australia. This species forages mainly on invertebrates, including worms, molluscs, crustaceans, and insects, as well as seeds.	<b>Marginal</b>  Farm dams and ephemeral creek line in the study area.	<b>Possible</b>  Study area within known distribution of species.	<b>No</b>  Marginal habitat and unlikely to occur.
<i>Calidris melanotos</i> Pectoral Sandpiper EPBC - M	This species breeds in high-arctic tundra from the Yamal Peninsula eastwards to the Bearing Strait in Siberia and in arctic Alaska and Canada. It is known to migrate mostly through the USA and Mexico and spends most of its non-breeding months in South America. A small number of these birds are known to reach Australia and are believed to be concentrated in south-eastern Australia. This species prefers freshwater mudflats.	<b>Absent</b>  No freshwater mudflats in study area.	<b>Unlikely</b>  No suitable habitat in study area.	<b>No</b>  No suitable habitat would be impacted by the proposal.
<i>Gallinago hardwickii</i> Latham's Snipe, Japanese Snipe EPBC - M	In Australia, Latham's Snipe occurs in permanent and ephemeral wetlands up to 2000 m above sea-level. They usually inhabit open, freshwater wetlands with low, dense vegetation (e.g. swamps, flooded grasslands or heathlands, around bogs and other water bodies). However, they can also occur in habitats with saline or brackish water, in modified or artificial habitats, and in habitats located close to humans or human activity. Latham's Snipe does not breed within Australia.	<b>Absent</b>  No wetlands in study area.	<b>Unlikely</b>  No suitable habitat in study area.	<b>No</b>  No suitable habitat would be impacted by the proposal.

Species	Habitat requirements	Presence of habitat	Likelihood of occurrence	Potential impact
<i>Numenius madagascariensis</i> Eastern Curlew, Far Eastern Curlew EPBC – M	The Eastern Curlew is most commonly associated with sheltered coasts, especially estuaries, bays, harbours, inlets and coastal lagoons, with large intertidal mudflats or sandflats, often with beds of seagrass. The Eastern Curlew mainly forages on soft sheltered intertidal sandflats or mudflats, open and without vegetation or covered with seagrass, often near mangroves, on saltflats and in saltmarsh, rockpools and among rubble on coral reefs, and on ocean beaches near the tideline. The Eastern Curlew roosts on sandy spits and islets, especially on dry beach sand near the high-water mark, and among coastal vegetation including low saltmarsh or mangroves. It occasionally roosts on reef-flats, in the shallow water of lagoons and other near-coastal wetlands.	<b>Absent</b>  No coastal landforms, mangroves or wetlands in the study area.	<b>Unlikely</b>  No suitable habitat in study area.	<b>No</b>  No suitable habitat would be impacted by the proposal.

Species	Habitat requirements	Presence of habitat	Likelihood of occurrence	Potential impact
<p>CE BC = listed as Critically Endangered under Schedule 1 of the NSW <i>Biodiversity Conservation Act 2016</i></p> <p>CE EPBC = listed as Critically Endangered under the Commonwealth <i>Environment Protection &amp; Biodiversity Conservation Act 1999</i>.</p> <p>E BC = listed as Endangered under Schedule 1 of the NSW <i>Biodiversity Conservation Act 2016</i></p> <p>E EPBC = listed as Endangered under the Commonwealth <i>Environment Protection &amp; Biodiversity Conservation Act 1999</i>.</p> <p>V BC = listed as Vulnerable under Schedule 1 of the NSW <i>Biodiversity Conservation Act 2016</i></p> <p>V EPBC = listed as Vulnerable under the Commonwealth <i>Environment Protection &amp; Biodiversity Conservation Act 1999</i>.</p> <p>M EPBC = listed as Migratory under the Commonwealth <i>Environment Protection &amp; Biodiversity Conservation Act 1999</i>.</p> <p>CE FM = listed as Critically Endangered under Schedule 4A of the NSW <i>Fisheries Management Act 1994</i>.</p> <p>E FM = listed as Endangered under Schedule 4 of the NSW <i>Fisheries Management Act 1994</i>.</p> <p>V FM = listed as Vulnerable under Schedule 5 of the NSW <i>Fisheries Management Act 1994</i>.</p>		<p>CAMBA = Chinese-Australia Migratory Bird Agreement</p> <p>JAMBA = Japan-Australia Migratory Bird Agreement</p>		



## APPENDIX F EPBC ASSESSMENT OF SIGNIFICANT IMPACT

The *Environment Protection and Biodiversity Conservation Act 1999* specifies factors to be taken into account in deciding whether a development is likely to significantly affect EECs, threatened species and migratory species, listed at the Commonwealth level. The following assessments assesses the significance of the likely impacts associated with the proposed works on:

### *Endangered Ecological Community*

Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions

### *Critically Endangered Species*

Swift Parrot – (*Lathamus discolor*) -CE

Regent Honeyeater (*Anthochaera phrygia*) -CE

### *Endangered species*

Small Purple-pea - E

### *Vulnerable Species*

Superb Parrot (*Polytelis swainsonii*) - V

Painted Honeyeater (*Grantiella picta*)- V

Corben's Long-eared Bat (*Nyctophilus corbeni*) – V

White-throated Needletail (*Hirundapus caudacutus*) - V

### *Migratory Species*

Fork-tailed Swift (*Apus pacificus*) - M

White-throated Needletail (*Hirundapus caudacutus*) - M

Table 13-1 Assessment of Significance for endangered ecological communities

<b>a) Will the action reduce the extent of an ecological community?</b>
<b>Inland Grey Box Woodland</b>
About 0.78 ha of Grey Box Grassy Woodland is assumed to occur within the development site. This vegetation zone would not be directly impacted by the works. The proposal would be very unlikely to lead to any long-term decline in this community locally.
<b>b) Will the action fragment or increase fragmentation of an ecological community?</b>
<b>Inland Grey Box Woodland</b>
The area of Grey Box Grassy Woodland occurs as a narrow linear strip along an internal road within the development site. This area of vegetation is heavily isolated. The development has avoided direct impacts to this vegetation zone. Although panels and infrastructure will occur either side of the woodland area, the northern and southern connectivity would be retained. The development is unlikely to increase the existing fragmentation of this ecological community.
<b>c) Will the action adversely affect habitat critical to the survival of an ecological community?</b>
<b>Inland Grey Box Woodland</b>
The development would not occur within areas critical for the survival of the EEC.
<b>d) Will the action modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns?</b>
<b>Inland Grey Box Woodland</b>
The development is unlikely to impact on abiotic components of the EEC. Exclusion fencing and signage would be installed during construction to avoid any potential indirect impacts.
<b>e) Will the action cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting?</b>
<b>Inland Grey Box Woodland</b>
This vegetation zone would not be directly impacted by the development. The development would not lead to any changes in species composition or lead to a decline in the occurrence of any species.
<b>f) Will the action cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to:</b>
<ul style="list-style-type: none"> <li>• assisting invasive species, that are harmful to the listed ecological community, to become established, or</li> <li>• Causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community?</li> </ul>
<b>Inland Grey Box Woodland</b>
There is a risk that invasive weeds could be established in the development area via seeds or plant parts on machinery during construction. These risks are already present in the development site through regular agricultural activity. With the implementation of mitigation measures from the Biodiversity Management Plan and Rehabilitation Plan, these risks would be minimal. The development is unlikely to change species composition within the community.

The development does not involve any additional introduction of any fertilisers, herbicides or other chemicals or pollutants.

With the recommended mitigation measures implemented, the likelihood of the proposal resulting in invasive species or introduction of pollutants that are harmful to an EEC is minimal.

**g) Will the action interfere with the recovery of an ecological community?**

**Inland Grey Box Woodland**

The development would not affect the recovery Grey Box Grassy Woodland

**Conclusion**

The development would not reduce the extent of Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia- Endangered EEC. The development has been designed to avoid direct impacts to community.

The development would not change the composition of the community in the locality.

No habitat would be removed that is considered important to the long-term survival of the community within the locality it occurs in.

Minor indirect impacts to this community including trampling of groundcover or weed encroachment are possible. However, these are existing risks to the community occurring within a disturbed agricultural landscape.

With the implementation of mitigation measures including site rehabilitation and management of retained vegetation, the condition of the community is likely to increase.

A significant impact to the community is considered unlikely.

Referral to the Minister is not required.

Table 13-2 Assessment of Significance for critically endangered EPBC species

Critically Endangered Species (Swift Parrot and Regent Honeyeater)	
a) Will the action lead to a long-term decrease in the size of a population of a species?	
<b>Swift Parrot</b>	
Swift Parrots can forage in lerp infested Grey Box and Yellow Box trees. Potential foraging habitat for Swift Parrots occurs within the development site and would be removed by the proposal. Surveys did not detect these species and no known records occur within the development site. The development site is not considered known habitat but provides potential foraging habitat.	
The proposal would involve the removal of around 0.31 ha of Box Gum Woodland. There would also be some disturbance associated with construction, including noise, vibration, light. The quality of potential habitat for these species is low, being largely cleared and highly disturbed by agriculture. Given the relatively small amount of habitat to be removed, and with the recommended mitigation measures, the likelihood of the proposal leading to a long-term decrease in the size of a population of this species is minimal.	
<b>Regent Honeyeater</b>	
The Regent Honeyeater is considered to occur as a single population throughout its range. No known records occur with the development site and they were not detected during the site surveys. The development site is not considered known habitat but provides potential foraging habitat.	



The proposal would involve the removal of around 0.31 ha of Box Gum Woodland. There would also be some disturbance associated with construction, including noise, vibration, light. The quality of potential habitat for these species is low, being largely cleared and highly disturbed by agriculture. Given the relatively small amount of habitat to be removed, and with the recommended mitigation measures, the likelihood of the proposal leading to a long-term decrease in the size of a population of this species is minimal.

**b) Will the action reduce the area of occupancy of the species?**

**Swift Parrot**

The proposal would involve the removal of around 0.31 ha of potential foraging habitat. There would also be some disturbance associated with construction. The development site is not considered known habitat.

The quality of habitat in the development site is low, being highly fragmented and partially cleared from agriculture and the area of habitat to be removed is relatively small in the context of the Swift Parrots range across South Eastern Australia. In this context, while removal of this habitat could reduce the area of occupancy, it would not be enough to have a significant impact on these species.

**Regent Honeyeater**

The proposal would involve the removal of around 0.31 ha of potential foraging habitat. There would also be some disturbance associated with construction. The development site is not considered known habitat.

The quality of habitat in the development site is low, being highly fragmented and partially cleared from agriculture and the area of habitat to be removed is relatively small in the context of the Swift Parrots range across South Eastern Australia. In this context, while removal of this habitat could reduce the area of occupancy, it would not be enough to have a significant impact on these species.

**c) Will the action fragment an existing population into two or more populations?**

**Swift Parrot**

The Swift Parrot occurs as a single migratory population (Saunders & Tzaros, 2011) The proposal would involve the removal of around 0.31 ha of potential habitat. There would also be some disturbance associated with construction. The development site is not considered known habitat.

The area of habitat to be removed is relatively small in the context of the Swift Parrots range across South-Eastern Australia and would not disrupt habitat connectivity for the migratory Swift Parrot. 62 ha of remnant vegetation would still remain within or adjacent to the development site and migratory movement would not be impacted. The proposal would not fragment an existing population of this species into two or more populations.

**Regent Honeyeater**

The Regent honeyeater population comprises a single population that moves throughout its range of South Eastern Australia. The proposal would involve the removal of around 0.31 ha of potential habitat. There would also be some disturbance associated with construction.

The area of habitat to be removed is relatively small in the context of the Regent Honeyeaters range across South-Eastern Australia and would not disrupt habitat connectivity for the Regent Honeyeater. 62 ha of remnant vegetation would still remain within or adjacent to the development site and movement would not be impacted. The proposal would not fragment an existing population of this species into two or more populations.

**d) Will the action adversely affect habitat critical to the survival of a species?**

**Swift Parrot**

Habitat critical to the survival of the Swift Parrot includes those areas of priority habitat for which the Swift Parrot has a level of site fidelity or are identified by the recovery team. The development site is not known habitat nor within a mapped important area identified by OEH and is unlikely to be habitat critical to the survival of the species.

#### Regent Honeyeater

Critical habitat for the survival of the Regent Honeyeater listed in the national recovery plan includes

- any breeding or foraging habitat where the species is likely to occur (as defined by the distribution map)
- Any newly discovered breeding or foraging locations

The development site falls within the mapped areas of where this species is likely to occur but not within a key breeding area. 0.31 ha of habitat would be removed. However, this vegetation is of low habitat quality comprised of smaller isolated patches within a cleared and disturbed agricultural landscape and road reserves.

#### e) Will the action disrupt the breeding cycle of the species?

##### Swift Parrot

Swift Parrots breed only in Tasmania, migrating to the mainland in autumn and winter. The likelihood of the action disrupting the breeding cycle of a population of these species is minimal.

##### Regent Honeyeater

Four key breeding areas occur in the known range of the Regent Honeyeater. The development site is not within a known breeding area for the Regent Honeyeater; thus the proposal is unlikely to disrupt the breeding cycle of the species.

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

##### Swift Parrot

The proposal would involve the removal of around 0.31 ha of foraging habitat. There would also be some disturbance associated with construction, which could decrease the quality of some habitat in the short-term. The development site is not considered known habitat and is considered potential foraging habitat only.

The area of habitat to be removed is relatively small in the context of the Swift Parrots range across South-Eastern Australia and would not disrupt habitat connectivity. Approximately 63ha of similar or better-quality habitat would remain within or adjacent to the development site. With the implementation of the recommended mitigation measures, the likelihood of the action modifying, destroying, removing, isolating, or decreasing the availability or quality of habitat to the extent that these species would be likely to decline is minimal.

##### Regent Honeyeater

The proposal would involve the removal of around 0.31 ha of foraging habitat, comprised of smaller isolated patches and road reserves. This habitat is considered low quality having been partially cleared and degraded from intense agricultural activities. There would also be some disturbance associated with construction,

which could decrease the quality of some habitat in the short-term. The development site is not considered known habitat and is considered potential foraging habitat only.

While the proposal may reduce the availability of habitat, this habitat is considered low quality. 63ha of similar or better-quality habitat would remain within or adjacent to the development site that could provide foraging habitat for the Regent Honeyeater. The likelihood of the action modifying, destroying, removing, isolating, or decreasing the availability or quality of habitat to the extent that these species would be likely to decline is minimal.

**g) Will the action result in invasive species that are harmful to a critically endangered species becoming established in the critically endangered species' habitat?**

**Swift Parrot and Regent Honeyeater**

The proposal will modify the current land use, potentially creating additional shelter habitat for predatory invasive species such as foxes and cats, which are considered likely to be locally prevalent regardless of the proposal. Management protocols will be prepared and implemented as part of the Flora and Fauna Management Plan for the proposal which will monitor and manage these species within the development site. These species are already widespread in a rural environment and the proposal is not anticipated to increase the numbers of feral pest animals.

There is a risk that invasive weed could be introduced to the proposal area via machinery, vehicles, and materials during construction. With the implementation of the recommended mitigation measures, including restricting vehicle movements to sealed tracks, the likelihood of the action resulting in harmful invasive species becoming established in the vulnerable species' habitat is minimal.

**h) Will the action introduce disease that may cause the species to decline?**

**Swift Parrot**

Beak and Feather Disease could impact the Swift Parrot; however, the proposal is not considered likely to act as a vector for the disease. With the implementation of the recommended mitigation measures, the likelihood of the action resulting in the introduction of diseases that may cause the species to decline is minimal.

**Regent Honeyeater**

The proposal is not considered to act as a vector for any diseases to the Regent Honeyeater.

**i) Will the action interfere substantially with the recovery of the species?**

**Swift Parrot**

The National Recovery Plan for the Swift Parrot lists the following objectives:

1. To identify and prioritise habitats and sites used by the species across its range, on all land tenures.
2. To implement management strategies to protect and improve habitats and sites on all land tenures.
3. To monitor and manage the incidence of collisions, competition and Beak and Feather Disease (BFD).
4. To monitor population trends and distribution throughout the range.

The proposal would not interfere with any of these objectives.

**Regent Honeyeater**

The National Recovery Plan for the Regent Honeyeater lists the following objectives;



1. Reverse the long-term population trend to decline and increase the number of regent honeyeaters to a level where there is a viable, wild breeding population even in poor breeding years
2. Enhance the condition of habitat across the regent honeyeater ranges to maximise survival and reproductive success and provide refugia during periods of extreme environmental fluctuation

The proposal would not substantially interfere with any of these objectives.

### **Conclusion**

A significant impact to these species is considered unlikely, on the basis that the proposal would not:

- Lead to a reduction of the size or area of occupancy of a population, or fragment or disrupt the breeding cycle of a population
- Affect habitat critical to the survival of these species
- Affect habitat or introduce disease such that these species would decline
- Introduce invasive species harmful to the species
- Interfere with the recovery of these species.

A referral to the Federal Department of Environment is not considered necessary.

Table 13-2 Assessment of Significance for endangered EPBC species

<b>Endangered Species (Small Purple-pea)</b>
<b>a) Will the action lead to a long-term decrease in the size of a population of a species?</b>
<p><b>Small Purple-pea</b></p> <p>Occurs in grassland and open woodland, often on stony hillsides, dominated by one or more of the following: <i>Callitris endichleri</i>, <i>C. glaucophylla</i>, <i>Eucalyptus blakelyi</i>, <i>E. bridgesiana</i>, <i>E. dives</i>, <i>E. melliodora</i>, <i>E. microcarpa</i>, <i>E. nortonii</i> and <i>E. polyanthemos</i>. Requires a forb-rich grassy groundlayer dominated by <i>Themeda triandra</i>, <i>Poa sieberiana</i> var. <i>sieberiana</i> or <i>Austrostipa</i> spp. Resprouts in autumn and winter from a woody root. It flowers in spring, peaking over two to three weeks in October. Although we have assumed its presence in the development footprint, of up to 0.17 ha of low-quality potential habitat will be impacted by the development which is unlikely to lead to a long-term decrease in the size of the population.</p>
<b>b) Will the action reduce the area of occupancy of the species?</b>
<p><b>Small Purple-pea</b></p> <p>The proposal would involve the removal of up to 0.17 ha of Box Gum Woodland with limited native understory, potential habitat for the Small Purple-pea. There may also be some disturbance associated with construction activities. As the quality of the habitat is low in comparison to the retained vegetation of the development site and the adjacent vegetation, the removal of this habitat may slightly reduce the area of occupancy, although it would not be enough to have a significant impact on these species.</p>
<b>c) Will the action fragment an existing population into two or more populations?</b>
<p><b>Small Purple-pea</b></p> <p>The proposal would involve the removal of up to 0.17 ha of Box Gum Woodland with limited native understory, potential habitat for the Small Purple-pea. This vegetation is part of a larger contiguous patch of Box Gum Woodland. The vegetation is of lower quality compared to the connected retained vegetation within the development site and in adjacent areas. The removal of this vegetation will not fragment the existing population.</p>
<b>d) Will the action adversely affect habitat critical to the survival of a species?</b>
<p><b>Small Purple-pea</b></p> <p>There are historical records around Wagga Wagga and within Culcairn where it is considered now extinct by OEH. As the quality of the habitat being removed is low in comparison to the retained vegetation of the development site and the adjacent vegetation, the removal of this habitat would unlikely be critical to the survival of the species within the landscape.</p>
<b>e) Will the action disrupt the breeding cycle of the species?</b>
<p><b>Small Purple-pea</b></p> <p>Impacts as a result of the development are restricted to low condition vegetation with an already disturbed ground layer. Any disruption to the breeding cycle of the species will be restricted to a small patch which will not affect the breeding cycles of known populations in the region.</p>

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

**Small Purple-pea**

The proposal would involve the removal of up to 0.17 ha of low-quality potential habitat. The action will not modify, destroy, remove, isolate or decrease the availability of quality habitat to the extent that the species is likely to decline.

**g) Will the action result in invasive species that are harmful to a critically endangered species becoming established in the critically endangered species' habitat?**

**Small Purple-pea**

There is a risk that invasive weed could be introduced to the proposal area via machinery, vehicles, and materials during construction. With the implementation of the recommended mitigation measures, including restricting vehicle movements to sealed tracks, the likelihood of the action resulting in harmful invasive species becoming established in the species' habitat is minimal.

**h) Will the action introduce disease that may cause the species to decline?**

**Small Purple-pea**

With the implementation of the recommended mitigation measures, the likelihood of the action resulting in the introduction of diseases that may cause the species to decline is minimal.

**i) Will the action interfere substantially with the recovery of the species?**

**Small Purple-pea**

The Saving our Species strategy lists 3 key management sites for this species (Mount Arthur, Tralee-Williamsdale Railway easement, Williamsdale), none of which are within the development site or the broader region. As such, the proposal would not interfere with any of these key management sites.

**Conclusion**

A significant impact to these species is considered unlikely, on the basis that the proposal would not:

- Lead to a reduction of the size or area of occupancy of a population, or fragment or disrupt the breeding cycle of a population
- Affect habitat critical to the survival of these species
- Affect habitat or introduce disease such that these species would decline
- Introduce invasive species harmful to the species
- Interfere with the recovery of these species.

A referral to the Federal Department of Environment is not considered necessary.

Table 12-3 Assessment of Significance for Vulnerable EPBC species

**Vulnerable Species (Superb Parrot & Painted Honeyeater)**

**a) Will the action lead to a long-term decrease in the size of an important population of a species?**

**Superb Parrot**



No records of the Superb Parrot occur within the development site and no known population of Superb Parrot occurs within the development site. The development site is not considered known habitat but provides potential foraging habitat. The breeding population of Superb Parrots *Polytelis swainsonii* is approximately 6500. The species is somewhat mobile, and typically utilises foraging habitat within 10km of breeding habitat (SPRAT, 2017).

The development site is not part of a core breeding area for the Superb Parrot (Baker Gabb, 2011). Thus, an important population is not considered to occur in the development site and no impacts are anticipated to an important population of Superb Parrot.

#### Painted Honeyeater

No records of the Painted Honeyeater occur within the development site and no known population occurs within the development site. The mistletoe which provides foraging and breeding habitat is also absent in the development site. The development site is not part of a key management site listed by OEH, thus an important population is not considered to occur in the development site and no impacts are anticipated to an important population of Painted Honeyeater.

#### Corben's Long-eared Bat

No records of the Corben's Long-eared Bat occur within the development site and no known population of Corben's Long-eared Bat occurs within the development site. The presence of Box-Gum Woodland and hollow bearing trees provides potential foraging and roosting habitat for this species. The development site is not part of a key management site listed by OEH, thus an important population is not considered to occur in the development site and no impacts are anticipated to an important population of Corben's Long-eared Bat.

#### White-throated Needletail

No records of the White-throated Needletail occur within the development site and no known population of White-throated Needletail occurs within the development site. The development site is not considered known habitat but provides potential foraging habitat. The subspecies *caudacutus* is the key breeding population that affects the Needletails that occur in Australia (SPRAT, 2019). However, this subspecies *caudacutus* only breeds outside of Australia, thus an important population is not considered to occur in the development site and no impacts are anticipated to an important population of White-throated Needletail.

### b) Will the action reduce the area of occupancy of an important population of the species?

#### Superb Parrot

As an important population is not considered to occur within the development site, the action is not considered to reduce the area of occupancy of an important population. The broader proposal area will continue to contain suitable areas of breeding and foraging habitat of a sufficient size and quality to maintain individuals of the species within the proposal area and the wider locality.

#### Painted Honeyeater

As an important population is not considered to occur within the development site, the action is not considered to reduce the area of occupancy of an important population. The broader proposal area will continue to contain suitable areas of breeding and foraging habitat of a sufficient size and quality to maintain individuals of the species within the proposal area and the wider locality.

#### Corben's Long-eared Bat

As an important population is not considered to occur within the development site, the action is not considered to reduce the area of occupancy of an important population. The broader proposal area will continue to contain suitable areas of roosting and foraging habitat of a sufficient size and quality to maintain individuals of the species within the proposal area and the wider locality.

#### White-throated Needletail

As an important population is not considered to occur within the development site, the action is not considered to reduce the area of occupancy of an important population. The broader proposal area will continue to contain suitable areas of foraging habitat of a sufficient size and quality to maintain individuals of the species within the proposal area and the wider locality.

### c) Will the action fragment an existing important population into two or more populations?

#### Superb Parrot

As the individuals of the species are not considered to form an important population, the action is not considered to fragment an existing important population. As the species is highly mobile, the proposal will not impact on its movement within or across the development site.

#### Painted Honeyeater

As the individuals of the species are not considered to form an important population, the action is not considered to fragment an existing important population. As the species is highly mobile, the proposal will not impact on its movement within or across the development site.

#### Corben's Long-eared Bat

As the individuals of the species are not considered to form an important population, the action is not considered to fragment an existing important population. As the species is highly mobile, the proposal will not impact on its movement within or across the development site.

#### White-throated Needletail

As the individuals of the species are not considered to form an important population, the action is not considered to fragment an existing important population. As the species is highly mobile and predominately aerial, the proposal will not impact on its movement within or across the development site.

### d) Will the action adversely affect habitat critical to the survival of a species?

#### Superb Parrot, Painted Honeyeater, Corben's Long-eared Bat and White-throated Needletail

The Register of Critical Habitat established under the EPBC Act does not list any critical habitat for these protected species. The proposed development is not located near any critical habitat for and species listed on the register.

### e) Will the action disrupt the breeding cycle of an important population of the species?

#### Superb Parrot

No known important population occurs within the proposal area. Three main breeding areas for the superb parrot occur in NSW. The nearest known breeding area to the proposal area occurs in the South West Slopes near Wagga Wagga, around 100km north of Walla Walla (Baker Gabb, 2011). Within the South West Slopes, the Superb Parrot breeds in hollows in River Red Gum, Blakely's Red Gum, Apple Box, Grey Box, White Box and Red Box species. The nests are usually located near water and the same nest hollows are used in successive years. The action would not disrupt the breeding cycle of an important population.

#### Painted Honeyeater

No known important populations occur within the proposal area.

#### Corben's Long-eared Bat

No known important population occurs within the proposal area.

#### White-throated Needletail

This species does not breed in Australia.

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

#### Superb Parrot

The proposal will remove approximately 0.31 ha of woodland vegetation in the development site. Approximately 70 ha of similar or better-quality habitat would remain in or adjacent to the development site. This modification and removal of habitat is not considered likely to modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline, as extensive habitat will remain in the locality.

#### Painted Honeyeater

The proposal will remove approximately 0.31 ha of woodland vegetation in the development site. Approximately 70 ha of similar or better-quality habitat would remain in or adjacent to the development site. This modification and removal of habitat is not considered likely to modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline, as extensive habitat will remain in the locality.

#### Corben's Long-eared Bat

The proposal will remove approximately 0.31 ha of woodland vegetation in the development site, and 49 hollow bearing trees. Approximately 70 ha of similar or better-quality habitat would remain in or adjacent to the development site. This modification and removal of habitat is not considered likely to modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline, as extensive habitat will remain in the locality.

#### White-throated Needletail



The proposal will remove approximately 0.31 ha of woodland vegetation in the development site. Approximately 70 ha of similar or better-quality habitat would remain in or adjacent to the development site. This modification and removal of habitat is not considered likely to modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline, as extensive habitat will remain in the locality.

**g) Will the action result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat?**

**Superb Parrot, Painted Honeyeater, Corben's Long-eared Bat and White-throated Needletail**

The proposal is not considered likely to result in invasive species becoming established within the Superb Parrot's habitat. Competition with Noisy Miners for breeding and foraging habitat and resources is a major threat to the species and cause for the decline in population numbers. Noisy Miners are already present at the development site. The proposal is unlikely to result in invasive species such as these that are harmful to the habitat of the Superb Parrot.

The proposal will modify the current land use, potentially creating additional shelter habitat for predatory invasive species such as foxes and cats, which are considered likely to be locally prevalent regardless of the proposal. Management protocols will be prepared and implemented as part of the Flora and Fauna Management Plan for the proposal which will monitor and manage these species within the development site.

**h) Will the action introduce disease that may cause the species to decline?**

**Superb Parrot**

Beak and Feather Disease has been proven to impact the Superb Parrot (DoE, 2017), however the proposal is not considered likely to act as a vector for the disease.

**Painted Honeyeater**

The proposal is not considered to act as a vector for any diseases to the Painted Honeyeater.

**Corben's Long-eared Bat**

The proposal is not considered to act as a vector for any diseases to the Corben's Long-eared Bat.

**White-throated Needletail**

The proposal is not considered to act as a vector for any diseases to the White-throated Needletail.

**i) Will the action interfere substantially with the recovery of the species?**

**Superb Parrot**

Core breeding areas and surrounding habitat are considered important to the recovery of the species. The nearest known breeding area to the proposal area occurs in the South West Slopes near Wagga Wagga, approximately 100km north of the development site. Habitats across the broader proposal area will remain available to the species and given its mobility, the proposal would not restrict the movements of the species across the development site. The proposal is unlikely to interfere with the recovery of the Superb Parrot.

#### Painted Honeyeater

No recovery plan has been developed for the Painted Honeyeater.

#### Corben's Long-eared Bat

No recovery plan has been developed for the Corben's Long-eared Bat.

#### White-throated Needletail

No recovery plan has been developed for the White-throated Needletail

#### Conclusion

A significant impact to this species is considered unlikely, on the basis that the proposal would not:

- Lead to a reduction of the size or area of occupancy of an important population, or fragment or disrupt the breeding cycle of a population
- Affect habitat critical to the survival of these species
- Affect habitat or introduce disease such that these species would decline
- Introduce invasive species harmful to the species
- Interfere with the recovery of these species.

A referral to the Federal Department of Environment is not considered necessary.

#### Migratory Species (Fork-tailed Swift and White-throated needletail)

An assessment of significance for migratory species must establish whether the habitat on the proposed site is considered "important habitat" as defined in the EPBC Act.

"Important habitat" for migratory species is described as:

1. Habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species; and/or
2. Habitat that is of critical importance to the species at particular life-cycle stages; and/or
3. Habitat utilised by a migratory species which is at the limit of the species range; and/or
4. Habitat within an area where the species is declining.

The habitat within the proposal site is not considered important habitat for the Fork-tailed Swift or the White-throated Needletail.

- a) Will the action substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles, or altering hydrological cycles), destroy, or isolate an area of important habitat for a migratory species?

#### Fork-tailed Swift & White-throated Needletail

The Fork-tailed Swift and the White-throated Needletail are almost exclusively aerial and are considered unlikely to rely on the habitats present within the proposal site. The habitats within the proposal site are not considered important habitat. Therefore, the action is unlikely to substantially modify, destroy or isolate an area of important habitat for either species.

**b) Will the action result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species?**

#### Fork-tailed Swift & White-throated Needletail

The Fork-tailed Swift and the White-throated Needletail are almost exclusively aerial and are considered unlikely to rely on the habitats present within the proposal site. The habitats within the proposal site are not considered important habitat. Therefore, the action is unlikely to substantially modify, destroy or isolate an area of important habitat for either species.

**c) Will the action seriously disrupt the lifecycle (breeding, feeding, migration, or resting behaviour) of an ecologically significant proportion of the population of a migratory species?**

#### Fork-tailed Swift & White-throated Needletail

The Fork-tailed Swift and the White-throated Needletail are almost exclusively aerial and are considered unlikely to rely on the habitats present within the proposal site. The area is not considered to support an ecologically significant proportion of the population of the species. Therefore, the action is unlikely to seriously disrupt the lifecycle of an ecologically significant proportion of the population of either species.

#### Conclusion

The project site area contains habitat that could potentially be used by the Fork-tailed Swift or the White-throated Needletail. Of the four criteria for significant impact for a migratory species, the project is unlikely to cause a significant impact to any criteria. The proposal is therefore considered unlikely to significantly impact the Fork-tailed Swift or the White-throated Needletail.



## APPENDIX G LAND CATEGORY ASSESSMENT



## Land Category Assessment

NGH has been engaged to prepare a Biodiversity Development Assessment Report (BDAR) for the proposed Culcairn Solar Farm, located in the Greater Hume Local Government Area (LGA), approximately 3.8 km south west of Culcairn, NSW. The proposal area includes Lots 9, 10, 11, 45, 46, 47, 53, and 54 DP 753735, Lots 70, 71, 72, 73 and 86 DP 753764, Lot 114 DP 664997, Lot 1 DP 171815, Lot 1 DP 179854, Lot 1 DP 575478, Lot 1 954904 and Lot B DP 972054 and Weeamera Road.

Section 6.8(3) of the Biodiversity Conservation Act 2016 determines that the Biodiversity Assessment Method (BAM) is to exclude the assessment of the impacts of clearing of native vegetation on Category 1-exempt land (within the meaning of Part 5A of the Local Land Services Act 2013) with exception to any impacts prescribed by the regulations under section 6.3. **Category 1-exempt land** is defined under the LLS act as;

- Land cleared of native vegetation as at 1 January 1990 or lawfully cleared after 1 January 2019
- Low Conservation Grasslands (following commencement of the new framework on 25th August 2017
- Land (not being grasslands) containing only low conservation groundcover (following commencement of the new framework on 25th August 2017)
- Native vegetation identified as regrowth in a Property Vegetation Plan under the repealed Native Vegetation Act 2003
- Land biodiversity certified under the *Biodiversity Conservation Act 2016*.

This report establishes the methodology, results and conclusions to evaluate the land categorisation for the proposal area. It is requested that Department of Planning, Industry and Environment (DPIE) review the proposed methodology, endorse it if considered appropriate, and provide comment where required for the land categorisation of the proposal area and the proposed Culcairn Solar Farm.

## Methodology

An initial desktop assessment and subsequent field assessments were undertaken over the proposal area to determine the ecological constraints and native vegetation communities on site. Assessment of the proposal area as Category 1-Exempt and Category 2- Regulated Land was undertaken using the following data sources:

- Aerial imagery of historical land use (Sourced from Spatial Services unit Department of Finance, Services and Innovation) (Figure 4 to Figure 13);
- 2017 Land Use Dataset (Australian Land Use and Management (ALUM) Classification Version 7 (OEH, 2017) (Figure 14 to Figure 16);
- NSW Woody vegetation extent and FPC 2011 (OEH, 2015) (Figure 18 to Figure 20);
- Sensitive regulated and vulnerable regulated lands on the Native Vegetation Regulatory Map portal (Figure 1 to Figure 3).
- Relevant vegetation mapping layers available from the SEED portal.

The potential of land legally cleared at or since 1 Jan 1990 (woody vegetation only) and/or land significantly disturbed or modified since 1990 (non woody vegetation) was assessed. Where there was any doubt, or where data was conflicting, the precautionary principle was applied, and deferred to Category 2 – Regulated Land. Historical images for 1990 and 2014 were evaluated to determine current and historic land-use (Figure 4 to Figure 13).



### WAGGA WAGGA

Suite 1, 39 Fitzmaurice Street (PO Box 5464) Wagga Wagga NSW 2650

T. (02) 6971 9696 E. [nggh@nghconsulting.com.au](mailto:nggh@nghconsulting.com.au) W. [www.nghconsulting.com.au](http://www.nghconsulting.com.au)

BEGA • BRISBANE • CANBERRA • GOLD COAST • NEWCASTLE • SYDNEY • WAGGA WAGGA

ABN 31 124 444 622 ACN 124 444 622

## Results

The analysis of the above sources identified in conjunction with aerial imagery that areas of land within the proposed proposal area for Culcairn Solar Farm have been used continuously for cropping and grazing prior to and post 1990. Although smaller areas of past cropping are clearly evident, the vast majority of the proposal area is identified as having modified pastures in the relevant land use layers, however, conclusive evidence within the supporting historical imagery could not determine the significance of groundcover modification and therefore a precautionary approach was applied. The only exception to this is recent areas of cropping evident during the field surveys (for example most of the open paddocks have been used for cropping, hay production or grazing). The following table (Table 1) demonstrates how the above-mentioned layers were used in determining land category:

Table 1 – Summary of data sources and interpretation

Data Sources	Category 1 – Exempt Land	Category 2– Regulated Land	Excluded Land
Aerial Imagery Culcairn Locality <ul style="list-style-type: none"> <li>1990</li> <li>2014</li> </ul>	<ul style="list-style-type: none"> <li>Clear evidence of cropping</li> <li>Clear evidence of significant groundcover modification</li> </ul>	<ul style="list-style-type: none"> <li>Woody vegetation present at 1990 in conjunction with woody vegetation extent layer</li> </ul>	N/A
2017 Land Use Dataset	Land use identified as; <ul style="list-style-type: none"> <li>Grazing modified pastures (excluding woody vegetation) where clear evidence of significant groundcover modification has occurred post 1990</li> <li>Cropping</li> <li>Manufacturing and industrial</li> <li>Residential and farm infrastructure</li> </ul>	Land use identified as; <ul style="list-style-type: none"> <li>Managed resource protection</li> <li>Grazing native vegetation</li> <li>Grazing modified pastures</li> <li>Cropping</li> <li>Residential and farm infrastructure</li> <li>Utilities</li> </ul>	N/A
NSW Woody vegetation extent	<ul style="list-style-type: none"> <li>Areas of woody vegetation regrowth that has occurred post 1990 following previous clearing events</li> </ul>	<ul style="list-style-type: none"> <li>Woody vegetation present as at 1990 in conjunction with historic aerial imagery</li> </ul>	N/A
Native regulatory map <ul style="list-style-type: none"> <li>Sensitive regulated land</li> <li>Vulnerable regulated land</li> <li>Excluded land</li> </ul>	N/A	<ul style="list-style-type: none"> <li>All areas identified as vulnerable regulated land</li> <li>All areas identified as sensitive regulated land (there were no areas identified as sensitive regulated land)</li> </ul>	N/A

Another determining feature of constant agricultural use is a lack of woody vegetation regrowth in the majority of areas, as represented in the aerial images. The 2011 Woody Vegetation extent data (Figures 18-20) does however demonstrate scattered patches and isolated paddock trees in the proposal area that has been mapped as Category 2 Regulated Land. In areas where it is not 100% conclusive whether the grassland areas



have been previously cropped or significantly modified, a precautionary approach has been applied and mapped as Category 2 – Regulated Land.

The Land Category Map identifies the areas of Vulnerable Regulated Land occurring within the proposal area, as Sensitive Regulated Land does not occur on site, and therefore has been mapped as Category 2 – Regulated land. Refer to Figure 1 Proposal area and land categorisation overview (Source ESRI)

PCTs in various condition states within the proposal area that were recorded during the field surveys undertaken thus far include;

Woodland areas;

- PCT 5 – River Red Gum herbaceous-grassy very tall open forest wetland on inner floodplains in the lower slopes sub-region of the NSW South Western Slopes Bioregion and the eastern Riverina Bioregion.
- PCT 74 – Yellow Box - River Red Gum tall grassy riverine woodland of the NSW South Western Slopes Bioregion and the Riverina Bioregion.
- PCT 76 – Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes Bioregion and the Riverina Bioregion.
- PCT 277 - Blakely's Red Gum – Yellow Box Grassy Woodland of the NSW South Western Slopes Bioregion

Patches of derived grassland communities associated with the above PCTs were also identified in low condition throughout the site.

One area identified as Category 2 Regulated Land was not identified as native vegetation during the surveys. No plots were completed in this area as the land had been sown with Oats. Recent aerial evidence provides an indication of this. This comparison is provided below.



Figure 1-1 Recent aerial imagery(Google, 2020) right indicating land disturbance and lack of native vegetation in comparison to Category 2 Land.



# **WAGGA WAGGA**

Suite 1, 39 Fitzmaurice Street (PO Box 5464) Wagga Wagga NSW 2650

**T.** (02) 6971 9696 **E.** [ngh@nghconsulting.com.au](mailto:ngh@nghconsulting.com.au) **W.** [www.nghconsulting.com.au](http://www.nghconsulting.com.au)

**BEGA • BRISBANE • CANBERRA • GOLD COAST • NEWCASTLE • SYDNEY • WAGGA WAGGA**

ABN 31 124 444 622 ACN 124 444 622



## Conclusion

Based on the above data sources, there is evidence to suggest that all of the lots within the proposal area have been under regular rotational cropping, hay production or grazing since 1990.

The 2017 Land Use data presented in Figures 14-16 supports primary land use within the identified areas within these lots as cropping or modified pastures, with smaller areas of grazing native vegetation. There is evidence of revegetation or native regeneration along riparian areas identified as category 2 regulated land within the proposal area shown to have occurred between 1990 and 2014 (Figures 4-13).

The Land Use Map (Figure 14) shows the majority of the site to be 'Cropping', with 'Grazing modified pastures' to the east of the proposal area. These areas are considered to meet the definition of Category 1-Exempt Land. Woody vegetation and areas identified as 'Grazing native vegetation' have been included as Category 2 - Regulated land. Where in doubt, or where data sources are conflicting, a precautionary approach has been implemented to areas deemed inconclusive in terms of determining historical land use.

A draft map of areas considered to be Category 1 Exempt Land and Category 2 Regulated Land (Vulnerable and Sensitive) has been produced and shown in Figures 1-3.



### **WAGGA WAGGA**

Suite 1, 39 Fitzmaurice Street (PO Box 5464) Wagga Wagga NSW 2650

**T.** (02) 6971 9696 **E.** [ngh@nghconsulting.com.au](mailto:ngh@nghconsulting.com.au) **W.** [www.nghconsulting.com.au](http://www.nghconsulting.com.au)

**BEGA • BRISBANE • CANBERRA • GOLD COAST • NEWCASTLE • SYDNEY • WAGGA WAGGA**

ABN 31 124 444 622 ACN 124 444 622



## Figures

Figure 1 Proposal area and land categorisation overview (Source ESRI) .....	7
Figure 2 Northern half of proposal area and land categorisation (Source ESRI).....	8
Figure 3 Southern half of proposal area and land categorisation (Source ESRI) .....	9
Figure 4 Aerial Imagery 1990 showing the northern half of the proposal area (Source: Dept. Spatial Services delivery) .....	10
Figure 5 Aerial Imagery 1990 showing the southern half of the proposal area (Source: Dept. Spatial Services delivery) .....	11
Figure 6 Aerial Imagery 1990 with Land categorisation in the northern half of the proposal area (Source: Dept. Spatial Services delivery).....	12
Figure 7 Aerial Imagery 1990 with Land categorisation in the southern half of the proposal area (Source: Dept. Spatial Services delivery).....	13
Figure 8 Aerial Imagery 2014 of northern half of proposal area (Source: Google Earth Pro).....	14
Figure 9 Aerial Imagery 2014 of southern half of proposal area (Source: Google Earth Pro) .....	15
Figure 10 Aerial Imagery 2014 of the Weeamera Road area (Source: Google Earth Pro).....	16
Figure 11 Aerial Imagery 2014 with Land categorisation of northern half of proposal area (Source: Google Earth Pro) .....	17
Figure 12 Aerial Imagery 2014 with Land categorisation of southern half of proposal area (Source: Google Earth Pro). .....	18
Figure 13 Aerial Imagery 2014 with Land categorisation of Weeamera Road (Source: Google Earth Pro)...	19
Figure 14 Land use overview map (Source ESRI) .....	20
Figure 15 Land use in the northern half of the proposal area (Source ESRI) .....	21
Figure 16 Land use in the southern half of the proposal area (Source ESRI) .....	22
Figure 17 Land Zoning (Source ESRI) .....	23
Figure 18 NSW Woody vegetation extent 2011 .....	24
Figure 19 NSW Woody vegetation extent 2011 with land categorisation in the northern half of the proposal area.....	25
Figure 20 NSW Woody vegetation extent 2011 in the southern half of the proposal area .....	26
Figure 21 Photo points across the proposal area.....	27



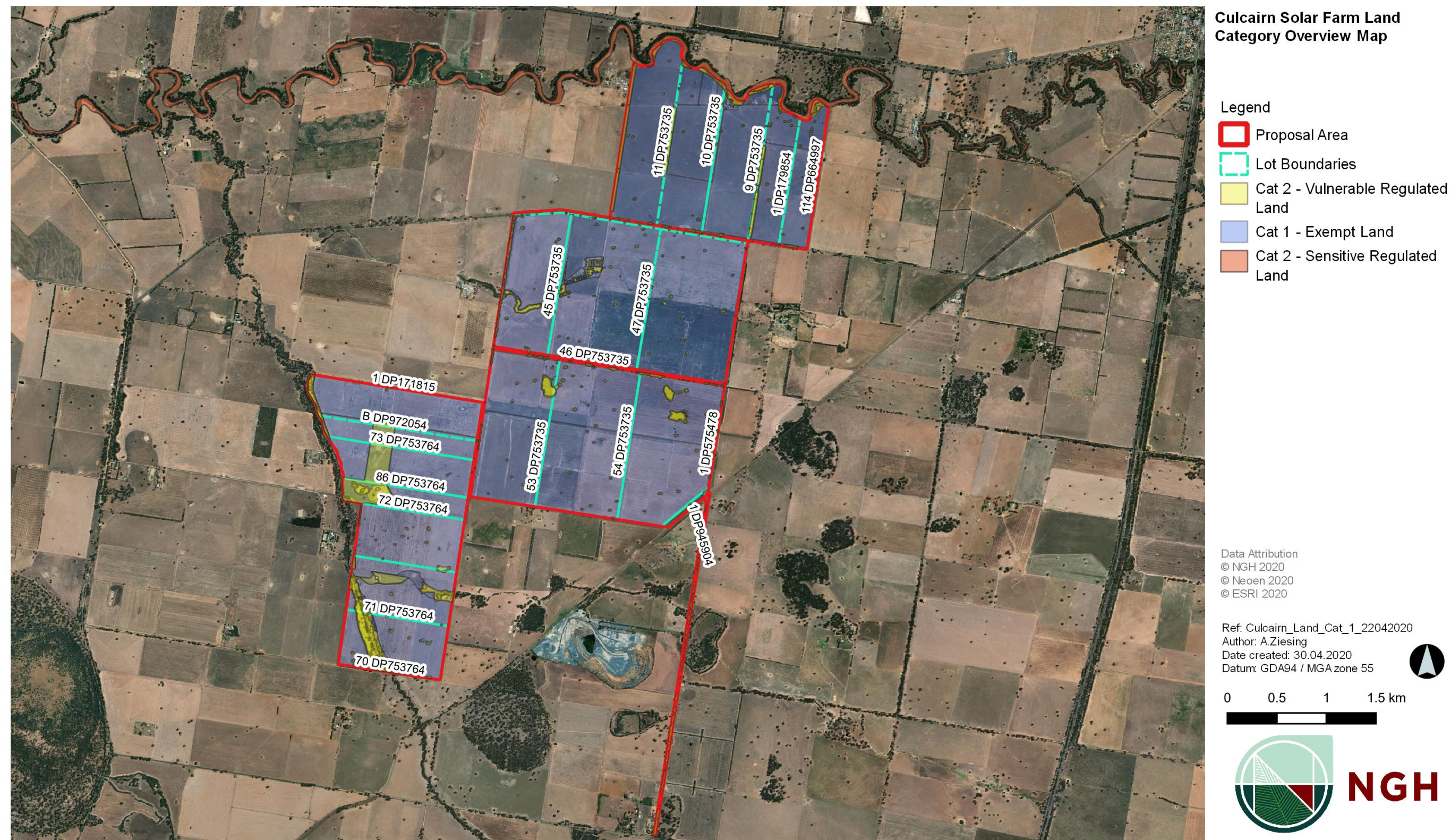


Figure 0-1 Proposal area and land categorisation overview (Source ESRI)



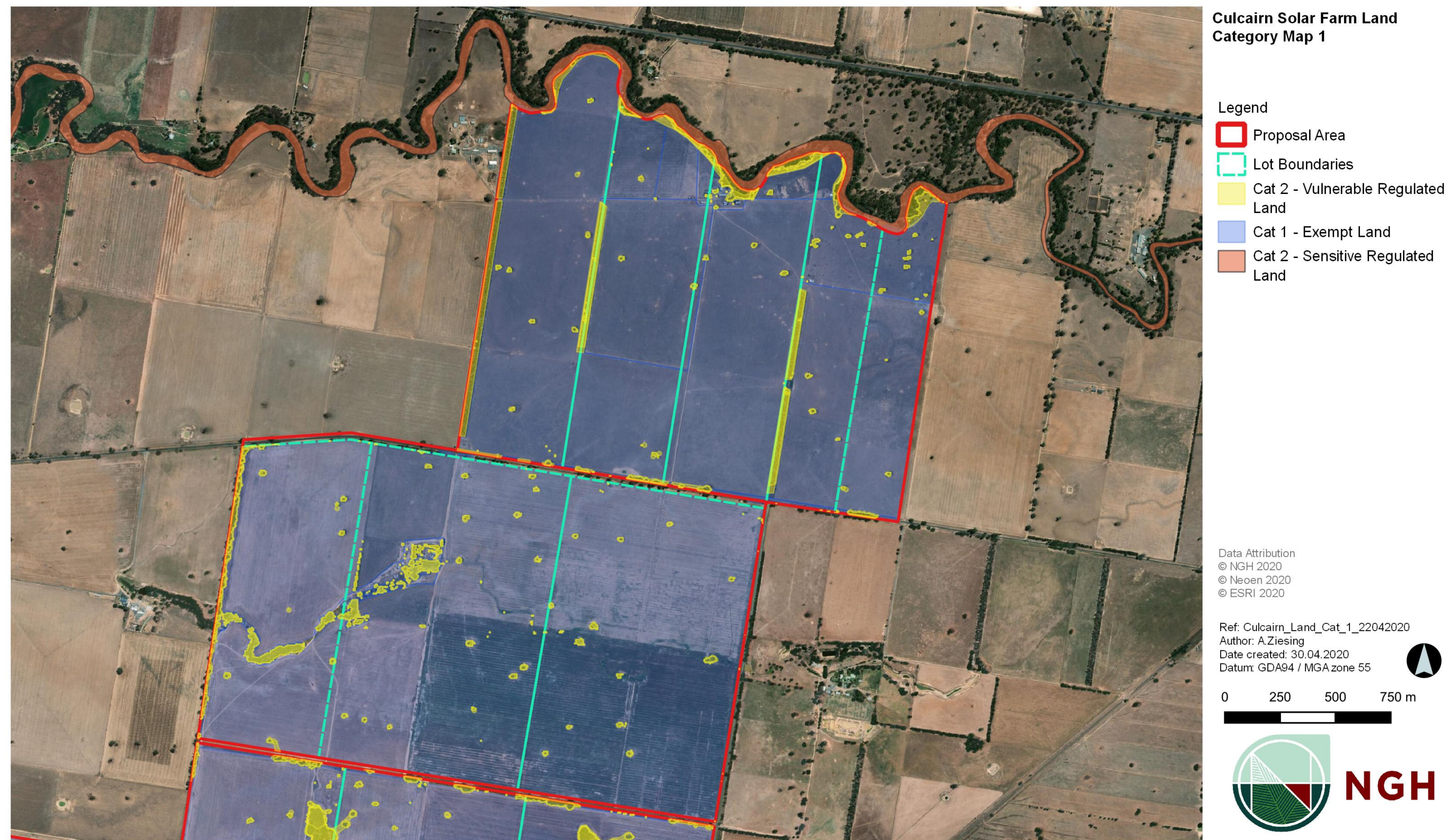
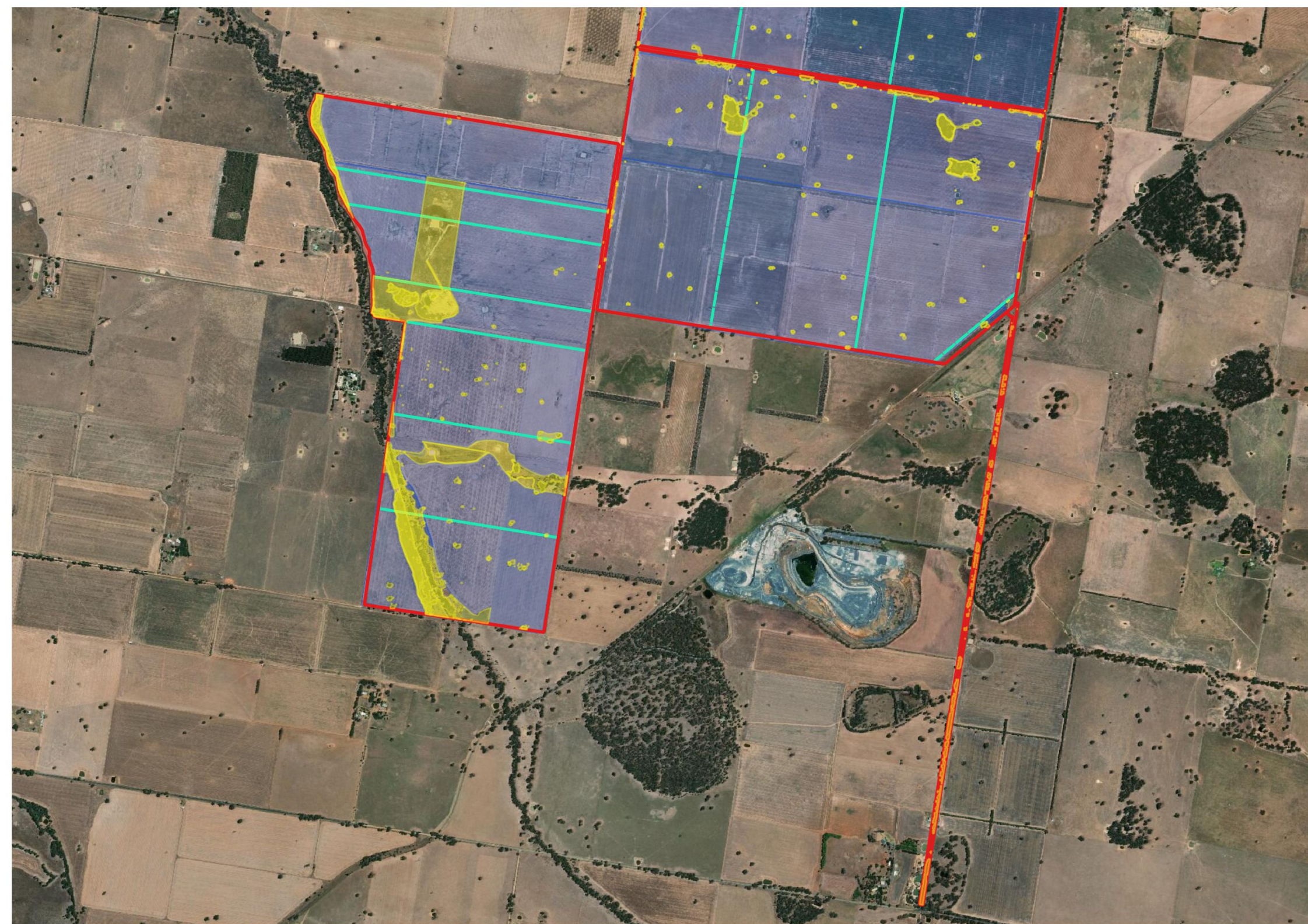


Figure 0-2 Northern half of proposal area and land categorisation (Source ESRI)





# **Culcairn Solar Farm Land Category Map 2**

## **Legend**

- Proposal Area
- Lot Boundaries
- Cat 2 - Vulnerable Regulated Land
- Cat 1 - Exempt Land
- Cat 2 - Sensitive Regulated Land

Data Attribution  
 © NGH 2020  
 © Neoen 2020  
 © ESRI 2020

Ref: Culcairn\_Land\_Cat\_1\_22042020  
 Author: A.Ziesing  
 Date created: 30.04.2020  
 Datum: GDA94 / MGA zone 55

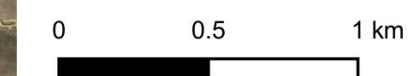


Figure 0-3 Southern half of proposal area and land categorisation (Source ESRI)





Culcairn Solar Farm 1990 Aerial  
Image Map 1

Legend

 Proposal Area

Data Attribution  
© NGH 2020  
© Neoen 2020  
© NSW Spatial Services 2020

Ref: Culcairn\_Land\_Cat\_1\_22042020  
Author: A.Ziesing  
Date created: 27.04.2020  
Datum: GDA94 / MGA zone 55

0 250 500 750 m



**NGH**

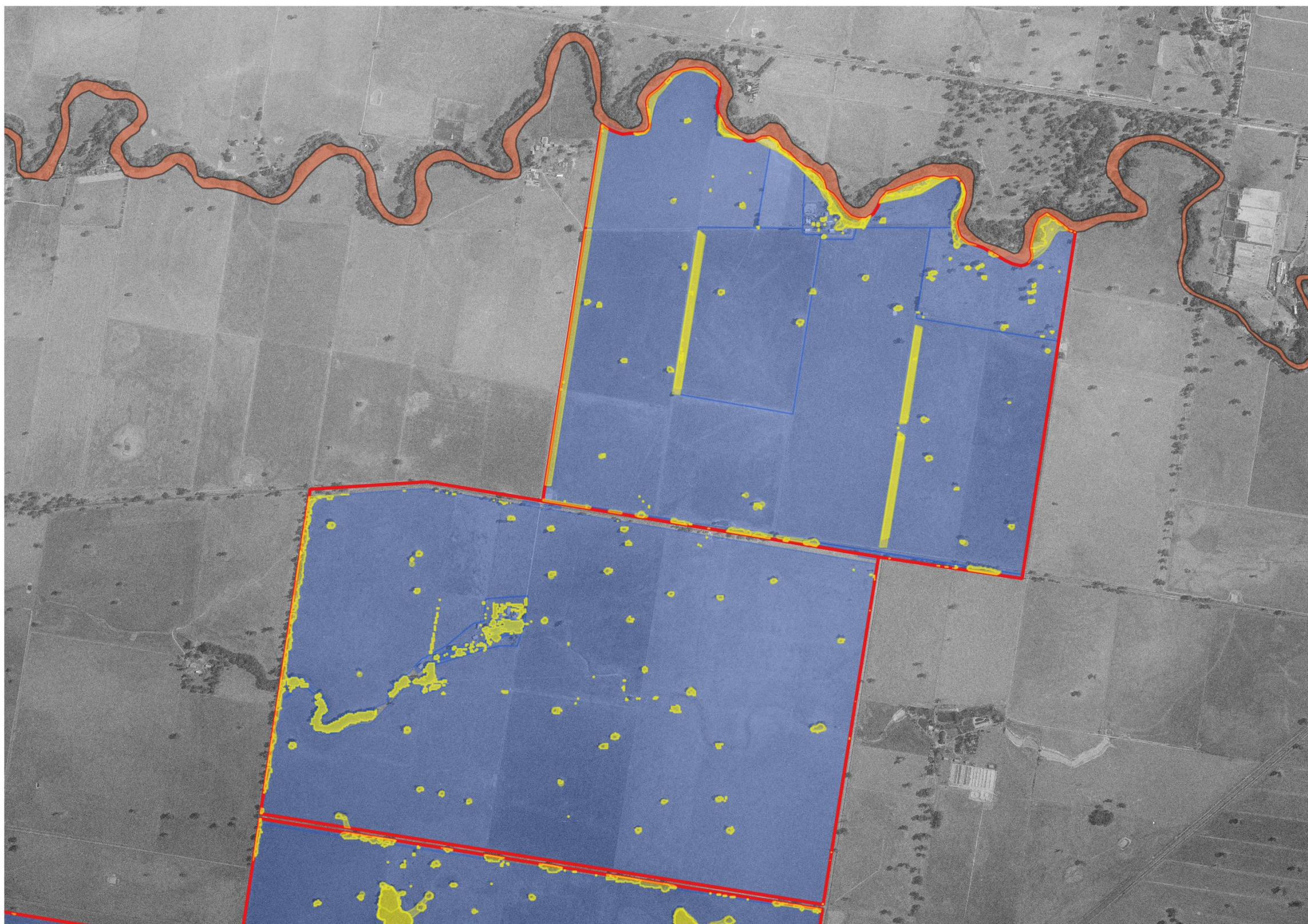
Figure 04 Aerial Imagery 1990 showing the northern half of the proposal area (Source: Dept. Spatial Services delivery)





Figure 0-5 Aerial Imagery 1990 showing the southern half of the proposal area (Source: Dept. Spatial Services delivery)





**Culcairn Solar Farm 1990 Aerial  
Image Land Category Map 1**

**Legend**

- Proposal Area
- Cat 1 - Exempt Land
- Cat 2 - Vulnerable Regulated Land

Data Attribution  
 © NGH 2020  
 © Neoen 2020  
 © NSW Spatial Services 2020

Ref: Culcairn\_Land\_Cat\_1\_22042020  
 Author: A.Ziesing  
 Date created: 30.04.2020  
 Datum: GDA94 / MGA zone 55



0 250 500 750 m



Figure 0-6 Aerial Imagery 1990 with Land categorisation in the northern half of the proposal area (Source: Dept. Spatial Services delivery)





**Culcairn Solar Farm 1990 Aerial Image Land Category Map 2**

**Legend**

- Proposal Area
- Cat 1 - Exempt Land
- Cat 2 - Vulnerable Regulated Land

Data Attribution  
 © NGH 2020  
 © Neoen 2020  
 © NSW Spatial Services 2020

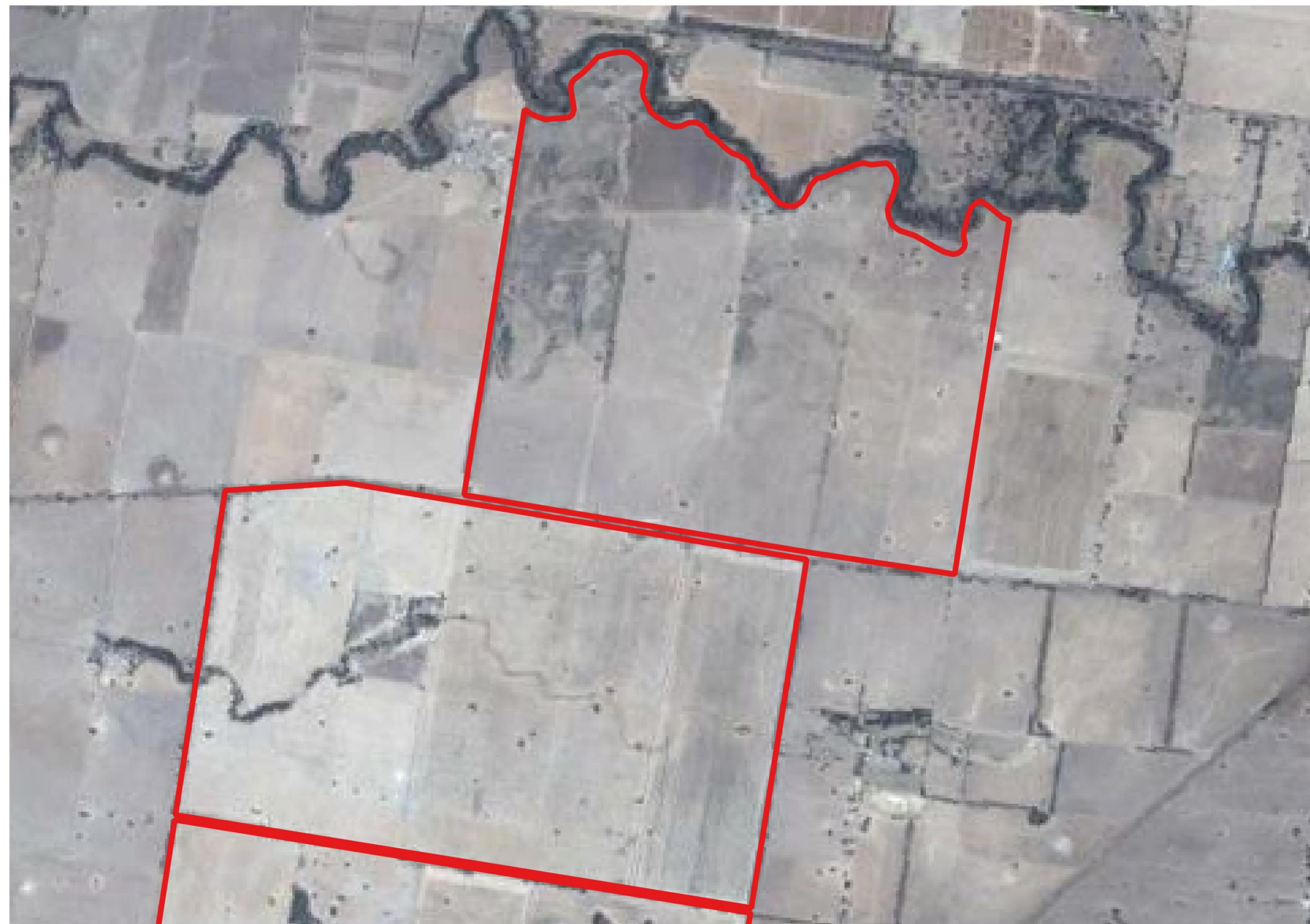
Ref: Culcairn\_Land\_Cat\_1\_22042020  
 Author: A.Ziesing  
 Date created: 30.04.2020  
 Datum: GDA94 / MGA zone 55

0 500 1,000 m




Figure 0-7 Aerial Imagery 1990 with Land categorisation in the southern half of the proposal area (Source: Dept. Spatial Services delivery)





**Culcairn Solar Farm 2014 Aerial  
Image Map 1**

**Legend**  
 Proposal Area

Data Attribution  
 © NGH 2020  
 © Neoen 2020  
 © Google Earth Pro 2020

Ref: Culcairn\_Land\_Cat\_1\_22042020  
 Author: A.Ziesing  
 Date created: 28.04.2020  
 Datum: GDA94 / MGA zone 55

0 250 500 750 m



**NGH**

Figure 0-8 Aerial Imagery 2014 of northern half of proposal area (Source: Google Earth Pro)





**Culcairn Solar Farm 2014 Aerial  
Image Map 2**

Legend

 Proposal Area

Data Attribution  
© NGH 2020  
© Neoen 2020  
© Google Earth Pro 2020

Ref: Culcairn\_Land\_Cat\_1\_22042020  
Author: A.Ziesing  
Date created: 28.04.2020  
Datum: GDA94 / MGA zone 55

0 250 500 750 m



**NGH**

Figure 0-9 Aerial Imagery 2014 of southern half of proposal area (Source: Google Earth Pro)





# Culcairn Solar Farm 2014 Aerial Image Weeamera Road Map

## Legend

Proposal Area

Data Attribution  
 © NGH 2020  
 © Neoen 2020  
 © Google Earth Pro 2020

Ref: Culcairn\_Land\_Cat\_1\_22042020  
 Author: A.Ziesing  
 Date created: 28.04.2020  
 Datum: GDA94 / MGA zone 55

0 250 500 750 m



**NGH**

Figure 0-10 Aerial Imagery 2014 of the Weeamera Road area (Source: Google Earth Pro)



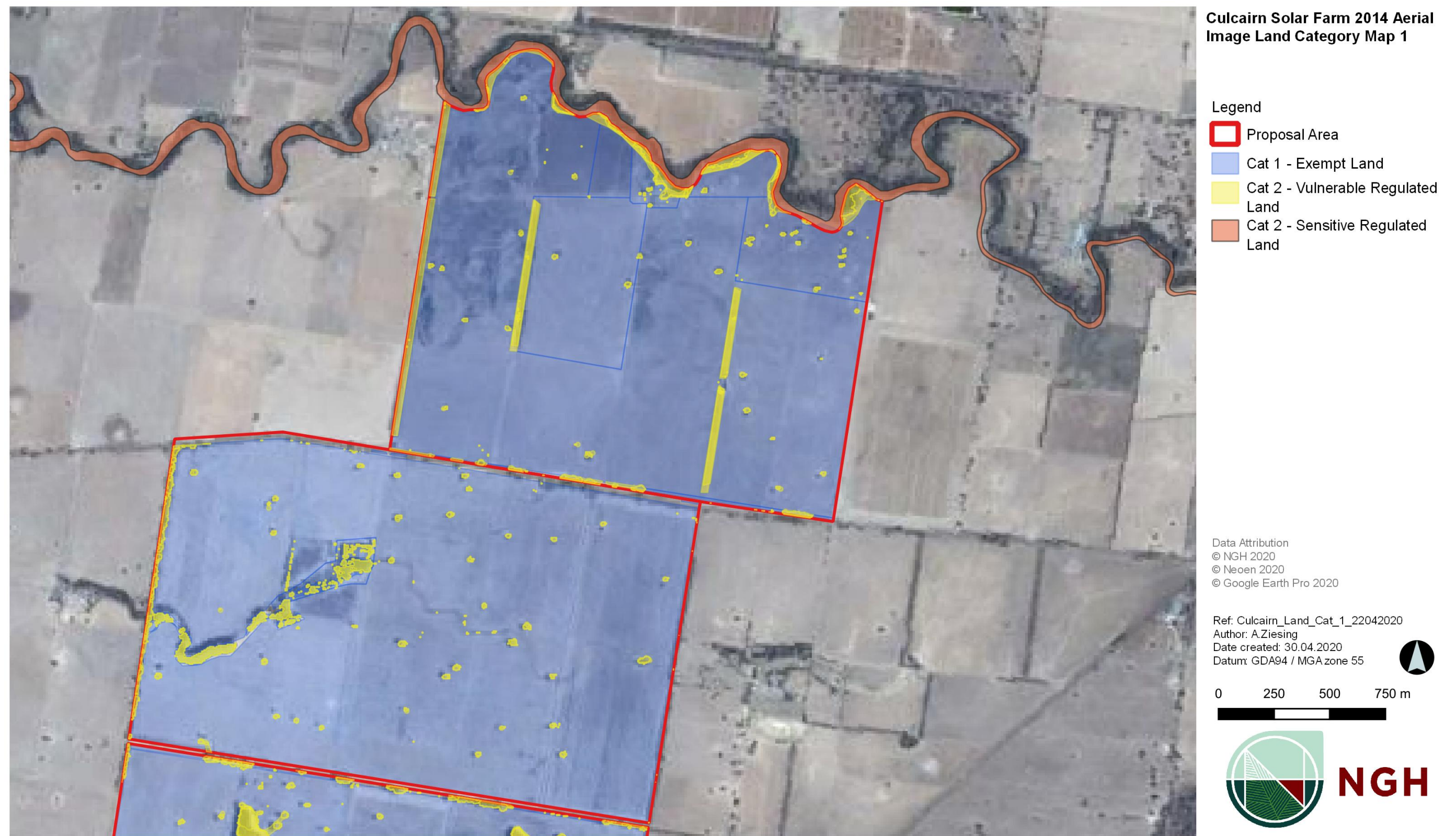


Figure 0-11 Aerial Imagery 2014 with Land categorisation of northern half of proposal area (Source: Google Earth Pro)



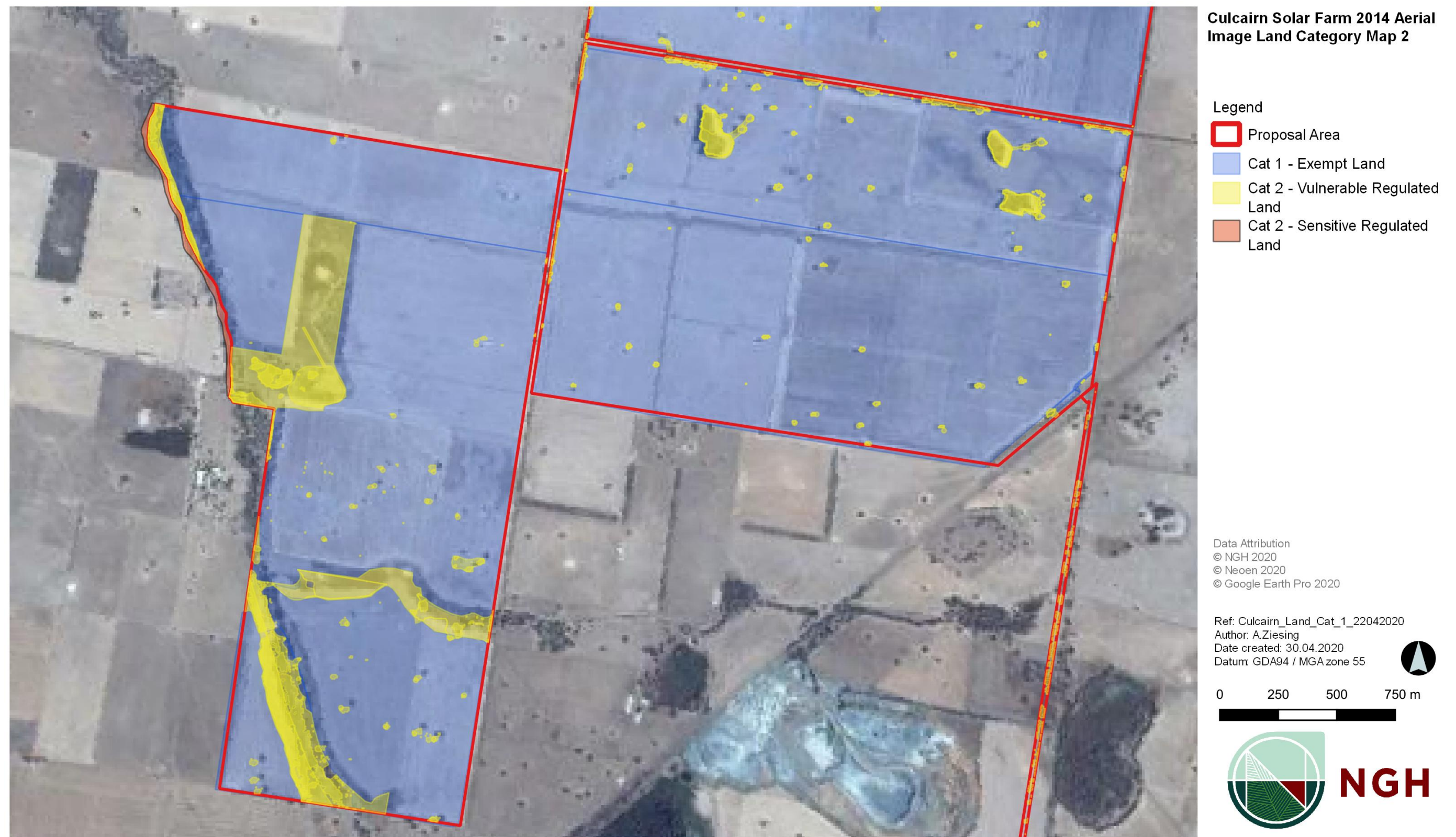


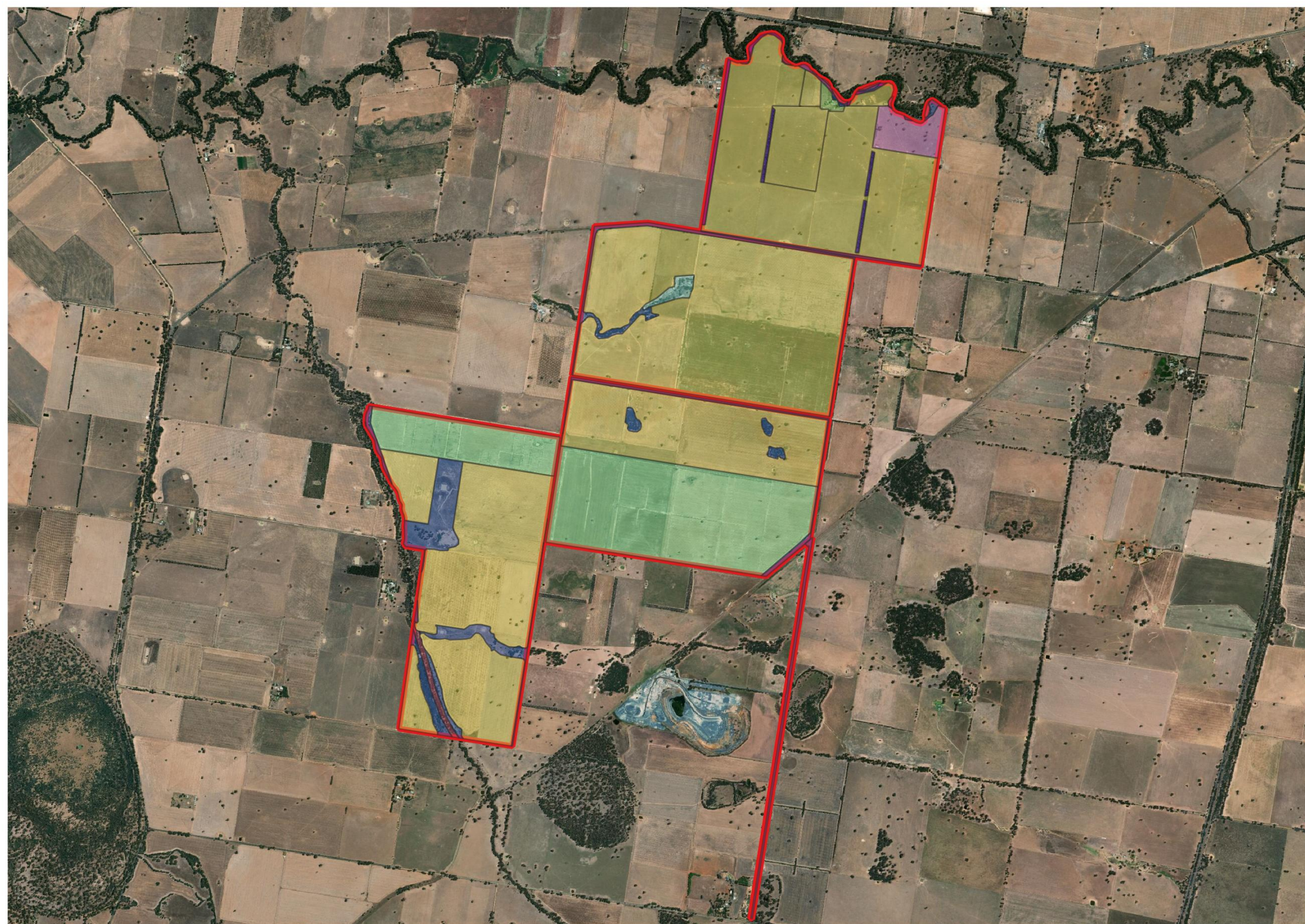
Figure 0-12 Aerial Imagery 2014 with Land categorisation of southern half of proposal area (Source: Google Earth Pro).





Figure 0-13 Aerial Imagery 2014 with Land categorisation of Weeamera Road (Source: Google Earth Pro)





# Culcairn Solar Farm Land Use Overview Map

## Legend

Proposal Area

## Land Use

- 1.2.0 Managed resource protection
- 2.1.0 Grazing native vegetation
- 3.2.0 Grazing modified pastures
- 3.3.0 Cropping
- 4.3.0 Irrigated cropping
- 5.3.0 Manufacturing and industrial
- 5.4.0 Residential and farm infrastructure
- 6.3.0 River

Data Attribution  
© NGH 2020  
© Neoen 2020  
© ESRI 2020

Ref: Culcairn\_Land\_Cat\_1\_22042020  
Author: A.Ziesing  
Date created: 28.04.2020  
Datum: GDA94 / MGA zone 55



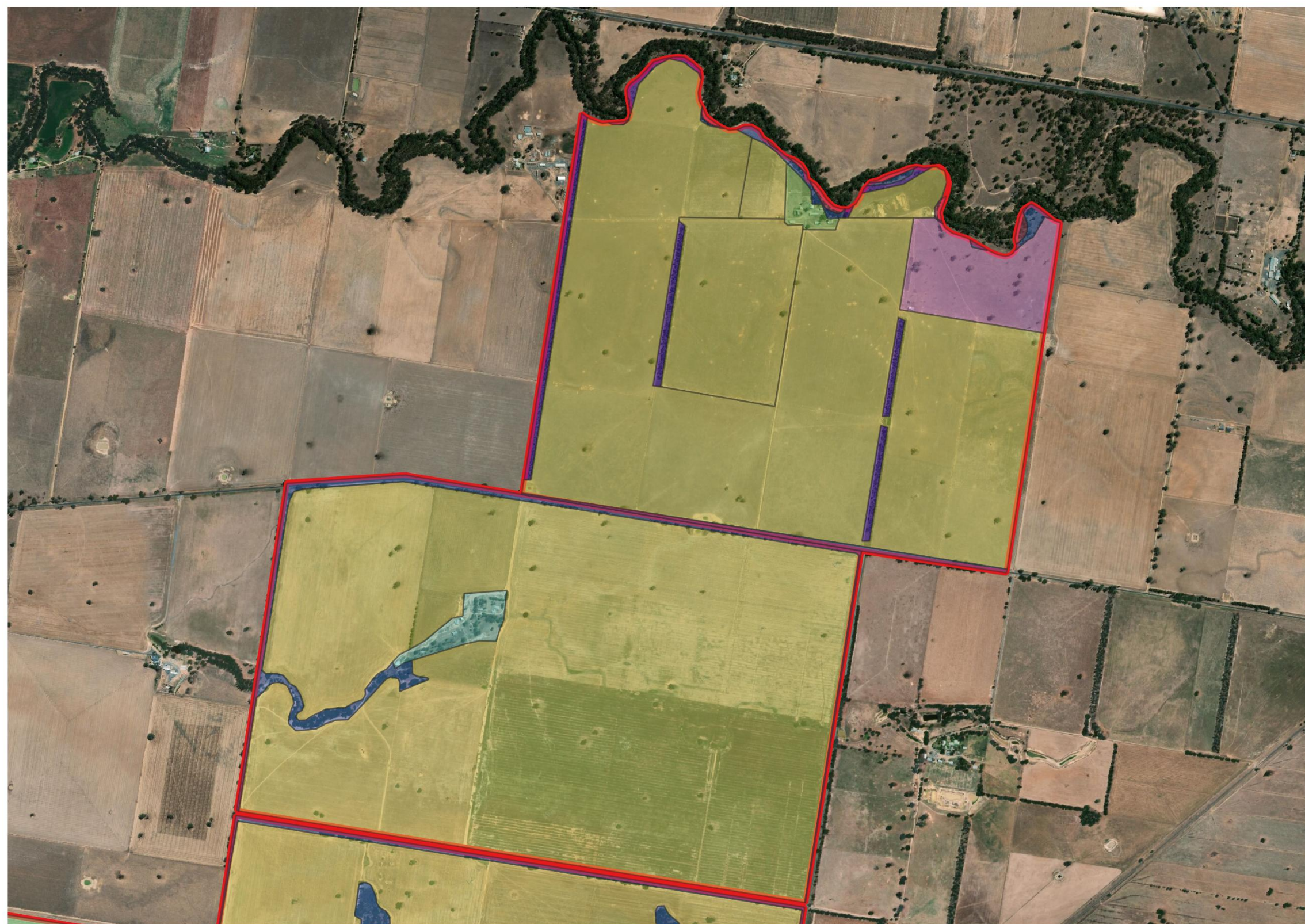
0 0.5 1 1.5 km



**NGH**

Figure 0-14 Land use overview map (Source ESRI)





**Culcairn Solar Farm Land Use  
Map 1**

**Legend**

Proposal Area

**Land Use**

- 1.2.0 Managed resource protection
- 2.1.0 Grazing native vegetation
- 3.2.0 Grazing modified pastures
- 3.3.0 Cropping
- 4.3.0 Irrigated cropping
- 5.3.0 Manufacturing and industrial
- 5.4.0 Residential and farm infrastructure
- 6.3.0 River

Data Attribution  
 © NGH 2020  
 © Neoen 2020  
 © ESRI 2020

Ref: Culcairn\_Land\_Cat\_1\_22042020  
 Author: A.Ziesing  
 Date created: 28.04.2020  
 Datum: GDA94 / MGA zone 55



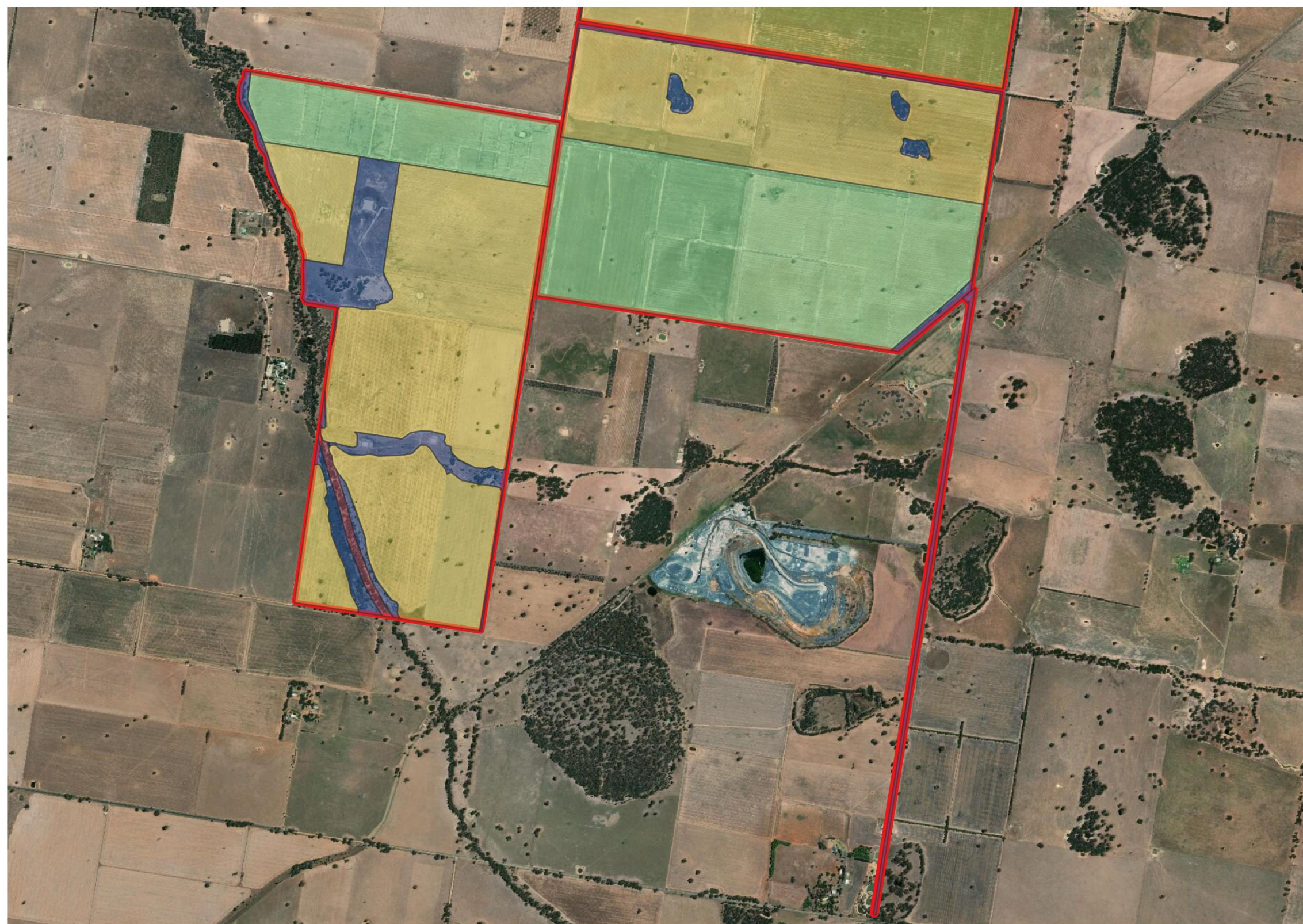
0 250 500 750 m



**NGH**

Figure 0-15 Land use in the northern half of the proposal area (Source ESRI)





## Culcairn Solar Farm Land Use Map 2

### Legend

  Proposal Area

### Land Use

- 1.2.0 Managed resource protection
- 2.1.0 Grazing native vegetation
- 3.2.0 Grazing modified pastures
- 3.3.0 Cropping
- 4.3.0 Irrigated cropping
- 5.3.0 Manufacturing and industrial
- 5.4.0 Residential and farm infrastructure
- 6.3.0 River

Data Attribution  
 © NGH 2020  
 © Neoen 2020  
 © ESRI 2020

Ref: Culcairn\_Land\_Cat\_1\_22042020  
 Author: A.Ziesing  
 Date created: 28.04.2020  
 Datum: GDA94 / MGA zone 55

0 500 1,000 m



**NGH**

Figure 0-16 Land use in the southern half of the proposal area (Source ESRI)



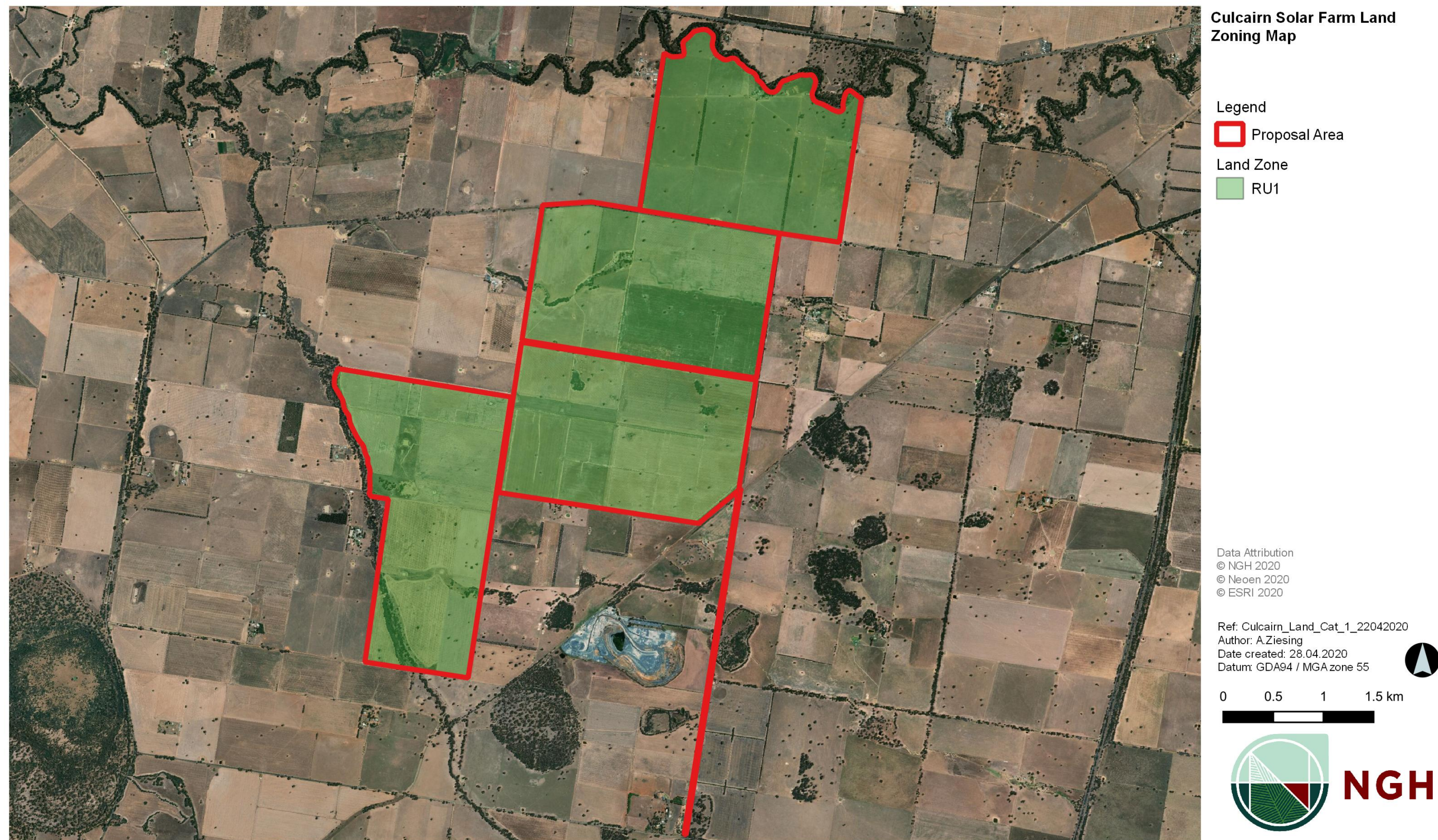
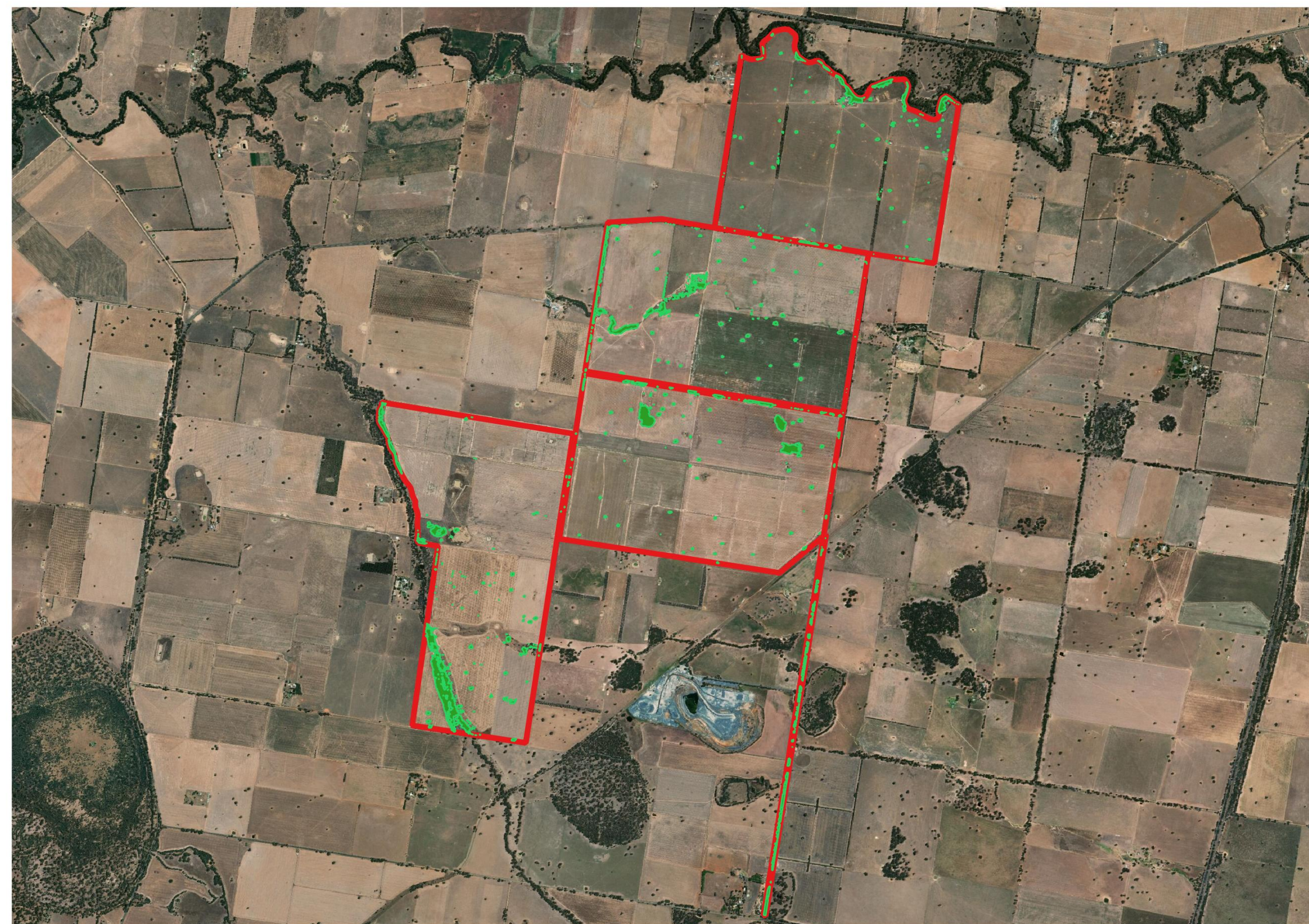


Figure0-17 Land Zoning (Source ESRI)





# Culcairn Solar Farm Woody Vegetation Overview Map

## Legend

- Proposal Area
- Woody Vegetation 2011

Data Attribution  
 © NGH 2020  
 © Neoen 2020  
 © ESRI 2020

Ref: Culcairn\_Land\_Cat\_1\_22042020  
 Author: A.Ziesing  
 Date created: 28.04.2020  
 Datum: GDA94 / MGA zone 55



**NGH**

Figure 0-18 NSW Woody vegetation extent 2011



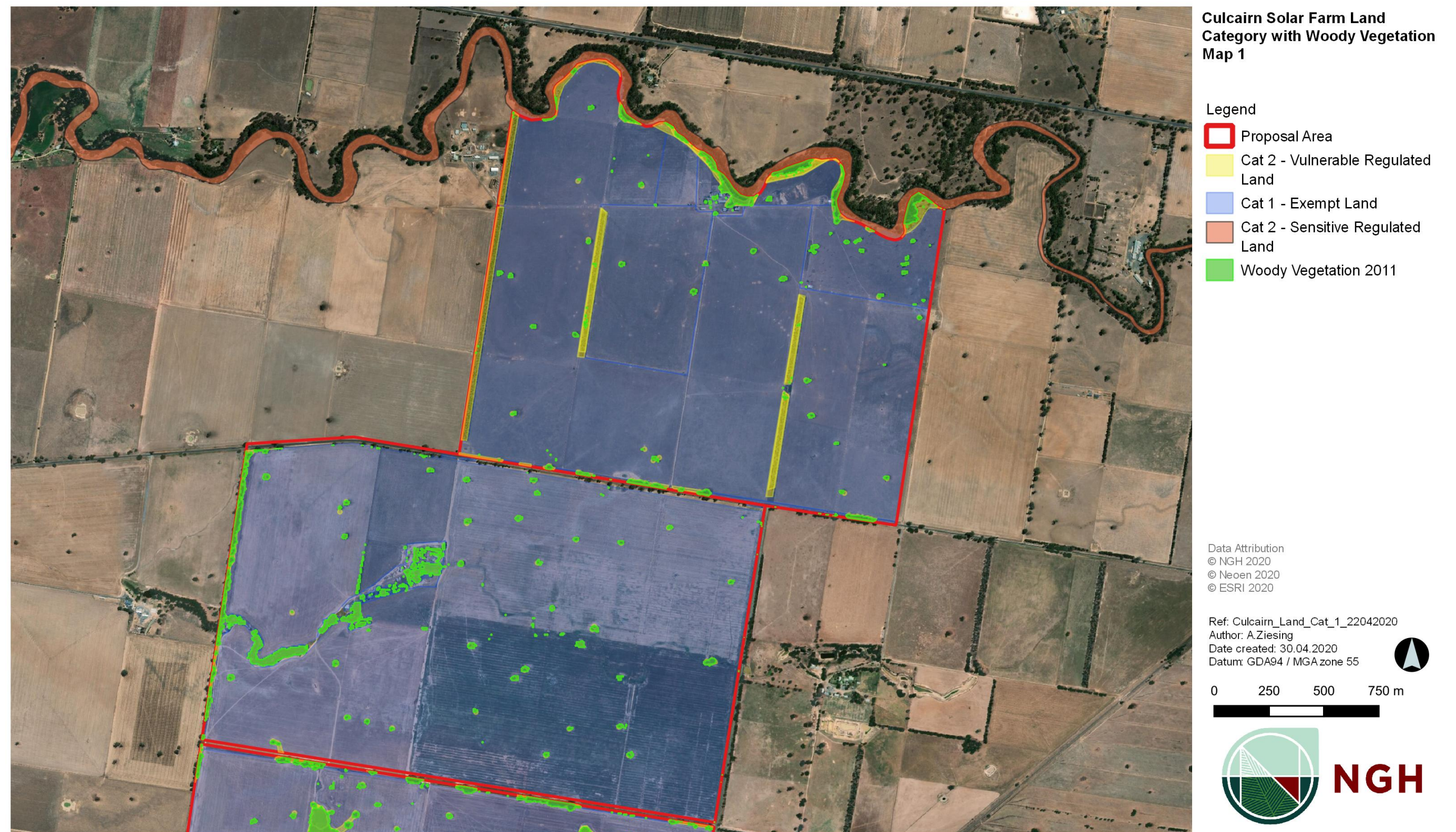
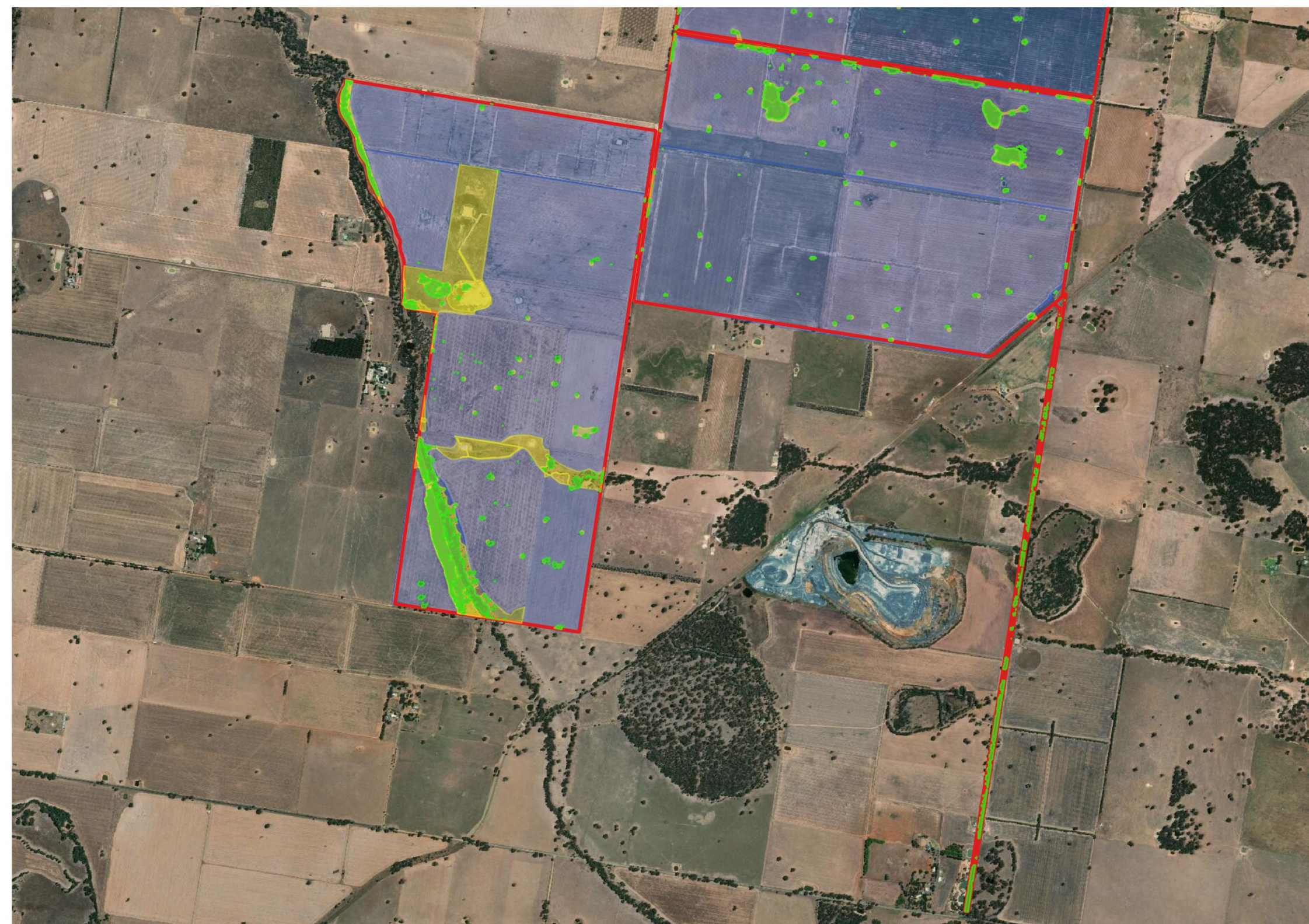


Figure 0-19 NSW Woody vegetation extent 2011 with land categorisation in the northern half of the proposal area





# **Culcairn Solar Farm Land Category with Woody Vegetation Map 2**

## **Legend**

- Proposal Area
- Cat 2 - Vulnerable Regulated Land
- Cat 1 - Exempt Land
- Cat 2 - Sensitive Regulated Land
- Woody Vegetation 2011

Data Attribution  
 © NGH 2020  
 © Neoen 2020  
 © ESRI 2020

Ref: Culcairn\_Land\_Cat\_1\_22042020  
 Author: A.Ziesing  
 Date created: 30.04.2020  
 Datum: GDA94 / MGA zone 55

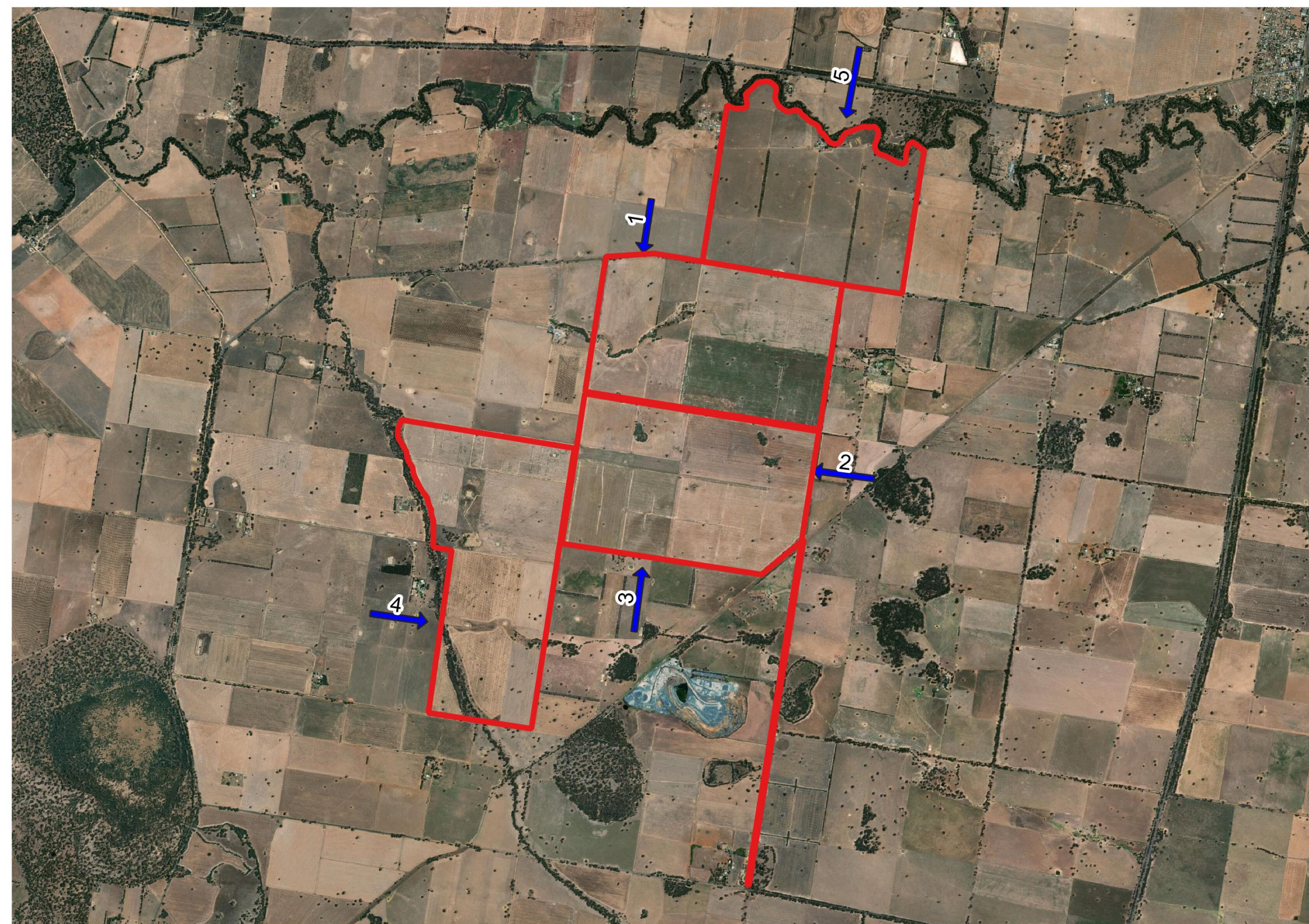
0 500 1,000 m



**NGH**

Figure 0-20 NSW Woody vegetation extent 2011 in the southern half of the proposal area





# Culcairn Solar Farm Photo Points Map

## Legend

- Proposal Area
- Photo Points

Data Attribution  
© NGH 2020  
© Neoen 2020  
© ESRI 2020

Ref: Culcairn\_Land\_Cat\_1\_22042020  
Author: A.Ziesing  
Date created: 28.04.2020  
Datum: GDA94 / MGA zone 55



Figure 0-21 Photo points across the proposal area



Table 2 – Photographs showing current land use (Figure 17)




Photo Points	Summary	Image
<b>Photo point 1</b> <b>Cumming Road, north</b>	Evidence of grazing	
<b>Photo point 2</b> <b>Southern area of development site</b>	Evidence of cropping in the south	
<b>Photo point 3</b>	Evidence of grazing and cropping	



Photo Points	Summary	Image
<p><b>Photo point 4</b></p> <p><b>Cumming Road, north</b></p>	<p>Hay production and grazing paddocks to the north</p>	

## APPENDIX H. BAM CALCULATOR CREDIT REPORT



# BAM Credit Summary Report

## Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00017027/BAAS18074/19/00017029	Culcairn Solar Farm	20/08/2020
Assessor Name	Report Created	BAM Data version *
	24/09/2020	30
Assessor Number	BAM Case Status	Date Finalised
	Open	To be finalised
Assessment Revision	Assessment Type	
2	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	Vegetation integrity loss / gain	Area (ha)	Constant	Species sensitivity to gain class (for BRW)	Biodiversity risk weighting	Potential SAIL	Ecosystem credits
<b>Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion</b>								
1	277_Native_Understory	47.0	0.16	0.25	High Sensitivity to Potential Gain	2.00	TRUE	4

## BAM Credit Summary Report

2	277_Derived_Grassland	23.5	0.03	0.25	High Sensitivity to Potential Gain	2.00	TRUE	1
3	277_Exotic_Understory	31.3	0.13	0.25	High Sensitivity to Potential Gain	2.00	TRUE	2
							<b>Subtotal</b>	<b>7</b>
<b>River Red Gum herbaceous-grassy very tall open forest wetland on inner floodplains in the lower slopes sub-region of the NSW South Western Slopes Bioregion and the eastern Riverina Bioregion.</b>								
4	5_Derived_Grassland	22.4	0.01	0.25	High Sensitivity to Potential Gain	1.50		1
							<b>Subtotal</b>	<b>1</b>
							<b>Total</b>	<b>8</b>

### Species credits for threatened species

Vegetation zone name	Habitat condition (HC)	Area (ha) / individual (HL)	Constant	Biodiversity risk weighting	Potential SAIL	Species credits
<b><i>Cullen parvum</i> / <i>Small Scurf-pea</i> ( Flora )</b>						
277_Native_Understory	47.0	0.15	0.25	2	False	4
277_Derived_Grassland	23.5	0.02	0.25	2	False	1
						<b>Subtotal</b>
						<b>5</b>
<b><i>Myotis macropus</i> / <i>Southern Myotis</i> ( Fauna )</b>						
277_Native_Understory	47.0	0	0.25	2	False	0
277_Derived_Grassland	23.5	0	0.25	2	False	0
277_Exotic_Understory	31.3	0	0.25	2	False	0



## BAM Credit Summary Report

					<b>Subtotal</b>	<b>0</b>
<b><i>Swainsona recta / Small Purple-pea ( Flora )</i></b>						
277_Native_Understory	47.0	0.15	0.25	2	False	4
277_Derived_Grassland	23.5	0.02	0.25	2	False	1
					<b>Subtotal</b>	<b>5</b>
<b><i>Swainsona sericea / Silky Swainson-pea ( Flora )</i></b>						
277_Native_Understory	47.0	0.15	0.25	2	False	4
277_Derived_Grassland	23.5	0.02	0.25	2	False	1
					<b>Subtotal</b>	<b>5</b>

# BAM Credit Summary Report

## Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00017027/BAAS18074/19/00017028	Culcairn Solar Farm_paddocktrees	20/08/2020
Assessor Name	Report Created	BAM Data version *
	24/09/2020	30
Assessor Number	BAM Case Status	Date Finalised
	Open	To be finalised
Assessment Revision	Assessment Type	
2	Paddock Trees	

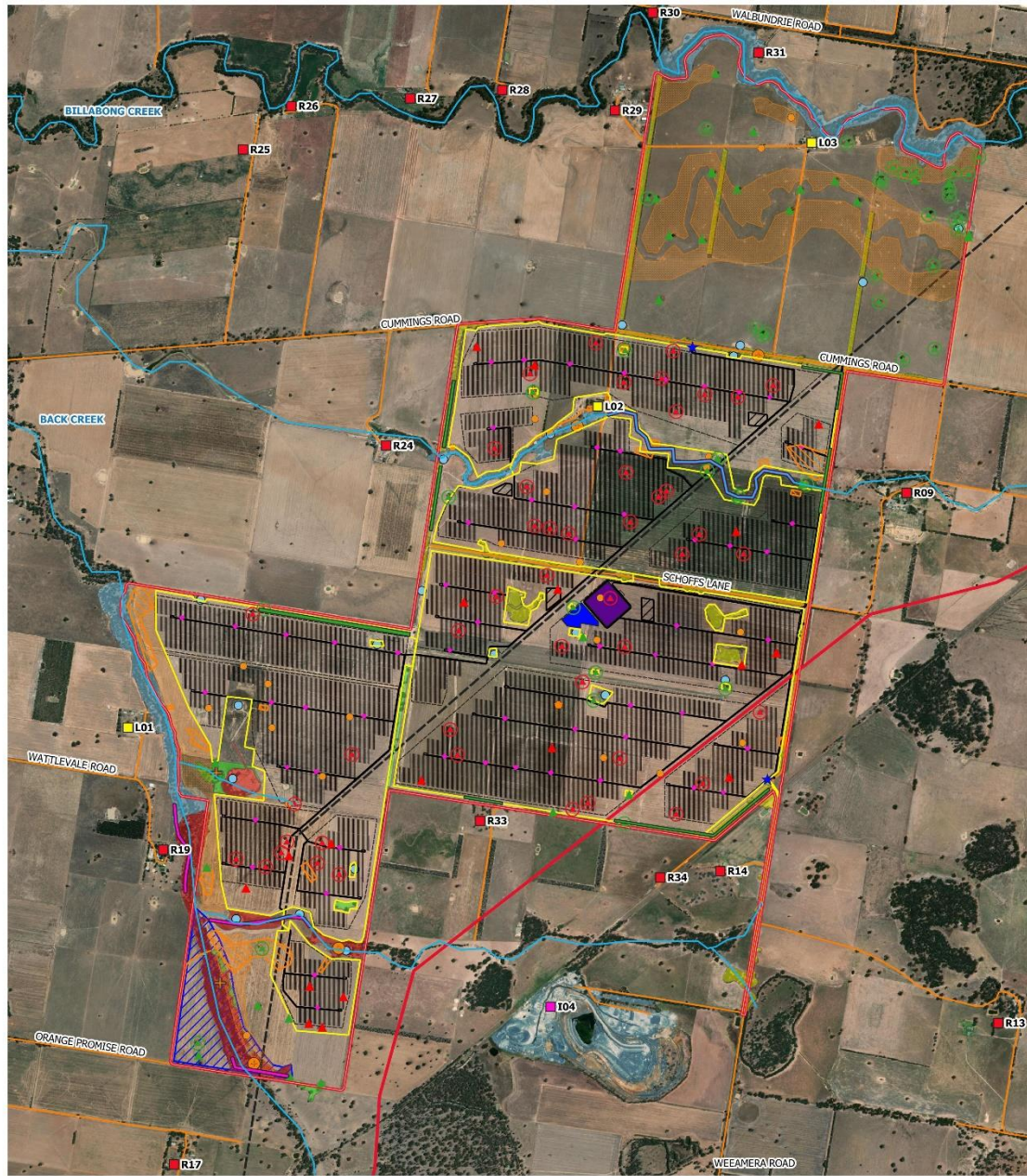
\* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

## Paddock Trees Credit Requirement

Class	Contains hollows	Number of trees	Ecosystem credits
<b>277-Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion</b>			
3	True	24.0	24
3	False	6.0	5
3	True	5.0	5
3	True	1.0	1
3	True	2.0	2
3	True	3.0	3
3	False	5.0	4
			<b>44</b>
<b>76-Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions</b>			
3	True	14.0	14
3	False	4.0	3
			<b>17</b>
			<b>61</b>



# APPENDIX I UPDATED CONSTRAINTS AND LAYOUT MAP



Culcairn Solar Farm Constraints Layout

Legend

Development Site	Subdivision	Sensitive Receivers	Paddock Trees
Development Footprint	Proposed Access	Associated Landowner	Hollow Bearing Retain
Substation	Internal Access Network	Non-associated Landowner	Non-hollow Bearing Retain
BESS	Public Roads	Industry	Hollow Bearing Remove
Control Building	Fences	Archaeological Site Type	Non-hollow Bearing Remove
Inverters	PV Array	Cultural Tree	
Construction Compound	Existing Transmission Line	Modified Tree	Plant Community Types (PCT)
Proposed Vegetative Screening	Gas Pipeline	Isolated Find	PCT5: River Red Gum herbaceous-grassy very tall open forest woodland
Visual Screening	Waterways	Cultural Object	PCT74: Yellow Box - River Red Gum tall grassy riverine woodland
Biodiversity/Supplementary Screening	Dams	Artefact Scatter	PCT76: Western Grey Box tall grassy woodland
		Potential Archaeological Deposits	PCT277: Blakely's Red Gum - Yellow Box Grassy Woodland

Data Attribution  
© NGH 2020  
© Neoen 2020  
© Esri 2020  
Ref: 200607 Culcairn SF \ Culcairn Solar Farm  
Constraints Layout  
Author: sarah.h  
Date created: 07.09.2020  
Datum: GDA84 / MGA zone 55



NGH