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Preliminary Biodiversity Assessment

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Romani Solar Farm and BESS

Preliminary Biodiversity Assessment

0704056

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ACRONYMS AND ABBREVIATIONS

Acronyms	Description
BAM	Biodiversity Assessment Methodology 2020
BAM-C	Biodiversity Assessment Methodology Calculator
BC Act	*Biodiversity Conservation Act 2016*
BDAR	Biodiversity Development Assessment Report
BOS	Biodiversity Offset Strategy
DP	Deposited Plans
DPE	Department of Planning & Environment
EP&A	*Environmental Planning and Assessment Act 1979*
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
ERM	Environmental Resources Management Australia Pty Ltd
GIS	Geographic Information System
ha	Hectare
IBRA	Interim Biogeographic Regionalisation for Australia
LGA	Local Government Area
LLS	Local Land Services Act
MNES	Matters of National Environmental Significance
MW	Mega Watt
NPWS	NSW National Parks and Wildlife Service
NSW	New South Wales
NVR	Native Vegetation Regulatory
PCT	Plant Community Type
PMST	Protected Matter Search Tool
SAII	Serious and Irreversible Impacts
SEED	The Central Resource for Sharing and Enabling Environmental Data in NSW
SF	Solar Farm
SSD	State Significant Development

Acronyms	Description
SVTM	State Vegetation Type Map
TEC	Threatened Ecological Community
VZ	Vegetation Zones
SEARS	Secretary’s Environmental Assessment Requirements

1. OVERVIEW OF BIODIVERSITY ASSESSMENT

Samsung C&T Renewable Energy Australia Pty Ltd (Samsung) proposes to construct and operate the Romani Solar Farm and Battery Energy Storage System (the Project), a renewable energy development located 44 km southwest of Hay in the Riverina Murray Region of New South Wales (NSW).

This Preliminary Biodiversity Assessment has the purpose of overviewing the project location's biodiversity values and providing a foundation for progression to the preparation of a Biodiversity Development Assessment Report (BDAR). The project BDAR will form part of the Environmental Impact Statement and is to be compliant with Stage 1 (Biodiversity Assessment) and Stage 2 (Impact Assessment) of the NSW Biodiversity Assessment Method (BAM).

This report provides details of initial desktop investigations aligned with this assessment framework and early field work. This report focuses on the mapping of plant community types (PCTs) and the identification of associated threatened species and ecological community constraints. Additionally, this report outlines future survey and assessment requirements, with an approach to addressing residual impacts.

1.1 APPLICABLE LEGISLATION AND POLICIES

The Project has been designated as a State Significant Development (SSD), which requires approval under Part 4 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) and requires consideration of the NSW *Biodiversity Conservation Act 2016* (BC Act). (s1.7 of the EP&A Act). Part 7 of the BC Act applies to the project which outlines the requirement of a BDAR for projects designated as SSD, unless a successful BDAR Waiver is obtained (s7.14 of the BC Act). A BDAR Waiver for the project cannot be considered until the relevant survey periods have been completed and the desktop data has been ground verified.

1.2 BIODIVERSITY OFFSETS SCHEME

Biodiversity Credits are used in the Biodiversity Offsets Scheme (BOS) to resolve residual impacts of a project on biodiversity values. Biodiversity credits are calculated through the application of the BAM for:

- Unavoidable impacts on biodiversity through the clearing of native vegetation and habitat for the development site; and
- Predicted gain in biodiversity values at a biodiversity stewardship site also known as a conservation area.

This preliminary biodiversity assessment focuses on a development site where the BDAR will be used to determine the number of biodiversity credits required to offset the project's residual and unavoidable impacts. The assessment of a biodiversity stewardship site does not form part of this assessment.

1.3 THE BIODIVERSITY ASSESSMENT METHOD

The BAM comprises of three stages of assessment. This preliminary biodiversity assessment only considers the relevant elements of Stages 1 and 2 of the BAM. The key elements of Stage 1 of the BAM applied in this assessment are listed in Table 1-1.

Stage 2 of the BAM outlines the requirements for assessing the impacts on biodiversity values identified in Stage 1. It follows the mitigation hierarchy principles of avoid, minimise, and offset. This stage is also used to determine the number and class of biodiversity credits required to offset any remaining impacts to biodiversity that are unavoidable.

TABLE 1-1 STAGE 1 OF THE BAM

Aspect	Description
Establishing the Site Context	Identification of the Subject Land Identification of landscape features including Interim Biogeographic Regionalisation for Australia (IBRA) bioregions and subregions, bodies of water, habitat connectivity, geographical features of significance, areas of outstanding biodiversity values, and NSW (Mitchell) landscapes. Assessment of native vegetation cover on the Subject Land Identification of Category 1 – Exempt Land
Assessing Native Vegetation, Threatened Ecological Communities and Vegetation Integrity	Review of existing databases for information on native vegetation communities Mapping of the native vegetation on the Subject Land, including ground cover and tree canopy cover Identification of plant community types (PCTs) Completing accepted methods of plot-based vegetation surveys (BAM Plots) Identification of threatened ecological communities (TECs) that are associated with identified PCTs Mapping of native vegetation zones and assessment of vegetation integrity.
Assessing Habitat Suitability for Threatened Species	Identification of Ecosystem Credit Species, Species Credit Species and Dual Credit Species Scoping of proposed field surveys to address relevant candidate species.
Identifying Prescribed Additional Biodiversity Impacts	Identification of prescribed direct, and indirect impacts on the habitat of threatened species, including geographical features of significance, human-made structures, and non-native vegetation, habitat connectivity, waterbodies, and potential vehicle strike.

1.4 INFORMATION SOURCES USED IN THE ASSESSMENT

The following information sources were used as a part of this assessment:

- The Biodiversity Assessment Method (BAM 2020);
- BAM Calculator (BAM-C) https://www.lmbc.nsw.gov.au/bamcalc;
- NSW Department of Planning and Environment (DPE) Threatened Species Database https://www.environment.nsw.gov.au/threatenedspeciesapp/;
- NSW Mitchell Landscapes map and descriptions (NPWS 2003);
- NSW State vegetation Type Map (SVTM) C1.1.M1.1 (December 2022);
- NSW eSPADE Soil and Land Information https://www.environment.nsw.gov.au/eSpade2Webapp/; and
- Interim Biogeographical Regionalisation for Australia (IBRA) and IBRA sub-regions v7 https://www.dcceew.gov.au/environment/land/nrs/science/ibra.

1.5 BIODIVERSITY VALUES NOT ASSESSED

The BAM does not assess the following biodiversity values and therefore have been excluded from this preliminary biodiversity assessment:

- Marine mammals;
- Wandering seabirds;
- Biodiversity that is endemic to Lord Howe Island; and
- Native vegetation and loss of habitat on category 1 exempt land (under Part 5A of the *Local Land Services Act 2013*) other than the additional biodiversity impacts under clause 6.1 of the BC Regulation.

2. INTRODUCTION

2.1 THE PROPOSAL

Samsung C&T Renewable Energy Australia Pty Ltd (Samsung) proposes to construct and operate the Romani Solar Farm (the project), a renewable energy development located 44 km southwest of Hay in the Riverina Murray Region of NSW. The proposed solar farm comprises of several allotments located on Booroorban Tchelery Road, north of the Forest Creek with an area of 1,680 hectares (ha).

2.1.1 PROJECT DESCRIPTION

The Project consists of a proposed solar farm and a Battery Energy Storage System (BESS) and associated infrastructure with project specifications outlined in Table 2-1 .

TABLE 2-1 PROJECT SPECIFICATIONS

Project Aspect	Details
Project Footprint	1,810 ha
Solar Farm	870.5ha of Solar Panels with an anticipated installed capacity of 250 MW.
Associated Infrastructure	• Battery Energy Storage System (BESS) • New high voltage substation proposed along Booroorban-Tchelery Road • Underground cables • Internal access roads • Access to the Project from Booroorban-Tchelery Roads via the Cobb Highway.

2.1.2 SUBJECT LAND

The Subject Land is shown in Figure 2-1. Description of the Subject Land is listed in Table 2-2.

For the purpose of this assessment the Subject Land is comprised of the area within the Project boundary. This assessment also considers a defined study area, which is comprised of the Subject Land and a 1500 m buffer from the Project boundary.

TABLE 2-2 SUBJECT LAND DESCRIPTION

Feature	Description	
Locality	Booroorban-Tchelery Road, Borroorban NSW	
Local Government Area	Edward River Council	
Lot/DP	• Lot 34 DP756561 • Lot 49 DP756561 • Lot 50 DP756561 • Lot 51 DP756561 • Lot 52 DP756561 • Lot 53 DP756561 • Lot 54 DP756561	• Lot 55 DP756561 • Lot 56 DP756561 • Lot 57 DP756561 • Lot 91 DP756561 • Lot 92 DP756561 • Lot 97 DP756561 • Lot 98 DP756561
Zoning	RU1 – Primary Production	
Current Land Use	Agricultural use including livestock grazing, and historical cropping.	

FIGURE 2-1 THE SUBJECT LAND

2.2 METHODS

This section outlines the methods used to prepare this Preliminary Biodiversity Assessment.

2.2.1 SITE CONTEXT

2.2.1.1 LANDSCAPE FEATURES

Landscape features were identified through desktop review and are required to be confirmed through field investigations. The following has been identified in accordance with the BAM.

- IBRA regions and subregions;
- Native vegetation extent and cleared areas within the Project Area (ha);
- Rivers, streams, estuaries, and wetlands;
- Connectivity features; and
- Areas of geological significance and soil hazard.

2.2.1.2 NATIVE VEGETATION COVER

A desktop assessment has been conducted to determine the indicative extent of native vegetation cover on the Subject Land and within the total study area (1500 m buffer). The following resources were used:

- ArcGIS Online (basemap imagery);
- Historic Imagery (Historical Imagery (nsw.gov.au)); and
- Sharing Enabled Environmental Data (SEED) Portal (Geocortex Viewer for HTML5 (nsw.gov.au)).

At the time of writing, the Study Area has not been ground verified. Reliance is placed on available desktop resources for this mapping. Consequently, there is likely additions or omissions to the actual extent of native vegetation as defined in the BAM.

2.2.1.3 LAND CATEGORISATION

Under the LLS Act, land is categorised as either:

- Category 1 – Exempt Land; and
- Category 2 – Regulated Land.

Land categorisation for the Subject Land was reviewed using the Draft Native Vegetation Regulatory Map (Draft NVR Map). The Draft NVR Map provides uncategorised land (i.e., lands not mapped as Category 2 vulnerable lands on the transitional NVR Map). Criteria for classifying these lands is provided in s60I of the LLS Act.

2.2.2 NATIVE VEGETATION TYPES, THREATENED ECOLOGICAL COMMUNITIES AND VEGETATION INTEGRITY

A desktop review was conducted to determine the PCTs and TECs hat have the potential to occur on the Subject Land. The SVTM identified the following PCTs as being mapped on the Subject Land:

- PCT 13 Black Box – Lignum woodland wetland of the inner floodplains in the semi-arid (warm) climate zone (mainly Riverina Bioregion and Murray Darling Depression Basin);
- PCT 15 Black Box open woodland wetland with chenopod understory mainly on the outer floodplains in south-western NSW (mainly Riverina Bioregion and Murray Darling Depression Bioregion);
- PCT 17 Lignum shrubland wetland of the semi-arid (warm) plains (mainly Riverina Bioregion and Murray Darling Depression Bioregion);
- PCT 24 Canegrass swamp tall grassland wetland of drainage depressions, lakes and pans of the inland plains;
- PCT 46 Curly Windmill Grass – Speargrass – Wallaby Grass grassland on alluvial clay and loam on the Hay Plain, Riverina Bioregion;
- PCT 153 Black Bluebush low open shrubland of the alluvial plains and sandplains of the arid and semi-arid zones;
- PCT 157 Bladder Saltbush shrubland on alluvial plains in the semi-arid (warm) zone including Riverina Bioregion;
- PCT 160 Nitre Goosefoot shrubland wetland on clays of the inland floodplains;
- PCT 164 Cotton Bush open shrubland of the semi-arid (warm) zone; and
- PCT 166 Disturbed annual saltbush forbland on clay plains and inundation zones mainly of south-western NSW.

BAM plot sampling was stratified by the SVTM, as shown in Figure 2-2, with the accuracy of the SVTM mapping to be examined following review of survey data.

2.2.2.1 BAM PLOTS

BAM plots are to be administered in accordance with section 4.2.1 of the BAM. The BAM plots are to be used to calculate the vegetation integrity score of each vegetation zone. The BAM plots consisted of a central 50 m transect and a 20 m by 20 m plot. Data collection within each plot includes:

- Identification of all flora species present within the plot area;
- Stratum and layers in which all species occur;
- Growth form of species;
- Abundance rating for each species;
- One 1000 m^2 (20m by 50 m) plot to assess the function attributes (Number of hollow bearing trees, stem size class, tree regeneration and length of logs); and
- Five 1 m^2 plots to assess average leaf litter cover, bare earth, cryptogram, and rock cover.

All BAM plots are to be recorded using GIS software and given unique identification for ease of assessment. The location of BAM plots is shown in Figure 2-2.

2.2.3 THREATENED FLORA SURVEY METHODS

2.2.3.1 REVIEW OF EXISTING INFORMATION

Review of the BioNet Atlas and the BAM-C, as informed by the SVTM, was conducted to produce an indicate candidate species list to inform this preliminary biodiversity assessment. This formed the basis for guiding the specifications for early field survey methods, timing and effort.

2.2.3.2 FIELD SURVEYS

A spring survey was conducted on the Subject Land by two ecologists from 19-24 September 2023, four ecologists from 19-24 October 2023 and two ecologists from 6-10 November 2023. Site evaluation was conducted through parallel walking transects to determine vegetation types, identification of areas containing biodiversity features and targeted threatened flora. Biodiversity features targeted in the spring survey included:

- Stands of native vegetation;
- Water sources;
- Mature Trees; and
- Areas of native vegetation recruitment.

Transects were conducted with 10 m spacing due to the chenopod vegetation type. Transects are shown in Figure 2-3.

The BAM requires targeted surveys for threatened flora when suitable habitat is identified. This information is used to inform the project BDAR. Targeted surveys were completed for the following species using the relevant survey guidelines:

- Brachyscome papillosa, Mossgiel Daisy;
- Calotis moorei, A Burr Daisy;
- Convolvulus tedmoorei, Bindweed;
- Eucalyptus leucoxylon subsp. pruinose, Yellow Gum;
- Lepidium monoplocoides, Winged Peppercress;
- Leptorhynchos orientalis, Lanky Buttons;
- Maireana cheelii, Chariot Wheels;
- Sclerolaena napiformis, Turnip Copperburr;
- Swainsona murrayana, Slender Darling-pea; and
- Swainsona plagiotropis, Red Darling-pea.

BAM plots were undertaken during the second spring visit and were conducted a per Section 2.2.2.1.

2.2.4 THREATENED FAUNA SURVEY METHODS

2.2.4.1 REVIEW OF EXISTING INFORMATION

Review of the BioNet Atlas and the BAM-C, as informed by the SVTM, was conducted to produce an indicate candidate species list to inform this preliminary biodiversity assessment. This formed the basis for guiding the specifications for early field survey methods, timing and effort.

2.2.4.2 FIELD SURVEYS

A spring survey was completed on the Subject Land by two ecologists from 19-24 and 26-29 September and 18 to 24 October searching for the following species:

- Pink-tailed Worm Lizard;
- Australian Bustard;
- White-bellied Sea Eagle
- Little Eagle;
- Major Mitchell's Cockatoo;
- Square-tailed Kite; and
- Superb Parrot.

FIGURE 2-2 SVTM AND BAM PLOT LOCATIONS

FIGURE 2-3 TARGETED FLORA SURVEY

2.2.5 WEATHER CONDITIONS

Weather conditions experienced during the spring survey period were appropriate for the survey of a variety of flora and fauna species. Weather conditions and values that occurred on each day were taken from the Hay Airport Station (Station 075019). Summary of the weather conditions present during the survey period is shown in Table 2-3.

TABLE 2-3 WEATHER CONDITIONS DURING SITE SURVEYS

Date	Temperature (˚C)		9am Wind (km/h)	Rainfall (mm)
	Min	Max		
19/09/2023	14.8	35.6	28	0
20/09/2023	11.4	25.4	19	0
21/09/2023	4.6	20.4	19	0
22/09/2023	2.3	22.9	17	0
23/09/2023	3.3	25.0	15	0
24/09/2023	4.5	29.2	22	0
26/09/2023	8.7	29.6	9	0
27/09/2023	5.8	25.4	15	0
28/09/2023	3.7	27.9	13	0
29/09/2023	3.6	29.7	2	0
18/10/2023	5.5	25.8	20	0
19/10/2023	8.1	30.9	24	0
20/10/2023	10.3	33.3	17	0
21/10/2023	14.3	26.7	28	0
22/10/2023	8.3	19.5	33	0
23/10/2023	3.9	24.2	17	0
24/10/2023	7.8	32.3	24	0
6/11/2023	16.4	34.5	26	0
7/11/2023	19.4	33.6	30	1.4
8/11/2023	13.6	33.3	19	0
9/11/2023	16.9	35.2	11	0
10/11/2023	14.7	37.2	19	0

2.3 STAFF QUALIFICATIONS

This report was prepared by:

- James Salinas, Ecologist ERM, Bachelor of Science in Environmental Sciences; and
- Samantha Maher, Ecologist ERM, Bachelor of Environmental Science and Management (Honours).

And reviewed by:

- Mark Aitkens, Principal Ecologist ERM, BAAS17034 Bachelor of Science (Environmental Biology).

Field work was completed by:

- Michael Somerville, Ecologist, Somerville Ecology, Bachelor of Science, Botany / Plant Biology (University of New England); Graduate Diploma, Natural Resources (University of New England);
- Kai Somerville, Ecologist Somerville Ecology;
- Gabrielle Rose, Ecologist MangoGreen, Bachelor Environmental Science, Natural Resources Management and Policy (Southern Cross University);
- Selkie Molloy, Ecologist MangoGreen;
- Samantha Maher, Ecologist ERM. Bachelor of Environmental Science and Management (Honours); and
- Mark Aitkens, Principal Ecologist ERM, BAAS17034 Bachelor of Science (Environmental Biology).

2.4 LICENSING

The flora and fauna surveys undertaken for the Preliminary Biodiversity Assessment were conducted under the NSW Scientific Licence SL100196 held by ERM.

3. SITE CONTEXT

3.1 LANDSCAPE FEATURES

This section of the preliminary biodiversity assessment provides details of the landscape of the Subject Land, in accordance with sections 4.2 and 4.3 of the BAM, including:

- IBRA bioregion and subregion;
- NSW (Mitchell) landscape;
- Rivers, streams, estuaries, and wetlands;
- Habitat connectivity;
- Karst, caves, crevices, cliffs, rocks, or other geological features of significance;
- Areas of outstanding biodiversity; and
- Soil hazard features.

Table 3-1 presents the landscape features of the Subject Land.

TABLE 3-1 LANDSCAPE FEATURES

Landscape Feature	Description
IBRA Bioregion and Subregion	The Subject Land is located entirely within the Riverina IBRA Bioregion and the Murrumbidgee Subregion
NSW (Mitchell) Landscape	The Subject Land is split between the Murrumbidgee Scalded Plains and Murrumbidgee Depression Plains Landscapes
Rivers, Streams, Estuaries, and Wetlands	The are no permanent natural watercourses. Field investigations indicate that there are several artificial canals (i.e., excavation undertaken to improve drainage lines).
Habitat Connectivity	The site forms part of a larger area of continuous mixed woodland, grassland and shrubland which extend along the Hay Plain.
Geological Features of Significance	There are no documented significant features in the Subject Land.
Areas of Outstanding Biodiversity	There are no areas of outstanding biodiversity on the Subject Land.
Soil Hazard Features	• Acidification hazard: southern portion of the site is 1 very slight to negligible limitations and the north is 2 slight but significant limitations. • Mass movement hazard: 1 Very slight to negligible limitations • Structural decline hazard: Southern portion of the site is 4 Moderate to severe limitations and the northern portion is 1 very slight to negligible limitations. • Water erosion hazard: Southern portion of the site is 2 Slight, but significant limitations and the north is 3 Moderate limitations. • Waterlogging hazard: Southern portion of the site is 2 slight but significant limitations and the northern portion is 1 Very slight to negligible limitations. • Wind erosion hazard: Southern portion of the site 5 severe limitations and the northern portion is 6 very severe limitations.

3.2 NATIVE VEGETATION COVER

Native vegetation cover agnostic of type is used to inform the BAM-C in predicting Candidate Species relevant to the assessment. The Study Area includes a 1.5 km buffer from the Subject Land boundary as shown in Figure 3-1. Areas of native vegetation that occur within the Study Area were calculated using data extracted from the recently published draft NVR Map. Broad assumptions have been made in determining the extent of native vegetation cover as outlined below:

- Category 1 – Exempt lands (draft): These lands are likely to have been cleared in the past for cropping and other high intensity agricultural activities. While native vegetation may occur across lands in this category, it is likely to be substantially disturbed and may be cleared without any requirement for regulatory approvals;
- Category 2 – Vulnerable Regulated Land (In-Force): These lands, which include riparian zones, steep lands and specially mapped areas are assumed to be 100% covered by native vegetation; and
- Category 2 – Regulated land (Draft): These lands are likely to comprise native vegetation cover as the predominant land use of the area (excluding cropping lands) is livestock grazing with limited pasture improvement. It has been assumed that the conservation value of the groundcover is at least medium.

The extent of native vegetation cover in the Study Area is provided in Table 3-2.

TABLE 3-2 AREA OF NATIVE VEGETATION ON SUBJECT LAND

Aspect	Value
Study Area (ha)	4,210
Total Area of Native Vegetation Cover (ha) • Category 2 – Regulated land (Draft) • Category 2 – Vulnerable Regulated Land (In-Force)	 3,394 54
Total Area of Exotic vegetation (ha) • Category 1 exempt lands (draft)	 762
Percentage of Native Vegetation Cover (%)	82%
Class (0-10, >10-30, >30-70 or >70%)	>70%

The estimated native vegetation cover for the Study Area is within the highest category and is therefore considered to be a conservatives estimate for the purpose of this biodiversity assessment.

FIGURE 3-1 STUDY AREA

4. NATIVE VEGETATION, THREATENED ECOLOGICAL COMMUNITIES AND VEGETATION INTEGRITY

4.1 NATIVE VEGETATION EXTENT

This section describes the PCTs present on the Subject Land, as defined by the SVTM, in accordance with the requirements of section 4 of the BAM as listed below:

- Vegetation formation and class;
- Species relied upon for identification of vegetation type and relative abundance;
- Justification of evidence used to identify a PCT (as outlined in paragraph 5.2.1.12 of the BAM);
- TEC status (as outlined in paragraph 5.2.1.14-15 of the BAM);
- Estimate percentage cleared value of PCT (as outlined in paragraph 5.2.1.16 of the BAM);
- Results of the vegetation integrity assessments completed for the Subject Land; and
- Areas of non-native vegetation and native vegetation are discussed in the subsequent sections.

4.1.1 AREAS OF NON-NATIVE VEGETATION

In this assessment, lands classified as Category 1-exempt vegetation on the Draft NVR Map have been interpreted as lands not comprising native vegetation. A review of this mapping is being undertaken as part of the BDAR, which will take into account site-based survey datasets.

4.2 MAPPING PCTS AND ECOLOGICAL COMMUNITIES

4.2.1 PCTS WITHIN THE SUBJECT LAND

The SVTM has mapped 10 PCTs occurring on the Subject Land. These are:

- PCT 13 Black Box – Lignum woodland wetland of the inner floodplains in the semi-arid (warm) climate zone (mainly Riverina Bioregion and Murray Darling Depression Basin);
- PCT 15 Black Box open woodland wetland with chenopod understory mainly on the outer floodplains in south-western NSW (mainly Riverina Bioregion and Murray Darling Depression Bioregion);
- PCT 17 Lignum shrubland wetland of the semi-arid (warm) plains (mainly Riverina Bioregion and Murray Darling Depression Bioregion);
- PCT 24 Canegrass swamp tall grassland wetland of drainage depressions, lakes and pans of the inland plains;
- PCT 46 Curly Windmill Grass – Speargrass – Wallaby Grass grassland on alluvial clay and loam on the Hay Plain, Riverina Bioregion;
- PCT 153 Black Bluebush low open shrubland of the alluvial plains and sandplains of the arid and semi-arid zones;
- PCT 157 Bladder Saltbush shrubland on alluvial plains in the semi-arid (warm) zone including Riverina Bioregion;

- PCT 160 Nitre Goosefoot shrubland wetland on clays of the inland floodplains;
- PCT 164 Cotton Bush open shrubland of the semi-arid (warm) zone; and
- PCT 166 Disturbed annual saltbush forbland on clay plains and inundation zones mainly of south-western NSW

A description for these PCTs is provided in the following tables.

TABLE 4-1 PCT 13 BLACK BOX - LIGNUM WOODLAND WETLAND OF THE INNER FLOODPLAINS IN THE SEMI-ARID (WARM) CLIMATE ZONE (MAINLY RIVERINA BIOREGION AND MURRAY DARLING DEPRESSION BIOREGION)

Aspect	Description
PCT ID and Name	13 Black Box - Lignum woodland wetland of the inner floodplains in the semi-arid (warm) climate zone (mainly Riverina Bioregion and Murray Darling Depression Bioregion)
Vegetation Formation	Semi-arid Woodlands (Grassy sub-formation)
Vegetation Class	Inland Floodplain Woodlands
Cleared Extent (%)	57
Vegetation Description (BioNet)	Woodland, open forest or open woodland averaging about 15 m high dominated by a sparse to dense stands of Lignum (*Muehlenbeckia florulenta*), Nitre Goosefoot (*Chenopodium nitrariaceum*) and River Cooba (*Acacia stenophylla*). The ground cover includes low shrubs such as *Sclerolaena muricata* var. *muricata*, *Enchylaena tomentosa*, *Einadia nutans* subsp. *nutans* and various saltbush species (*Atriplex* spp.). Forb species include *Solanum esuriale*, *Cotula australis*, *Oxalis perennans*, *Alternanthera denticulata* and *Pratia concolor*. Grass species include Warrego Summer Grass (*Paspalidium jubiflorum*), Curly Windmill Grass (*Enteropogon acicularis*) and Walwhalleya proluta and wallaby grasses (*Austrodanthonia* spp.). Weed species include the shrub African Boxthorn (*Lycium ferocissimum*), the forbs *Cotula bipinnata*, *Erodium cicutarium* and *Sisymbrium irio* and the grasses *Hordeum leporinum* and *Lolium perenne*. Occurs on clay or clay-loam, often gilgaied, soils on inner floodplains and on alluvial plains mostly in depressions that are frequently flooded. A widespread community along rivers in south-western NSW including the Murray, Wakool, lower Darling, Lachlan, Murrumbidgee Rivers and Willandra Creek. Mainly located in the semi-arid (warm) climate zone in the Riverina and Murray Darling Depression and southern Cobar Peneplain Bioregions. This community extends up the Darling River to above Kinchega National Park where it intergrades with floodplain communities dominated by Coolabah (*Eucalyptus coolabah* subsp. *coolabah*). In more arid areas of the Murray-Darling Depression Bioregion this community grades into the Black Box - chenopod community (ID15) that occurs on higher ground and contains less or no lignum and more chenopod shrubs. This community has been extensively cleared in eastern areas such as near Lake Cargelligo on the Lachlan River and east of Deniliquin on the Murray River.
Threatened Ecological Communities	No associations

TABLE 4-2 PCT 15 BLACK BOX OPEN WOODLAND WETLAND WITH CHENOPOD UNDERSTOREY MAINLY ON THE OUTER FLOODPLAINS IN SOUTH-WESTERN NSW (MAINLY RIVERINA BIOREGION AND MURRAY DARLING DEPRESSION BIOREGION)

Aspect	Description
PCT ID and Name	15 Black Box open woodland wetland with chenopod understorey mainly on the outer floodplains in south-western NSW (mainly Riverina Bioregion and Murray Darling Depression Bioregion)
Vegetation Formation	Semi-arid Woodlands (Grassy sub-formation)
Vegetation Class	Inland Floodplain Woodlands
Cleared Extent (%)	50
Vegetation Description (BioNet)	Woodland or open woodland dominated by Black Box (*Eucalyptus largiflorens*) with an understorey of chenopod shrubs such as Black Bluebush (*Maireana pyramidata*), *Maireana decalvans*, Nitre Goosefoot (*Chenopodium nitrariaceum*) and Old Man Saltbush (*Atriplex nummularia*) but the latter has mostly disappeared due to grazing. Small shrubs include Bladder Saltbush (*Atriplex vesicaria*) and Cotton Bush (*Maireana aphylla*) with a ground cover of annual or perennial saltbushes, copperburrs, grasses and forbs. Common copperburrs include *Sclerolaena obliquicuspis*, *Sclerolaena stelligera*, *Sclerolaena divaricata*, *Sclerolaena brachyptera*. Lignum (*Muehlenbeckia florulenta*) may be absent or very sparse. Weed species include Black Nightshade (*Solanum nigrum*) and Paddy Melon (*Cucumis myriocarpus* subsp. *leptodermis*). Occurs on alkaline brown or grey clay soil on alluvial plains or sandy-loam soils on the flood plain of river systems. Also observed on sandy lunettes of some dry lakes in the semi-arid (warm) and arid climate zones of far south western NSW. In many places the understorey may have once been dominated by Old Man Saltbush (*Atriplex nummularia*) but this has been reduced due to grazing leaving bluebush, Nitre Goosefoot and copperburrs to dominate today. Grades into bluebush shrubland on higher ground. Mostly cleared in some regions such as the Murray CMA but significant stands remain in far western regions. The understorey is degraded throughout.
Threatened Ecological Communities	No associations

TABLE 4-3 PCT 17 LIGNUM SHRUBLAND WETLAND OF THE SEMI-ARID (WARM) PLAINS (MAINLY RIVERINA BIOREGION AND MURRAY DARLING DEPRESSION BIOREGION)

Aspect	Description
PCT ID and Name	17 Lignum shrubland wetland of the semi-arid (warm) plains (mainly Riverina Bioregion and Murray Darling Depression Bioregion)
Vegetation Formation	Freshwater Wetlands
Vegetation Class	Inland Floodplain Shrublands
Cleared Extent (%)	63
Vegetation Description	Open shrubland usually up to 2 m high dominated by Lignum (*Muehlenbeckia florulenta*) often with Nitre Goosefoot (*Chenopodium nitrariaceum*) and low cover of Canegrass (*Eragrostis australasica*). Scattered trees of Black Box (*Eucalyptus largiflorens*) may be present. Cooba (*Acacia salicina*) and River Cooba (*Acacia stenophylla*) may be present as tall shrubs. Ground cover species include the small shrubs such as Giant Redburr (*Sclerolaena tricuspis*), Roly Poly (*Sclerolaena muricata* var. *muricata*), *Atriplex lindleyi*, *Atriplex suberecta* and *Salsola tragus* subsp. *tragus*, the fern *Marsilea drummondii*, the rush *Juncus flavidus*, the forbs *Rumex tenax*, *Einadia nutans* subsp. *nutans*, *Bulbine bulbosa*, *Senecio glossanthus* and *Senecio cunninghamii*. Grass species include *Walwhalleya proluata* and *Enteropogon ramosus*. Weed species include *Lolium perenne*, *Hordeum leporinum* and *Rapistrum rugosum*. Occurs on black, brown and grey-cracking clay soils and clay loam soils in river channels and depressions on floodplains subject to regular flooding in south-western NSW extending into Victoria and South Australia mainly in the semi-arid (warm) climate zone. Although very widespread it tends to have a consistent floristic composition. Grades into Black Box or River Red Gum woodlands near major rivers and into Bladder Saltbush or other chenopod shrublands on higher ground. Large areas of Lignum have been cleared for cropping in the middle-western and eastern parts of its range including in the Lowbidgee region on the Murrumbidgee River floodplain. Some stands remain in the west. This community is becoming increasingly threatened by clearing and altered flooding regimes due to irrigation developments.
Threatened Ecological Communities	No associations

TABLE 4-4 PCT 24 CANEGRASS SWAMP TALL GRASSLAND WETLAND OF DRAINAGE DEPRESSIONS, LAKES AND PANS OF THE INLAND PLAINS

Aspect	Description
PCT ID and Name	24 Canegrass swamp tall grassland wetland of drainage depressions, lakes and pans of the inland plains
Vegetation Formation	Freshwater Wetlands
Vegetation Class	Inland Floodplain Shrublands
Cleared Extent (%)	20
Vegetation Description (BioNEt)	Tall, tussock grassland dominated by Canegrass (*Eragrostis australasica*) growing to over 2 m high ranging in cover from dense to isolated plants. Sometimes growing with Glasswort (*Sclerostegia tenuis*) or samphire *Halosarcia pergranulata*. Depending which part of NSW a range of grass species may be present including Windmill Grass (*Chloris truncata*), Blown Grass (*Lachnagrostis filiformis*), Plains grass (*Austrostipa aristiglumis*), Neverfail (*Eragrostis setifolia*) and *Eragrostis parviflora*. A range of low shrubs occur including *Sclerolaena* spp., *Atriplex* spp. and *Teucrium racemosum*. Sedges such as *Eleocharis acuta*, *Eleocharis pusilla* and *Eleocharis pallens* may be common along with rushes (*Juncus* spp.). The aquatic *Marsilea drummondii*, *M. costulifera*, *Azolla filiculoides* and *Myriophyllum* spp. May be present but die off in dry times. Highly salt tolerant plant species are more common in western-most areas and include *Disphyma crassifolium* subsp. *clavellatum*, *Frankenia serpyllifolia* and *Osteocarpum acropterum*. There is considerable floristic variation across its range and this sub-formation could be divided into a number of communities but several dominant species tend to be consistently present. Occurs on heavy non-cracking clay and silty clay soils in periodically flooded depressions on floodplains, alluvial plains, claypans in sand dune and sandplain areas, and floodouts of watercourses. Soils are red-grey compact clay or sandy clay that crack very little. These soils form claypans that pond from local runoff after rain. Widespread. Distributed in throughout western NSW in the arid and semi-arid zones.
Threatened Ecological Communities	BC Act listed, critically endangered, Artesian Springs Ecological Community in the Great Artesian Basin

TABLE 4-5 PCT 46 CURLY WINDMILL GRASS – SPEARGRASS – WALLABY GRASS GRASSLAND ON ALLUVIAL CLAY AND LOAM ON THE HAY PLAIN , RIVERINA BIOREGION

Aspect	Description
PCT ID and Name	46 Curly Windmill Grass – Speargrass – Wallaby Grass grassland on alluvial clay and loam on the Hay Plain , Riverina Bioregion
Vegetation Formation	Grasslands
Vegetation Class	Riverine Plain Grasslands
Cleared Extent (%)	20
Vegetation Description	Open to closed tussock grassland generally about 0.3 m high dominated by Curly Windmill Grass (Enteropogon ramosus), corkscrew grass (Austrostipa nodosa and/or Austrostipa scabra) and a number of wallaby grass species (Austrodanthonia spp.) with a range of forbs including Rhodanthe corymbiflora, Crassula colorata var. acuminata, Erodium crinitum, Oxalis perennans, Sida trichopoda, Sida corrugata, Goodenia pusilliflora, Goodenia fascicularis, Calotis scabiosifolia var. scabiosifolia, Calocephalus sonderi, Bulbine semibarbata and Daucus glochidiatus form G. A very sparse shrub layer may be present including Sclerolaena stelligera, Maireana excavata and Maireana aphylla. Occurs on medium brown to grey clays and loams on level alluvial plains on the western Riverine Plain (Hay Plain) near Hay and north-east of Deniliquin in the Riverina Bioregion. Contains a high proportion of annual exotic species in Spring dominated by Wimmera Rye Grass (Lolium rigidum) and Wild Oats (Avena fatua). Very poorly represented in protected areas as of 2005 and susceptible to clearing for cropping.
Threatened Ecological Communities	EPBC Act listed, critically endangered, Natural Grasslands of the Murray Valley Plains.

TABLE 4-6 PCT 153 BLACK BLUEBUSH LOW OPEN SHRUBLAND OF THE ALLUVIAL PLAINS AND SANDPLAINS OF THE ARID AND SEMI-ARID ZONES

Aspect	Description
PCT ID and Name	153 Black Bluebush low open shrubland of the alluvial plains and sandplains of the arid and semi-arid zones
Vegetation Formation	Arid Shrublands (Chenopod sub-formation)
Vegetation Class	Aeolian Chenopod Shrublands
Cleared Extent (%)	40
Vegetation Description (BioNet)	Mid-high open shrubland generally less than one meter high dominated by Black Bluebush (*Maireana pyramidata*) which may be dominant. Scattered low trees of Black Oak (*Casuarina pauper*) or Western Rosewood (*Alectryon oleifolius* subsp. *canescens)* may be present. Tall shrubs are rare or absent and may include *Eremophila sturtii*. Other chenopod shrub species include Thorny Saltbush (*Rhagodia spinescens*), bluebushes such as *Maireana georgei*, *Maireana sedifolia* and *Maireana appressa*, Bladder Saltbush (*Atriplex vesicaria sens lat*), *Atriplex lindleyi* and *Atriplex pumillio*, Cannonball (*Dissocarpus paradoxus*), Ruby Saltbush (*Enchylaena tomentosa*) and copperburrs such as *Sclerolaena obliquicuspis, Sclerolaena patenticuspis, Sclerolaena brachyptera, Sclerolaena lanicuspis, Sclerolaena divaricata, Sclerolaena tricuspis* and *Sclerolaena diacantha*. Grass species include the cork screw grasses *Austrostipa nitida, Austrostipa scabra* and *Austrostipa nodosa* and wallaby grass *Austrodanthonia caespitosa. Eragrostis dielsii* and *Enneapogon avenaceus* occur in northern areas. Forbs include *Calotis hispidula, Tetragonia tetragonioides, Goodenia pinnatifida, Plantago* varia, *Minuria integerrima, Senecio runcinifolius, Brachyscome lineariloba, Brachyscome ciliaris* var*. ciliaris, Calandrinia eremaea*. Bladder Saltbush may have been more common prior to stock grazing. Weeds include *Hordeum* spp., *Heliotropium europaeum, Salvia verbenaca, Medicago* spp. and *Salvia verbenacea*. Occurs on red-brown duplex soils with textures of clay loam, sandy-loam or light clay on low sandy rises, undulating sandplains, drainage depressions and prior stream levees in the semi-arid and arid zones of far western NSW extending into South Australia and northern Victoria. In NSW, Black Bluebush tends to be more common than Pearl Bluebush (ID154). It occurs on soils where the surface sandy layer is deep and contains medium to low levels of lime, whereas Pearl Bluebush tends to dominate areas with lime-rich soils. However, both species commonly co-exist. Black Bluebush is widespread on the transition zone between the eolian sand sheets and the riverine plain in far south-western NSW but also occurs to the north on sandplains and on the Darling River floodplain.
Threatened Ecological Communities	BC Act listed, endangered, *Acacia loderi* shrublands (Part)

TABLE 4-7 PCT 157 BLACK BLUEBUSH LOW OPEN SHRUBLAND OF THE ALLUVIAL PLAINS AND SANDPLAINS OF THE ARID AND SEMI-ARID ZONES

Aspect	Description
PCT ID and Name	157 Bladder Saltbush shrubland on alluvial plains in the semi-arid (warm) zone including Riverina Bioregion
Vegetation Formation	Arid Shrublands (Chenopod sub-formation)
Vegetation Class	Riverine Chenopod Shrublands
Cleared Extent (%)	60
Vegetation Description (BioNet)	Low to mid-high to 90cm high, open to sparse chenopod shrubland dominated by Bladder Saltbush (*Atriplex vesicaria*) often with Desert Glasswort (*Pachycornia triandra*), Three-spined Copperburr (*Sclerolaena tricuspis*), *Sclerolaena intricata* and Pigface (*Disphyma crassifolium* subsp. *clavellatum*). Other commonly occurring small shrubs include Slender Glasswort (*Sclerostegia tenuis*), *Sclerolaena brachyptera, Sclerolaena tenuis, Maireana decalvans, Maireana aphylla, Malacocera tricornis, Dissocarpus biflorus* var. *biflorus, Atriplex lindleyi* and *Atriplex pseudocampanulata*. Grasses include *Chloris truncata, Austrodanthonia setacea* and *Sporobolus caroli*. Ephemeral daises occur after rains including *Minuria cunninghamii, Brachyscome smithwhitei* and *Rhodanthe corymbiflora*. The succulent forb *Calandrinia volubilis* often present. Myall (*Acacia pendula*) or Black Oak (*Casuarina pauper*) may occur as isolated trees. In heavily grazed regions Bladder Saltbush may be replaced by a disturbed shrubland complex composed of *Nitraria billardierei, Sclerolaena* spp. and Cotton Bush (*Maireana aphylla*) or Desert glasswort (*Pachycornia triandra*). This has happened on the lake beds of most of the Willandra Lakes and along the heavily grazed floodplains of the Murray River. Floristic variation occurs from north to south and from east to west, however many species are consistently present over the range. Occurs on grey and brown cracking clays and red-brown clay loam soils on alluvial plains including the Hay Plain, in the Darling Ana-Branch region and occurrences in the Scotia mallee around salt lakes in south west NSW. This community grades into ID195 Bladder Saltbush on the floodplains of the Darling Riverine Plain on the Darling and its tributaries near Wilcannia and east of Bourke including the Warrego River. In the Riverina it grades into bluebush and other chenopod shrublands, glasswort/samphire forblands (e.g. ID18), native grasslands, Myall woodlands, and Black Box woodland near watercourses. It is estimated that over half of this community has been cleared or severely altered through grazing and dieback over the last 150 years. Due to a combination of stock and rabbit grazing, droughts and grub-herbivory dieback, it is considered that Bladder Saltbush may have retreated 100 km to the west on the Riverine Plain leaving behind "derived" grasslands (IDs 44-46).
Threatened Ecological Communities	No associations.

TABLE 4-8 PCT 160 NITRE GOOSEFOOT SHRUBLAND WETLAND ON CLAYS OF THE INLAND FLOODPLAINS

Aspect	Description
PCT ID and Name	160 Nitre Goosefoot shrubland wetland on clays of the inland floodplains
Vegetation Formation	Freshwater Wetlands
Vegetation Class	Inland Floodplain Shrublands
Cleared Extent (%)	28
Vegetation Description	Tall shrubland to two metres high, dominated by Nitre Goosefoot (*Chenopodium nitrariaceum*) often with Black Roly Poly (*Sclerolaena muricata*). Low shrubs include *Sclerolaena stelligera,* Soft Horns (*Malacocera tricornis*) and *Atriplex semibaccata*; forb species include *Omphalolappula concava, Harmsiodoxa blennodioides* and *Oxalis perennans*. Exotic species may be common including the grasses *Hordeum leporinum, Hordeum marinum, Lolium perenne* and *Avena fatua*. Common exotic forbs include *Brassica tournefortii; Cirsium vulgare; Echium plantagineum; Erodium cicutarium, Hedypnois rhagadioloides* subsp. *cretica* and *Medicago polymorpha*. Tall shrubs of Cooba (*Acacia salicina*) and River Cooba (*Acacia stenophylla*) may be present. Occurs on cracking clay or sandy clay soils in lake beds, low lying plains, drainage depressions and alluvial plains subject to flooding in the arid and semi-arid zones of far western NSW. Widespread but usually found in discrete stands. In some places this community may be derived from a previous Old Man Saltbush shrubland as it generally occurs in highly disturbed sites. Grades into Lignum communities in wetter sites where drainage is impaired.
Threatened Ecological Communities	(part) BC Act listed, critically endangered, Artesian Springs Ecological Community in the Great Artesian Basin

TABLE 4-9 PCT 164 COTTON BUSH OPEN SHRUBLAND OF THE SEMI-ARID (WARM) ZONE

Aspect	Description
PCT ID and Name	164
Vegetation Formation	Arid Shrublands (Chenopod sub-formation)
Vegetation Class	Riverine Chenopod Shrublands
Cleared Extent (%)	8
Vegetation Description	Low to mid-high sparse to mid-dense shrubland usually about 0.8 m high dominated by Cotton Bush (*Maireana aphylla*) with occasional remnant shrubs of Bladder Saltbush (*Atriplex vesicaria* s.l.). Smaller shrubs include copperburrs (*Sclerolaena muricata, Sclerolaena tricuspis* and *Sclerolaena bicornis*) and annual saltbushes (*Atriplex lindleyi, Atriplex leptocarpa*). The sparse ground cover contains native forbs such as paper daisies (*Rhodanthe* spp.), *Minuria cunninghamii*, and *Calotis scabiosifolia* var*. scabiosifolia* and grasses such as *Austrodanthonia caespitosa*. Often contains a very high cover of weed species including *Hordeum* spp., *Bromus* spp., *Vulpia* spp., *Medicago* spp., *Avena fatua* and *Lolium perenne*. Occurs on grey to grey-brown clays or clay-loam soils on depressed alluvial plains mainly in the Riverina Bioregion of the semi-arid (warm) climatic zone. This is derived community occurring in highly disturbed areas. Areas in which it occupies were probably dominated by Bladder Saltbush and other species prior to European settlement but heavy grazing and other processes have led to the decline of perennial saltbush species leaving this Cotton Bush-dominated community.
Threatened Ecological Communities	No associations.

TABLE 4-10 PCT 166 DISTURBED ANNUAL SALTBUSH FORBLAND ON CLAY PLAINS AND INUNDATION ZONES MAINLY OF SOUTH-WESTERN NSW

Aspect	Description
PCT ID and Name	166 Disturbed annual saltbush forbland on clay plains and inundation zones mainly of south-western NSW
Vegetation Formation	Saline Wetlands
Vegetation Class	Inland Saline Lakes
Cleared Extent (%)	34
Vegetation Description	A disturbed and probably derived open chenopod, herbland or grassland dominated by annual saltbushes such as Baldoo (*Atriplex lindleyi*), *Atriplex eardleyae* and *Atriplex angulata* along with and Babbagia (*Osteocarpum acropterum* var. *deminuta*). *Atriplex holocarpa* is often present. Many species of copperburr may be present including *Sclerolaena divaricata, Sclerolaena intricata, Sclerolaena brachyptera, Sclerolaena decurrens, Sclerolaena diacantha, Sclerolaena stelligera, Sclerolaena ventricosa* and *Sclerolaena bicornis*. Cottonbush (*Maireana aphylla*) common in places. Other Maireana species include *Maireana ciliata, Maireana coronata* and *Maireana turbinata*. Forbs include daisies such as *Rhodanthe floribunda* and *Brachyscome ciliaris*. Swainsona peas - *Swainsona affinis* and *Swainsona campylantha* may be present after rain. Neverfail grass (*Eragrostis setifolia*) is common in northern areas. The main weeds species are the grasses Hordeum marinum *and Hordeum leporinum* along with Capeweed (*Arctotheca calendula*) and Ward's Weed (*Carrichtera annua*). This community occurs on clay and loam clay soils on dry lake-beds and alluvial floodplains in the semi-arid and arid zones - mainly in south-western NSW but also to the north. This is probably a derived community from previous perennial chenopod shrublands, although some areas may be similar to a natural state where regular flooding is a feature.
Threatened Ecological Communities	No associations

4.2.2 VEGETATION OF THE SUBJECT LAND

A total of 39 BAM plots were completed to test the occurrence and extent of PCTs identified in the SVTM. This data will be analysed using the Bray Curtis similarity metric to classify plots into similar groups and will be presented in the Project BDAR, prepared to support the EIS.

In general, the native vegetation of the Subject Land can be characterised as a mosaic of low chenopod shrublands and native grasslands on grey cracking clays to sandy rises. A stand of Black Box (*Eucalyptus largiflorens*) is in the central parts of the Subject Land west of the main homestead and associated livestock yards. Vegetation around the main homestead and livestock yards comprises mainly planted native trees of mostly West Australian origin. East of the livestock yards is a single senescent White Cypress Pine (*Callitris glaucophylla*), with Emu Bush (*Eremophila longifolia*) and Sugarwood (*Myoperum platycarpum*) also noted nearby. Plot analysis to be completed as part of the BDAR will be used to determine which types of native vegetation occur and their consideration states.

4.3 THREATENED ECOLOGICAL COMMUNITIES

PCTs mapped by the SVTM within the Subject Land were reviewed to identify any potential TEC associations. The results are provided in Table 4-11.

TABLE 4-11 TECS ASSOCIATED WITH SVTM PCTS MAPPED ON THE SUBJECT LAND

SVTM PCTs	Associated TEC	BC Act Listing	EPBC Act Listing
24, 160	Artesian Springs Ecological Community in the Great Artesian Basin	Critically Endangered	Not listed
46	Natural Grasslands of the Murray Valley Plains	Not Listed	Critically Endangered
153	*Acacia loderi* shrublands	Endangered	Not listed

The following interim conclusions are provided:

- The Artesian Springs Ecological Community in the Great Artesian Basin CEEC is discounted as being present within the Subject Land as it does not comprise any artesian fed springs.
- The Natural Grasslands of the Murray Valley Plains CEEC (Commonwealth listing), if present, would be restricted to natural grassland areas where sufficient characterise forb and grass species occur. This will be ascertained using BAM pot data during the preparation of the BDAR.
- The Acacia loderi shrublands EEC is not present within the Subject Land as field verification surveys failed to identify any occurrence of the characteristic canopy species. Confirmation of this conclusion will be provided in the BDAR.

Potential exists for some of the native vegetation located on a sandy rises to be a derived form of the Sandhill Pine Woodland in the Riverina, Murray-Darling Depression and NSW South Western Slopes bioregions - Endangered Ecological Community listing. Analysis of detailed plot data against the listing advise is required to determine the presence and extent of this community within the Subject Land if it is deemed present.

5. THREATENED SPECIES

Review of the BAM-C provided a list of candidate species likely to occur within the Subject Land. Potential Candidate species are listed in Table 5-1. The BAM Important Area Viewer was also reviewed as a part of this process and there were no important areas present within the Subject Land.

TABLE 5-1 CANDIDATE SPECIES LIST

Common Name	Scientific Name	BC Act	EPBC Act	Recommended Survey Period	Recorded on Site
Flora					
A Spear Grass	*Austrostipa wakoolica*	E	E	☐ January ☐ June ☑ October ☐ February ☐ July ☑ November ☐ March ☐ August ☑ December ☐ April ☐ September ☐ N/A ☐ May	Undetermined
Mossgiel Daisy	*Brachyscome papillosa*	V	V	☐ January ☐ June ☑ October ☐ February ☐ July ☑ November ☐ March ☐ August ☐ December ☐ April ☑ September ☐ N/A ☐ May	Absent
A Burr-daisy	*Calotis moorei*	E	E	☐ January ☐ June ☑ October ☐ February ☐ July ☑ November ☐ March ☐ August ☐ December ☐ April ☑ September ☐ N/A ☐ May	Absent
Bindweed	*Convolvulus tedmoorei*	E	-	☐ January ☑ June ☐ October ☐ February ☑ July ☐ November ☐ March ☑ August ☐ December ☐ April ☑ September ☐ N/A ☐ May	Undetermined (likely absent)
Yellow Gum	*Eucalyptus leucoxylon subsp. pruinosa*	V	-	☑ January ☑ June ☑ October ☑ February ☑ July ☑ November ☑ March ☑ August ☑ December ☑ April ☑ September ☐ N/A ☑ May	Absent
Winged Peppercress	*Lepidium monoplocoides*			☐ January ☐ June ☑ October ☐ February ☐ July ☑ November ☐ March ☐ August ☑ December ☐ April ☑ September ☐ N/A ☐ May	Present

Common Name	Scientific Name	BC Act	EPBC Act	Recommended Survey Period	Recorded on Site
Lanky Buttons	*Leptorhynchos orientalis*			☐ January ☐ June ☑ October ☐ February ☐ July ☑ November ☐ March ☐ August ☐ December ☐ April ☑ September ☐ N/A ☐ May	Likely absent (reviewing collected plant material)
Chariot Wheels	*Maireana cheelii*	V	V	☐ January ☐ June ☑ October ☐ February ☐ July ☑ November ☐ March ☐ August ☑ December ☐ April ☑ September ☐ N/A ☐ May	Present
Turnip Copperburr	*Sclerolaena napiformis*	E	E	☐ January ☐ June ☑ October ☐ February ☐ July ☑ November ☐ March ☐ August ☑ December ☐ April ☑ September ☐ N/A ☐ May	Absent
Slender Darling pea	*Swainsona murrayana*	V	V	☐ January ☐ June ☐ October ☐ February ☐ July ☐ November ☐ March ☐ August ☐ December ☐ April ☑ September ☐ N/A ☐ May	Present (note: survey performed in October)
Red Darling pea	*Swainsona plagiotropis*	V	V	☐ January ☐ June ☐ October ☐ February ☐ July ☐ November ☐ March ☐ August ☐ December ☐ April ☑ September ☐ N/A ☐ May	Absent (note: survey performed in October)
Silky Swainson Pea	*Swainson sericea*	V	-	☐ January ☐ June ☑ October ☐ February ☐ July ☑ November ☐ March ☐ August ☐ December ☐ April ☑ September ☐ N/A ☐ May	Absent (note: survey performed in October)

Common Name	Scientific Name	BC Act	EPBC Act	Recommended Survey Period	Recorded on Site
Fauna					
Australian Bustard	*Ardeotis australis*	E	-	☑ January ☑ June ☑ October ☑ February ☑ July ☑ November ☑ March ☑ August ☑ December ☑ April ☑ September ☐ N/A ☑ May	Absent
Bush Stone-curlew	*Burhinus grallarius*	E	-	☑ January ☑ June ☑ October ☑ February ☑ July ☑ November ☑ March ☑ August ☑ December ☑ April ☑ September ☐ N/A ☑ May	Undetermined
Little Eagle	*Hieraaetus morphnoides*	V	-	☐ January ☐ June ☑ October ☐ February ☐ July ☐ November ☐ March ☑ August ☐ December ☐ April ☑ September ☐ N/A ☐ May	Present (note: survey for breeding inconclusive)
Southern Bell Frog	*Litoria raniformis*	E	V	☑ January ☐ June ☑ October ☐ February ☐ July ☑ November ☐ March ☐ August ☑ December ☐ April ☐ September ☐ N/A ☐ May	Undetermined (note: no suitable habitat present)
Major Mitchell's Cockatoo	*Lophochroa leadbeateri*	V	-	☐ January ☐ June ☑ October ☐ February ☐ July ☑ November ☐ March ☐ August ☑ December ☐ April ☑ September ☐ N/A ☐ May	Likely absent
Square-tailed Kite	*Lophoictinia isura*	V	-	☑ January ☐ June ☑ October ☐ February ☐ July ☑ November ☐ March ☐ August ☑ December ☐ April ☑ September ☐ N/A ☐ May	Likely absent
Barking Owl	*Ninox connivens*	V	-	☐ January ☑ June ☑ October ☐ February ☑ July ☑ November ☐ March ☑ August ☑ December ☐ April ☑ September ☐ N/A ☑ May	Undetermined

Common Name	Scientific Name	BC Act	EPBC Act	Recommended Survey Period	Recorded on Site
Koala	*Phascolarctos cinereus*	E	E	☑ January ☑ June ☑ October ☑ February ☑ July ☑ November ☑ March ☑ August ☑ December ☑ April ☑ September ☐ N/A ☑ May	Undetermined (note: no preferred feed tree species identified)
Superb Parrot	*Polytelis swainsonii*	V	V	☐ January ☐ June ☑ October ☐ February ☐ July ☑ November ☐ March ☐ August ☐ December ☐ April ☑ September ☐ N/A ☐ May	Absent
Masked Owl	*Tyto novaehollandiae*	V	-	☐ January ☑ June ☐ October ☐ February ☑ July ☐ November ☐ March ☑ August ☐ December ☐ April ☐ September ☐ N/A ☑ May	Undetermined

This list of Candidate species will be reviewed following completion of PCT mapping for the Subject Land.

The location of threatened flora and fauna species within the locality is provided in Figure 5-1 (flora) and Figure 5-2 (fauna)

FIGURE 5-1 THREATENED FLORA LOCATIONS

FIGURE 5-2 THREATENED FAUNA LOCATIONS

6. IDENTIFYING PRESCRIBED IMPACTS

Prescribed impacts are identified in Clause 6.1 of the Biodiversity Conservation Regulation 2017 (BC Regulation). Prescribed impacts are those that are additional to the clearing of native vegetation and associated habitat. These include:

- Management of the habitat of threatened species or ecological communities associated with:
  - Karst, caves, crevices, cliffs, rock outcrops and other geological features of significance;
  - Human made structures; and
  - Non-native vegetation.
- Management of areas connecting threatened species habitat, such as movement corridors;
- Management of water quality, water bodies and hydrological processes that sustain threatened species and TECs (including from subsidence or subsidence from underground mining);
- Wind turbine strikes on protected animals; and
- Vehicle strikes on threatened species or on animals that are part of a TEC.

The BAM does not provide an approach to determine the number and class of biodiversity credits that are required for a prescribed impact. However, prescribed impacts on biodiversity may be considered by a consent authority when they determine biodiversity credits generated on a Biodiversity Stewardship Site.

An assessment of the relevance of these prescribed impacts to the Project is provided in Table 6-1.

TABLE 6-1 PRESCRIBED IMPACTS

Feature	Present	Description of feature characteristics and location	Threatened entities that use, are likely to use, or are part of the habitat feature
Karst, caves, crevices, cliffs, rocks, or other geological features of significance	☐Yes/ ☒No	N/A (there are no karst, caves, crevices, cliffs, or other geological features of significance to threatened species or threatened communities within the Subject Land)	N/A
Human-made structures	☐Yes/ ☒No	Transmission towers intersect the Subject Land	Nesting habitat for birds.
Non-native vegetation	☒Yes/ ☐No	Areas of non-native vegetation are present within the Subject Land (planted trees endemic to Western Australia)	Several nests have been observed in planted trees throughout the site.
Habitat connectivity	☒Yes/ ☐No	Remnant and planted trees and drainages occur within the Subject Land. These features may aid in local and regional wildlife movement.	Ecosystem and Candidate bird species.
Waterbodies, water quality and hydrological processes	☒Yes/ ☐No	Constructed dams and water channels occur being part of a wider irrigation system of the Hay Plains.	Permanent water bodies with sufficient vegetation character may provide habitat for frog and waterbird species.
Wind turbine strikes	☐Yes/ ☒No	N/A	N/A
Vehicle strikes	☒Yes/ ☐No	An increase in access tracks to maintain solar farm infrastructure has the potential to result in an increase in vehicle strikes to threatened fauna.	Threatened birds and reptiles

7. MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE

Matters of National Environmental Significance (MNES) relevant to the Subject Land are provided in Table 7-1.

TABLE 7-1 PRELIMINARY ASSESSMENT OF MNES

MNES	Relevance to the Subject Land
World Heritage Properties	No World Heritage Properties are mapped within or are adjacent to the Subject Land
National Heritage Places	No National Heritage Places are mapped within or are adjacent to the Subject Land
Wetlands of International Importance (Ramsar Wetlands)	The Ramsar sites NSW Central Murray State Forests Wetlands and Hattah-kulkyne lakes are located 44km and 150 km from the Subject Land respectively and are not expected to be impacted by the construction, operation and decommissioning of the proposed project. Other Ramsar wetlands identified by the PMST are in excess of 300 km from the Subject Land.
Listed Threatened Ecological Communities (TECs)	The PMST identified four TECs with the potential to occur within the Subject Land: • Buloke Woodlands of the Riverina and Murray-Darling Depression Bioregions • Grey Box (Eucalyptus macrocarpa) Grassy Woodlands and Derived Native Grassland of South-eastern Australia. • Plains mallee box woodlands of the Murray Darling Depression, Riverina and Naracoorte Coastal Plan Bioregions. • Weeping Myall Woodlands. • Spring surveys failed to verify the occurrence of these TECs within the Subject Land. Further analysis will be provided in the BDAR to confirm this interim conclusion.
Listed Threatened Species	The PMST identified twenty-eight threatened species listed under the EPBC Act that have the potential to occur within the Subject Land.
Listed Migratory Species	The PMST identified nine migratory species with the potential to occur two of these species are listed as critically endangered.
Great Barrier Reef Marine Park	Not applicable
Other Matters Protected by the EPBC Act	Not other matters protected by the EPBC Act.

Under the EPBC Act, projects that are expected to have a significant impact on MNES are required to refer the proposed action (the Project) to the Commonwealth Minister for Climate Change, Energy, Environment and Water. This process involves a formal assessment and determination by the Minister. If the Minister determines the proposed action is likely to have a significant impact on MNES then the action is deemed to be controlled action under the EPBC Act.

NSW maintains a bilateral agreement with the Australian Government with regards to biodiversity. This agreement aims to establish a consistent framework for environmental assessment and approvals. This agreement allows accredited assessors in NSW to conduct assessments and approvals for state significant development projects in line with state and federal standards.

8. NEXT STEPS

The Project SEARs are likely to require the preparation of a BDAR. This will require completion of Stage 1 and Stage 2 of the BAM. The following sections generally outline the future scope of these works.

8.1 STAGE 1 OF THE BAM

Stage 1 of the BAM requires that additional survey periods be completed to inform the Project BDAR. At this stage of the project, ERM has completed the Spring Survey period, which is to be followed by the Summer and Winter seasonal surveys to meet the anticipated survey requirements. The project BDAR will document the methods and results of these survey efforts and how they adhere to the relevant survey guidelines. Relevant survey guidelines include:

- Threatened Reptiles – Biodiversity Assessment Method Survey Guide, 7 November 2022;
- Koala (*Phascolarctos cinereus*): Biodiversity Assessment Method Survey Guides, 17 June 2022;
- Surveying Threatened Plants and their Habitats: NSW Survey Guide for the Biodiversity Assessment Method, 3 April 2020;
- Species Credit Threatened Bats and their Habitats, 3 October 2018;
- NSW Survey guide for threatened Frogs, 24 September 2020; and
- 2004 Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities (Working Draft), 1 November 2004.

Remaining investigations include the following:

- Review of Category 1-exempt land mapping as presented in the Draft NVR Map;
- Mapping of field verified PCTs and conditions states to determine vegetation zones;
- Obtaining of additional BAM plot data for delineated vegetation zones;
- Review of Candidate Species list following confirmation of PCT mapping; and
- Conduct targeted surveys for updated Candidate Species list.

8.2 STAGE 2 OF THE BAM

Application of Stage 2 of the BAM aims to determine how the project will meet the "No Net Loss" standard required by the NSW BC Act. This calculation depends on the extent of biodiversity values being impacted, whether the impact is direct, indirect of prescribed. These impacts are to be assessed following application of the mitigation hierarchy (Avoid, minimise, mitigate). Therefore, allowing for the quantification of residual impacts.

The BAM is then used to calculate the offset liability of the Project in units referred to as biodiversity credits. A biodiversity offset strategy will be defined to demonstrate how this offset is to be delivered, this defines the "No Net Loss" for the proposed project.

8.2.1 APPLICATION OF THE MITIGATION HIERARCHY

This Preliminary biodiversity Assessment has identified the biodiversity constraints on the proposed Romani Solar Farm and BESS that will require consideration and application of the mitigation hierarchy. Impacts to native vegetation and threatened species should be avoided as apriority. The following principles are to be considered in the application of the mitigation hierarchy:

Avoid

- Avoid areas of native vegetation patches of defined PCTs and corresponding TECs; and
- Avoid areas that contain identified biodiversity values such as habitat features.

Minimise

- Minimise the risk for weed and pest incursion on the Subject Land; and
- Minimise the risk of injury to fauna.

Mitigate

- Mitigate any residual impacts to biodiversity. This should be achieved through the conservation and improvement of existing native vegetation on the Subject Land.

8.2.2 OFFSET STRATEGY

If deemed to be required, an offset strategy is required to demonstrate a 'no net loss' outcome and accordingly could comprise one or more of the following:

- Retirement of suitable ecosystem and species credits registered in the BOS;
- Contribution to a conservation initiative; and
- Implementation of a voluntary planning agreement.

In relation to the latter two listed options, for the Project may take into consideration the balance of the Subject Land where the management and protection of biodiversity values could be used to demonstrate achievement of a 'no net loss' standard. An operational biodiversity management plan for proximal lands could be used to improve local biodiversity values as well as implementation of a suitable conservation mechanism, which can act together to remedy any biodiversity loss. This approach is supported by the Subject Land falls within a landscape/ IBRA subregion that is highly over cleared and comprises a poor representation of biodiversity values within the conservation reserve network. Such efforts effectively represent conservation initiatives that directly address biodiversity loss in a local context.

The merits of this approach hinge on the extent of avoid/minimise/mitigate measures and how any related commitments expressed through condition of consent can act to improve local biodiversity values relative to the identified losses. For instance, a planning agreement (s7.18 of the BC Act) may form part of the application where it specifies the project offset for impacts on biodiversity values by way of managing and conserving retained native vegetation and habitat in the local area. In considering s7.14(2) of the BC Act and in exercising s7.14(3), the Minister for Planning may form the view that by endorsing the terms of the Planning Agreement there are no residual impacts thus obviating any credit retirement liability. This approach to achieving a 'no net loss' standard is supported by s7.14(5) of the BC Act where it states that the Minister for Planning is not limited by the matters specified in s7.14 when considering the impact of the proposed development on biodiversity values.

8.3 PREPARATION OF A BDAR

A BDAR prepared in accordance with the provisions of the BAM is expected to be provided as a part of the EIS. This is to be used to assess the impacts of the Project on assessable biodiversity values. The project BDAR will comprise the survey methods and results, and the assessment of the impacts. It will also outline the offset strategy for any residual impacts as a result of the Project.

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