BayWa r.e.

r.e. think energy

Appendix 5 (Part A): Amended Biodiversity Development Assessment Report - Main Body

umwelt
Environmental & Social Consultants

BayWa r.e.

BULLAWAH WIND FARM PROJECT

Amended Biodiversity Development Assessment Report

FINAL

April 2025

BULLAWAH WIND FARM PROJECT

Amended Biodiversity Development Assessment Report

FINAL

Prepared by
Umwelt (Australia) Pty Limited
on behalf of
Bullawah Wind Farm Pty Ltd

Project Director:	Nathan Baker
Project Manager:	Lauren Evans
Technical Director:	Rachel Musgrave
Report No.	22110/R34
Date:	April 2025

Environmental & Social Consultants

This report was prepared using Umwelt's ISO 9001 certified Quality Management System.

Acknowledgement of Country

Umwelt would like to acknowledge the traditional custodians of the country on which we work and pay respect to their cultural heritage, beliefs, and continuing relationship with the land. We pay our respect to the Elders – past, present, and future.

Acknowledgement of contributions

Umwelt would like to thank the following people for their assistance and contribution to this assessment:

- The Project landholders for providing access, site condition updates and local knowledge to our team since the beginning of this project in 2022.
- Anna McConville (Echo Ecology and Surveying) and her team for their expertise and patience analysing the hundreds of thousands of bat calls from two years of seasonal bat call data collected for the bat utilisation surveys.
- Greg Ford for his expedited processing of at height bat call data and providing insight into bat behaviour, specifically near meteorological masts.

Disclaimer

This document has been prepared for the sole use of the authorised recipient and this document may not be used, copied or reproduced in whole or part for any purpose other than that for which it was supplied by Umwelt (Australia) Pty Ltd (Umwelt). No other party should rely on this document without the prior written consent of Umwelt.

Umwelt undertakes no duty, nor accepts any responsibility, to any third party who may rely upon or use this document. Umwelt assumes no liability to a third party for any inaccuracies in or omissions to that information. Where this document indicates that information has been provided by third parties, Umwelt has made no independent verification of this information except as expressly stated.

©Umwelt (Australia) Pty Ltd

Document Status

Rev No.	Reviewer		Approved for Issue	
	Name	Date	Name	Date
Final	Bill Wallach	4 April 2025	Nathan Baker	7 April 2025

Declarations

i. Certification under clause 6.15 *Biodiversity Conservation Act 2016*

I, Rachel Musgrave, certify that this report has been prepared based on the requirements of, and information provided under, the Biodiversity Assessment Method 2020 and clause 6.15 of the *Biodiversity Conservation Act 2016* (BC Act).

Signature:

Date: 9 April 2025

BAM assessor accreditation number: BAAS18032

ii Conflict of Interest

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

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

Full disclosure has also been provided to the client.

Signature:

Date: 9 April 2025

BAM assessor accreditation number: BAAS18032

iii Details and Experience of Author/s and Contributors

The development of this BDAR has been carried out by appropriately qualified and experienced environmental professional, ecologists and accredited people as demonstrated below.

Name	BAM assessor accreditation number. (if relevant)	Position/Role	Tasks performed	Relevant qualifications
Rachel Musgrave	BAAS18032	Ecology Manager South East Australia – Principal Ecologist / Biodiversity Technical Lead Accredited assessor certifying the BDAR.	Scoping and delivery of BAM assessment, technical oversight, BAM VI plots (June 2023), targeted threatened flora surveys (November 2023), BDAR lead author.	Bachelor of Science (Honours) Ecology.
Larissa Abbott	-	Senior Ecologist/Biodiversity Technical Manager Fauna Lead	Scoping and delivery of BAM assessment, survey coordination and planning, BDAR preparation.	Bachelor of Science (Honours) Environmental Science.
Lachlan Laurie	BAAS18011	Principal Ecologist / Botanist Vegetation Lead	Fieldwork including vegetation mapping, BAM VI plots (December 2022 to January 2025) and targeted threatened flora surveys (August 2023, September 2023, October 2023, November 2023, December 2023, January 2024, September 2024, October 2024, November 2024, and January 2025), Threatened bird hollow utilisation surveys – September 2024 and October 2024. Road Upgrade Assessments BDAR preparation.	Advanced Plant Identification for Research and Development UNSW. Biodiversity Offset Scheme (BOS) Accredited Assessor.
Dr James Garnham	BAAS19021	Principal Ecologist/ Field Surveyor	Bird and Bat Utilisation Surveys – September 2022 and February 2024.	Doctor of Philosophy (Conservation Biology). Bachelor of Environmental Science and Management (Honours).

Name	BAM assessor accreditation number. (if relevant)	Position/Role	Tasks performed	Relevant qualifications
Mark Allen	BAAS22025	Senior Ecologist / Field Surveyor	Bird and Bat Utilisation Surveys – June 2022 and September 2023. Targeted threatened flora surveys – August 2023 and September 2023. Authored Prescribed Impacts Assessments.	Bachelor of Science (Honours – First Class) Resource and Environmental Management.
Matthew Mullaney	BAAS24014	Ecologist / Field Surveyor	Targeted threatened flora surveys – July 2023, August 2023, and September 2023.	Bachelor of Environmental Science.
Sharae Hurley	-	Ecologist / Field Surveyor	Threatened fauna habitat assessment – May 2023. Targeted threatened flora surveys – July 2023. BDAR preparation.	Bachelor of Environmental Science.
Sarah Hart	BAAS21026	Senior Ecologist/ Field Surveyor	Targeted threatened flora surveys – September 2023.	Master of Science (Ecology and Zoology). Bachelor of Science (Zoology). Graduate Diploma of Environmental Management.
Tim Cusack	-	Ecologist	Acoustic analysis – December 2023.	Bachelor of Zoology. Bachelor of Environmental Science.
Harry Ellington	-	Ecologist / Field Surveyor	Targeted threatened flora surveys – September 2023. Bird and Bat Utilisation Surveys – May 2023.	Bachelor of Environmental Science.
Cassidy Le Busque	-	Ecologist / Field Surveyor	Targeted threatened flora surveys – January 2024. BDAR preparation.	Bachelor of Science (Honours) Wildlife Conservation Biology.
Peter Splatt	-	Senior Ecologist / Field Surveyor	Bird and Bat Utilisation Surveys – June 2022, September 2022, and January 2023.	Bachelor of Science (Ecology and Conservation Biology).
Chloe D'Monte	-	Ecologist / Field Surveyor	Targeted threatened flora surveys – January 2024. BDAR preparation.	Bachelor of Environmental Science.

Name	BAM assessor accreditation number. (if relevant)	Position/Role	Tasks performed	Relevant qualifications
Clare Vincent	BAAS23034	Ecologist / Field Surveyor	Targeted threatened flora surveys – January 2024.	Bachelor of Environmental Management and Ecology. Graduate Diploma in Environmental Management.
Kealyn Madden	-	Ecologist / Field Surveyor	Targeted threatened flora surveys – October 2023, November 2023, May 2024 and September 2024. Koala Spot Assessment Surveys – May 2024. Plains Wander Surveys – November 2024 and December 2024. Bush stone-curlew surveys – March 2025. BDAR preparation.	Bachelor of Science (Animal Behaviour). Master of Environmental Management (Conservation)
Jade Philipson	-	Ecologist / Field Surveyor	Targeted threatened flora surveys – May 2024, October 2024. Koala Spot Assessment Surveys – May 2024. BDAR preparation.	Master of Environmental Management and Sustainability. Bachelor of Zoology.
Lee O'Shea	-	Ecologist / Field Surveyor	Targeted threatened flora surveys – December 2023. BDAR preparation.	Bachelor of Science (Honours) Ecology and Conservation Biology. Sustainability & Biodiversity (single units of study).
Bryce Miller	-	Ecologist / Field Surveyor	Threatened fauna habitat assessment – May 2023. Targeted threatened flora surveys – July 2023, August 2023, September 2023, October 2023, November 2023, December 2023, and November 2024 Southern Myotis surveys – February 2024. BDAR preparation.	Bachelor of Biodiversity and Conservation.
Maddie Sanders	-	Senior Ecologist / Field Surveyor	Targeted threatened flora surveys – September 2023.	Bachelor of Environmental Science and Management (Honours). Bachelor of Science (Biology).

Name	BAM assessor accreditation number. (if relevant)	Position/Role	Tasks performed	Relevant qualifications
Dr David Sharpe	-	Principal Ecologist / Field Surveyor	Targeted threatened flora surveys – November 2023. Southern Myotis surveys – February 2024. BDAR preparation. Authored Prescribed Impacts Assessments. Technical reviews.	Doctor of Philosophy, Ecology of the Squirrel Glider in the Core of its Range. Bachelor of Applied Science (Honours). Bachelor of Applied Science.
Kate Schmahl	-	Ecologist / Field Surveyor	Threatened amphibian and reptile surveys – December2023. BDAR Preparation.	Bachelor of Environmental Science and Management.
Rachael Donelly	-	Ecologist / Field Surveyor	Targeted threatened flora surveys – October 2023. Threatened amphibian and reptile surveys – December 2023. Bird and Bat Utilisation Surveys – February 2024. BDAR Preparation.	Bachelor of environmental Science and Management.
Aleksei Atkin (Holocene Ecology)	BAAS17093	Principal Ecologist / Field Surveyor	Bird and Bat Utilisation Surveys – May 2023. Targeted threatened flora surveys – September 2023. Plains-wanderer surveys – November 2024 Preparation of the Prescribed Imapct Assessment for Turbine Strike.	Macquarie University - Master of Wildlife Management University of Western Sydney, Hawkesbury - Bachelor of Natural Science (Nature Conservation)
David Russell (David Russell Ecology)	BAAS18084	Vegetation Ecologist / Field Surveyor	Targeted threatened flora surveys – August 2023.	Bachelor of Science University of Newcastle
Ella West	-	Ecologist / Field Surveyor	Targeted threatened flora surveys – September 2023.	Bachelor of Science (Honours – First Class) Ecology and Environmental Science). Bachelor of Science (Wildlife Conservation). Bachelor of Science (Animal Science).

Name	BAM assessor accreditation number. (if relevant)	Position/Role	Tasks performed	Relevant qualifications
Dayna Hoadley	-	Ecologist / Field Surveyor	Targeted threatened flora surveys – September 2023.	Bachelor of Science (Animals Science). Graduate Certificate in Captive Vertebrate Management.
Jesse Carpenter	-	Senior Ecologist / Field Surveyor	Targeted threatened flora surveys – September 2023.	Bachelor of Applied Science (Environmental Science). Former Biodiversity Assessment accredited assessor.
Ned Piscioneri	-	Ecologist / Field Surveyor	Targeted threatened flora surveys – September 2023.	Bachelor of Science (Honours – First Class) Environmental Science.
Jessica Skewes	-	Senior Ecologist / Field Surveyor	Targeted threatened flora surveys – September 2023.	Postgraduate Diploma in Science (Ecology). Bachelor of Science (Ecotourism).
Connor Panozzo	-	Ecologist / Field Surveyor	Targeted threatened flora surveys – September 2023 and October 2023.	Bachelor's Degree of Biodiversity and Conservation (Honours)
Andrew Mitchell	-	Senior Ecologist / Field Surveyor	Targeted threatened flora surveys – October 2023 and November 2023.	Bachelor of Science (Botany, Zoology, Geography).
Shelly Greer	-	Ecologist / Field Surveyor	Targeted threatened flora surveys – October 2023.	Bachelor of Environmental Science
Bethany Cox	-	Ecologist / Field Surveyor	Targeted threatened flora surveys – October 2023.	Honours Degree of Bachelor of Science Bachelor of Wildlife Conservation Biology Bachelor of Environmental Management and Policy Certificate I in Conservation and Land Management
Lily Mackintosh	-	Ecologist / Field Surveyor	Targeted threatened flora surveys – November 2023.	Bachelor of Science (Honours – First Class) Bachelor of Science (Wildlife Conservation Biology).
Tom Riley	-	Ecologist / Field Surveyor	Targeted threatened flora surveys – November 2023.	Bachelor of Environmental Science and Management (studying). Bachelor of Business (studying).

Name	BAM assessor accreditation number. (if relevant)	Position/Role	Tasks performed	Relevant qualifications
Gemma Hopkins	-	Environmental Consultant / Field Surveyor	Targeted threatened flora surveys – November 2023.	Diploma of Project Management. ISCA Accredited Professional (ISAP) ISv2.0 Bachelor of Environmental Science (Honours- First Class).
Alistair Campbell	-	Environmental Consultant / Field Surveyor	Targeted threatened flora surveys – November 2023, October 2024, and November 2024.	Master of Environmental Management and Sustainability. Bachelor of Science and Business (Biotechnology).
Dr Matthew Renner	-	Senior Ecologist / Botanist / Field Surveyor	Targeted threatened flora surveys – September 2024, October 2024, November 2024, December 2024 and January 2025. Threatened bird hollow utilisation surveys – September 2024, October 2024, and November 2024. Road upgrade assessments BDAR preparation	Doctor of Philosophy, University of Sydney
Dr Matthew Chard	-	Senior Ecologist / Field Surveyor	Targeted threatened flora surveys – October 2024 and November 2024. Bush stone-curlew surveys – March 2025. Threatened bird hollow utilisation surveys – November 2024.	Doctor of Philosophy, Australian National University, 2023 Bachelor of Conservation Biology (Honours), 2015
Dr Peter Weston	-	Botanist / Field Surveyor	Targeted threatened flora surveys – November 2024 and December 2024.	Bachelor of Science (Honours), University of Sydney. Doctor of Botany/Plant Biology (University of Sydney)
Nick Weston	-	Botanist / Field Surveyor	Targeted threatened flora surveys – November 2024 and December 2024.	Bachelor of Environmental Science

Name	BAM assessor accreditation number. (if relevant)	Position/Role	Tasks performed	Relevant qualifications
Rebecca Vere	-	Principal Ecologist / Field Surveyor	Plains-wanderer surveys – November 2024.	Master of Environmental Management, University of New England Bachelor of Science (Honours), University of New England Bachelor of Science, University of New England
Ben Mackenzie	-	Ecologist / Field Surveyor	Plains-wanderer surveys – November 2024.	Bachelor of Science. (Major in Wildlife Biology) Griffith University
Mike Timms	-	Senior Ecologist / Field Surveyor	Targeted threatened flora surveys – October 2024 and November 2024. Threatened bird hollow utilisation surveys – November 2024.	Bachelor of Science (Ecology and Evolutionary Biology) The University of Melbourne Master of Environment (Conservation and Restoration) The University of Melbourne
Michael Jones	-	Ecologist/Field Surveyor	Targeted threatened flora surveys – September 2024 and November 2024.	Bachelor of Environmental Science (RMIT) Bachelor of environment & Society (RMIT) Bachelor of Science – Honours 1st class (ANU)
Luke Hush	-	Ecologist / Field Surveyor	Targeted threatened flora surveys – October 2024 and November 2024. Threatened bird hollow utilisation surveys – November 2024.	Bachelor of Environmental Science, University of Canberra
Bill Wallach	BAAS17068	Principal Ecologist	Technical review of the amended BDAR.	Bachelor of Biological Sciences (Hons), La Trobe University

Executive Summary

The Proposal

Bullawah Wind Farm Pty Ltd (BWF) proposes to develop the Bullawah Wind Farm (the Project), located approximately 36 kilometres (km) south east of Hay, within the South West Renewable Energy Zone (South West REZ). The Project is therefore strategically located in an area identified by the NSW Government as suitable for renewable energy projects and will assist the NSW government in delivering on the objectives for the Electricity Strategy and the South West REZ.

The Project will include the installation, operation, maintenance and decommissioning of up to 143 wind turbine generators (WTGs), battery storage, ancillary infrastructure and temporary facilities associated with construction of the Project. The Project design incorporates up to 143 wind turbines, with a maximum blade-tip height of 300 metres (m) above ground level, and an installed capacity of up to 815.1 megawatts (MW).

Landscape Features

The Project is located wholly within the Murrumbidgee Interim Biogeographic Regionalisation for Australia (IBRA) Subregion, in the Riverina Bioregion of NSW. The Project Area is almost completely flat topographically as a result of occurring within the Hay Plain. Oolambeyan National Park is situated immediately north of the Project Area, while South West Woodland Nature Reserve is located approximately 24 km west and 12 km south of the Project Area.

The primary land use within the Project Area is agriculture, specifically cattle and sheep grazing, with small areas also being used for irrigated cropping. The majority of the Project Area is primarily comprised of native grassland and chenopod shrubland, with a smaller proportion of the vegetation consisting of a mosaic of freshwater wetlands and open woodland. River Red Gum – Black Box Woodland wetland of the semi-arid (warm) climatic zone, fringes the Coleambally Outfall Drain throughout the Subject Land.

The Project is considered linear in nature, with exception of three offsite areas that will be used as laydowns and ancillary sites to support Stage 1 construction. The linear component of the Project falls within a single ~ 230 m wide corridor within which WTG pads, access roads, cabling and ancillaries are located.

Native vegetation cover within the assessment areas is calculated to be >90%, falling within the >70% BAM vegetation cover class. Patch size for all vegetation zones has been calculated at >100 ha.

Assessment Methods

Extensive ecological surveys in accordance with the Biodiversity Assessment Method (BAM) 2020 were carried out across the Subject Land between March 2022 and May 2024, as summarised in **Table ES.1**.

Table ES.1 Biodiversity Surveys Carried Out for the Project

Survey type	Dates	Location
Vegetation Assessment		
Vegetation assessment and PCT mapping	December 2022–May 2024	Stage 1 – Linear and Stage 2 – Linear assessment areas Stage 1 – Site based area
BAM VI Plots	December 2022–May 2024	Stage 1 – Linear and Stage 2 – Linear assessment areas Stage 1 – Site based area
Threatened Flora Surveys		
Survey Group 1	July–September 2023	Stage 1 – Linear and Stage 2 – Linear assessment areas
Survey Group 2	September 2023	Stage 1 – Linear and Stage 2 – Linear assessment areas
Survey Group 3	October 2023	Stage 1 – Linear and Stage 2 – Linear assessment areas
Survey Group 4	December 2023–January 2024	Stage 1 – Linear and Stage 2 – Linear assessment areas
Survey Group 5	September 2023	Stage 1 – Linear and Stage 2 – Linear assessment areas
Survey Group 6	May 2024	Stage 1 – Linear and Stage 2 – Linear assessment areas
Threatened Fauna Surveys		
Habitat Assessment Surveys	March 2022–August 2023 May 2024	Stage 1 – Linear and Stage 2 – Linear assessment areas Stage 1 – Site based area
Bird and bat utilisation surveys	March 2022–February 2024	Project Area
Acoustic call detection	August 2023 November–December 2023	Stage 1 – Linear and Stage 2 – Linear assessment areas
Reptile and amphibian surveys	December 2023	Stage 1 – Linear
Koala SAT surveys	May 2024	Stage 1 – Linear and Stage 2 – Linear assessment areas
Ultrasonic call detection surveys	March 2022–February 2024 February 2024	Stage 1 – Linear and Stage 2 – Linear assessment areas

Native Vegetation

The vegetation within the Subject Land is predominantly native in relatively good condition despite historical and ongoing land use pressures. The vegetation within the Subject Land is made up of the following 5 vegetation formations:

- Forested Wetlands.
- Semi-arid Woodlands (Grassy sub-formation).
- Freshwater Wetlands.
- Grasslands.
- Arid Shrublands (Chenopod sub-formation).

A total of 4,283.32 ha of native vegetation comprised of 10 Plant Community Types across 12 vegetation zones were recorded within the Subject Land as follows:

- PCT 10: River Red Gum - Black Box woodland wetland of the semi-arid (warm) climatic zone (mainly Riverina Bioregion and Murray Darling Depression Bioregion)
- 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)
- 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 26: Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion
- PCT 28: White Cypress Pine open woodland of sand plains, prior streams and dunes mainly of the semi-arid (warm) climate zone
- PCT 44: Forb-rich Speargrass - Windmill Grass - White Top grassland of the Riverina Bioregion
- PCT 46: Curly Windmill Grass - speargrass - wallaby grass grassland on alluvial clay and loam on the Hay Plain: 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.

Three Threatened Ecological Communities were recorded within the Subject Land

- Sandhill Pine Woodland in the Riverina, Murray-Darling Depression and NSW South Western Slopes bioregion – listed as endangered under the NSW *Biodiversity Conservation Act 2016* (BC Act)
- Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions – listed as endangered under the BC Act
- Weeping Myall Woodlands – listed as endangered under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Threatened Species

In accordance with the BAM threatened species have been assessed as predicted or ecosystem credit species and species credit species.

Forty-one (41) ecosystem credit species are predicted to occur within the Subject Land. There were eight ecosystem credit species recorded within the Subject Land or Project Area during the field surveys:

- Southern Whiteface (*Aphelocephala leucopsis*) – listed as vulnerable under the BC Act
- Spotted Harrier (*Circus assimilis*) – listed as vulnerable under the BC Act
- White-fronted chat (*Epthianura albifrons*) – listed as vulnerable under the BC Act
- Black Falcon (*Falco subniger*) – listed as vulnerable under the BC Act
- Blue-winged Parrot (*Neophema chrysostoma*) – listed as vulnerable under the BC Act and EPBC Act
- Flame Robin (*Petroica phoenicea*) – listed as vulnerable under the BC Act
- Grey-crowed Babbler (*Pomatostomus temporalis temporalis*) – listed as vulnerable under the BC Act
- Diamond Firetail (*Stagonopleura guttata*) – listed as vulnerable under the BC Act and EPBC Act.

A total of 17 threatened flora candidate species were considered to have potential associated habitat within the Subject Land and were the subject of targeted surveys. Of these, five (5) threatened flora species were recorded during the targeted surveys:

- *Eleocharis obcis* (spike-rush) – listed as vulnerable under the BC Act and the EPBC Act
- *Maireana cheelii* (Chariot Wheels) – listed as vulnerable under the BC Act and the EPBC Act
- *Swainsona sericea* (Silky Swainson-pea) – listed as vulnerable under the BC Act
- *Swainsona murrayana* (Slender Darling Pea) – listed as vulnerable under the BC Act and EPBC Act
- *Lepidium monoplocoides* (Winged Peppercress) – listed as endangered under the BC Act and EPBC Act.

Two (2) previously assumed present species, *Austrostipa wakoolica* and *Cullen parvum*, have had targeted flora surveys completed in the Project Area since exhibition of the BDAR. Neither target species was recorded through these detailed surveys. As such, there is no species polygon applicable for these two species and the Project is not considered to impact them.

A total of 14 threatened fauna species were considered to have potential associated habitat within the Subject Land and were the subject of targeted surveys. Of these, four (4) threatened fauna species were recorded during the targeted surveys:

- Barking Owl (*Ninox connivens*) – listed as vulnerable under the BC Act
- Little Eagle (*Hieraaetus morphnoides*) – listed as vulnerable under the BC Act
- Southern Bell Frog (*Litoria raniformis*) – listed as endangered under the BC Act and vulnerable under the EPBC Act
- Plains-wanderer (*Pedionomus torquatus*) – listed as endangered under the BC Act and critically endangered under the EPBC Act.

Important habitat for Plains-wanderer has been recorded within Project Area and the species was incidentally recorded during the field surveys. All areas of mapped Important habitat have been avoided by the Project and the Project will not directly impact any extents of Important Habitat for the species, which is considered a Serious and Irreversible Impact (SAII).

Avoidance and Design Refinements

The proposal has been refined to avoid and minimise potential impacts on biodiversity values including:

- Reduction in the Project Area, Development Corridor, and Development Footprint by between 25 and 34%.
- A hierarchical approach to avoidance was adopted, targeting the entities with the highest biodiversity value.
- Avoidance of all extents of mapped Important Habitat for Plains-wanderer. No areas of Important Habitat for Plains-wanderer will be impacted by the Project.
- Avoidance of biodiverse riparian land.
- Removal of WTG from within a ~450 buffer of Oolambeyan National Park.

BWF is committed to further avoidance and minimisation of impacts to biodiversity during detailed design, construction, and operation.

Based on the outcomes of the Project's blade throw assessment conducted for the Amendment Report, BWF has committed to the removal of two (2) WTGs from the EIS Project i.e. the 143 WTG layout assessed for the Project EIS and associated BDAR. The WTG that are to be removed are WTG 37 and WTG 38. This information was received late in the process of finalising the Amended BDAR such that it includes the full assessment of the maximum proposed impacts, being the 143 WTG layout assessed in the Project EIS. The amended areas of impacts to ecosystem credits and species credits are however presented in separate tables in **Section 10.1.1** and **Section 10.1.2**, as agreed to by DPHI. The BAM-C reflects the 143 WTG layout as submitted in support of this Amended BDAR, and was not re-opened to calculate the credit liability for the amended project layout (i.e. 141 WTG design).

Impact Assessment

The Project would directly impact up to 638.01 ha of native vegetation within the Development Footprint across the three assessment areas as follows:

- Stage 1 – Linear assessment: 269.69 ha.
- Stage 1 – Site-based assessment: 0.91 ha.
- Stage 2 – Linear assessment: 367.41 ha.

The native vegetation to be directly impacted within the Development Footprint is comprised 10 PCTs across 11 vegetation zones. The 638.01 ha of direct impacts to native vegetation represents approximately 15% of the native vegetation within the Subject Land, and 3% of the total Project Area.

Of the 638.01 ha of native vegetation to be directly impacted by the Project, there would be direct impacts to 87.42 ha of TECs including:

- 22.80 ha of direct impacts to Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions (EEC – BC Act)
- 4.92 ha of direct impacts to Weeping Myall Woodland (EEC – EPBC Act)
- 59.70 ha of direct impacts to Sandhill Pine Woodland in the Riverina, Murray-Darling Depression and NSW South Western Slopes bioregion (EEC – BC Act).

Impacts on threatened species have been considered in accordance with the BAM based on ecosystem credit species and species credit species. Impacts resulting from the proposal on threatened species includes:

- Loss of habitat for up to 44 ecosystem species predicted to occur within the Subject Land.
- Direct impacts to five threatened flora species recorded during field surveys within the Subject Land including:
    - *Maireana cheelii* (4.67 ha)
    - *Swainsona sericea* (9.78 ha)
    - *Swainsona murrayana* (123.09 ha)
    - *Lepidium monoplocoides* (3.52 ha)
    - *Eleocharis obicis* (7.31 ha).

Direct impacts to four threatened fauna species recorded during field surveys including:

- Barking Owl (2.80 ha)
- Little Eagle (35.81 ha)
- Southern Bell Frog (52.16 ha).
- Plains-wanderer (20.89 ha [supplementary habitat, not NSW important habitat mapping]).

Mitigation

BWF has committed to the design and implementation of a comprehensive biodiversity mitigation strategy to minimise the unavoidable impacts of the Project. The following Management Plans will be prepared post approval as part of the Biodiversity Management strategy:

- Bird and Bat Adaptive Management Plan (BBAMP).
- Construction Environmental Management Plan (CEMP).

- Biodiversity Management Plan, which will include the following subplans.
    - Plains-wanderer Management Sub-plan.
    - Threatened Species Sub-plan.
    - Rehabilitation Management Subplan.
    - Offsetting Biodiversity Impacts.

The Project will have direct impacts on 638.01 ha of native vegetation within the Development Footprint. Additionally, the impacts will be finalised following the completion of the detailed design and micro-siting of turbines and associated infrastructure. In doing so, BWF will seek to further minimise impacts to biodiversity values. A range of impact mitigation strategies are proposed to mitigate the impact on ecological values prior to the consideration of offsetting requirements.

Residual impacts that are not able to be managed through mitigation would be offset in accordance with BAM calculations for both ecosystem and species credits. The proposed offset obligation based on the disturbance area has been calculated to require the following biodiversity credits:

- 10,873 ecosystem credits
- 7,085 species credits.

The offset strategy will be implemented in consideration of the process outlined in the BC Act and the final composition of the offset strategy may evolve as the Project progresses.

BWF will retire the credits required to offset the impacts of the Project as specified in **Section 10.1** and the offset options available under the BC Act and BC Regulation including:

- Land based offsets through the establishment of new Stewardship Sites (and subsequent retirement of credits) or by retiring credits from existing Stewardship Sites. BWF would retire the required number and class of credits determined in accordance with the BDAR and the offset rules in the BC Regulation.
- Securing (purchasing) credits through the open credit market. And/or
- Paying into to the Biodiversity Conservation Fund (BCF).

Additional and appropriate measures are also proposed to offset the residual biodiversity impacts of the Amended Project, comprising additional offsets for impacts to Plains-wanderer supplementary habitat, and contributions to Land Management for both Plains-wanderer and Black Falcon. These additional and appropriate measures are detailed in **Section 10.2**.

Abbreviations

Abbreviation	Definition
AHD	Australian Hight Datum
AOBV	Areas of Outstanding Biodiversity Value
AoS	Assessment of Significance
BAM	Biodiversity Assessment Method 2020
BAM-C	Biodiversity Assessment Method Calculator
BC Act	NSW *Biodiversity Conservation Act 2016*
BCD	Biodiversity and Conservation Division of NSW DCCEEW
BCF	Biodiversity Conservation Fund
BDAR	Biodiversity Development Assessment Report
BESS	Battery Energy Storage System
BoM	Bureau of Meteorology
BOS	NSW Biodiversity Offset Scheme
BWF	Bullawah Wind Farm Pty Ltd
CASA	Civil Aviation Safety Authority
Commonwealth DCCEEW	Commonwealth Department of Climate Change, Energy, the Environment and Water
NSW DCCEEW	NSW Department of Climate Change, Energy, the Environment and Water
DA	Development Application
DBH	diameter at breast height
DEWHA	Commonwealth Department of the Environment, Water, Heritage and the Arts (superseded)
DNG	derived native grassland
DPE	NSW Department of Planning and Environment (superseded)
DPHI	NSW Department of Planning, Housing and Infrastructure
DPI	NSW Department of Primary Industries
DSEWPaC	Commonwealth Department of Sustainability, Environment, Water, Population and Communities (superseded)
EAH	Environmental Agency Head
EEC	endangered ecological community
EP&A Act	NSW *Environmental Planning and Assessment Act 1979*
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
EIS	Environment Impact Statement
FM Act	NSW *Fisheries Management Act 1994*
FTE	full time equivalent
GDE	Groundwater Dependent Ecosystem
GIS	Geographic Information Systems

Abbreviation	Definition
ha	hectares
km	kilometres
kV	kilovolt
IBRA	Interim Biogeographic Regionalisation for Australia
LEP	Local Environment Plan
LGA	Local Government Area
LLS	Local Land Services
LLS Act	NSW *Local Land Services Act 2013*
LLS Regulation	NSW Local Land Services Regulation 2014
m	metres
mm	millimetres
MNES	matters of national environmental significance
MWh	Megawatt hour
NPW Act	NSW *National Parks and Wildlife Act 1974* (NPW Act)
NSW	New South Wales
NVR Map	Native Vegetation Regulatory map
OSOM	oversize, overmass
PCT	plant community type
PMST	Protected Matters Search Tool
the Project	Bullawah Wind Farm
RBGS	Royal Botanic Gardens Sydney
South West REZ	South West Renewable Energy Zone
RMP	rapid mapping point
SAII	serious and irreversible impact
SEARS	Secretary's Environmental Assessment Requirements
SEPP	State Environmental Planning Policy
South West REZ	South West Renewable Energy Zone
SPRAT	Species Profiles and Threats Database
SSD	State Significant Development
SVTM	State Vegetation Type Map
TBDC	Threatened Biodiversity Data Collection
TEC	threatened ecological community
TSSC	Threatened Species Scientific Committee
Umwelt	Umwelt (Australia) Pty Ltd
VI	vegetation integrity
WTG	Wind Turbine Generators

Glossary

Term	Definition
Accredited person or assessor	Means as person accredited under section 6.10 of the BC Act to prepare reports in accordance with the BAM.
Ancillary Infrastructure	All permanent infrastructure necessary for the construction and operation of the wind farm with the exception of WTGs and battery storage, including but not limited to internal roads, hardstands, main and collector substations, switchyard, operations and maintenance facility, underground and overhead electricity transmission lines and poles, communication cables (includes control cables and earthing), permanent meteorological masts and water storage tanks.
Benefit sharing	Benefit sharing aims to distribute benefits generated by a project between the Proponent and the community through mutually agreed opportunities such as funding or sponsoring local community initiatives, programs or projects.
Biodiversity Assessment Method Calculator	Biodiversity Assessment Method Calculator (BAM-C) – the online computer program that provides decision support to assessors and proponents by applying the BAM and referred to as the BAM-C. The BAM-C contains biodiversity data from the BioNet Vegetation Classification and the Threatened Biodiversity Data Collection that the assessor is required to use in a BAM assessment. The BAM-C applies the equations used in the BAM, including those to determine the number and class of biodiversity credits required to offset the impacts of a development, or created at a biodiversity stewardship site. It is published by the Department (DPIE 2020a).
Biodiversity credit report	The report produced by the BAM-C that sets out the number and class of biodiversity credits required to offset the remaining adverse impacts on biodiversity values at a development site, or on land to be biodiversity certified, or that sets out the number and class of biodiversity credits that are created at a biodiversity stewardship site (DPIE 2020a).
Biodiversity offsets	The gain in biodiversity values achieved from the implementation of management actions on areas of land, to compensate for losses to biodiversity values from the impacts of development (DPIE 2020a).
Biodiversity Offsets and Agreement Management System	The online system used to administer the Biodiversity Offsets Scheme. The BOAMS is used by accredited assessors (to carry out specific BAM-related tasks involving access to the BAM-C to perform assessments, submit data, generate credits and calculate a credit price), by landholders (to apply for a Biodiversity Stewardship Agreement and manage ongoing reporting obligations for their agreement) and by proponents of developments (to view their credit obligation or the payment required to the Biodiversity Conservation Fund).
Biodiversity Stewardship site	Refers to land which is the subject to a Biodiversity Stewardship Agreement under the BC Act.
BioNet Atlas	The DPIE database of flora and fauna records (formerly known as the NSW Wildlife Atlas). The Atlas contains records of plants, mammals, birds, reptiles, amphibians, some fungi, some invertebrates (such as insects and snails listed under the BC Act) and some fish (DPIE 2020a).

Term	Definition
BioNet Vegetation classification	Refers to the vegetation community-level classification for use in vegetation mapping programs and regulatory biodiversity impact assessment frameworks in NSW. Refer About BioNet Vegetation Classification | NSW Environment and Heritage (DPIE 2020a).
Blade Overhang Areas	Areas within the Project Area within which WTG blades fall outside with Subject Land. These areas will be subject to ongoing prescribed impacts from potential bird and bat strike and barotrauma during project operation.
Candidate species	Also known as 'species credit species', these are threatened species for which vegetation surrogates and/or landscape features cannot reliably predict the likelihood of their occurrence or components of their habitat. These species are identified in the TBDC. A targeted survey or an expert report is required to confirm the presence of these species on the Subject Land. Alternatively, for a development, activity, clearing or biodiversity certification proposal only, the proponent may elect to assume the species is present (DPIE 2020a).
Construction	The construction of the Project, including but not limited to the construction of WTGs, battery storage, ancillary infrastructure but excluding pre-construction works.
Construction Footprint	The area to be directly impacted by the proposal during construction activities.
Cumulative impact	The impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time. Refer to Clause 228(2) of the EP&A Regulation 2000 for cumulative impact assessment requirements.
Decommissioning	The removal of WTGs, battery storage and ancillary infrastructure.
Development Consent	This is the area within which all proposed Project infrastructure will be placed and all Project related ground disturbance will occur. The Development Corridor is of variable width (to avoid key site constraints) and has been designed to provide some flexibility for micro-siting of infrastructure.
Development Footprint	The area of land that is directly impacted by the proposed development. The Development Footprint is equivalent to the total area of impact for the Disturbance Footprint (~642 ha) and Local Area Transport Route (~19 ha) identified within the EIS. The Disturbance Footprint identified in the EIS is indicative. The actual location and extent of the Disturbance Footprint will be determined prior to construction, subject to the micro-siting provisions outlined in the EIS.
Direct impact	Direct impacts on biodiversity values include those related to clearing native vegetation and threatened species habitat and impacts on biodiversity values prescribed by the Biodiversity Conservation Regulation 2017 (the BC Regulation) (DPIE 2020a).
Ecosystem credit species	Threatened species or components of species habitat that are identified in the Threatened Species Data Collection as requiring assessment for ecosystem credits. This is analogous with the definition of 'predicted species'.
Ecosystem credits	A measurement of the value of threatened ecological communities, threatened species habitat for species that can be reliably predicted to occur with a PCT, and PCTs generally. Ecosystem credits measure the loss in biodiversity values at a development, activity, clearing or biodiversity certification site and the gain in biodiversity values at a biodiversity stewardship site (DPIE 2020a).

Term	Definition
Ground Disturbance	Activities that cut into the existing ground surface. To avoid any doubt this does not include activities that occur on the ground surface including but not limited to driving vehicles on the ground, parking vehicles, placing infrastructure or materials such as stockpiles on the ground.
Habitat	An area or areas occupied, or periodically or occasionally occupied, by a species, population or ecological community, including any biotic or abiotic component (DPIE 2020a).
Heavy Vehicle	As defined under the Heavy Vehicle National Law (NSW) but excluding light and medium rigid trucks (less than eight tonnes and with no more than two axles) and buses containing more than 12 seats.
Host landholder	The owner(s) of a host residence. A host landholder has reached an agreement with BWF to host Project infrastructure within their landholdings and in relation to the management of impacts.
Important area (mapped)	Mapping of important habitat areas provided by the DPIE for those species for which the habitat constraint in the Threatened Biodiversity Data Collection (TBDC) refers to a mapped important area.
Indirect impact	Impacts that occur when the proposal affects native vegetation and threatened species habitat beyond the Development Footprint or within retained areas (e.g., transporting weeds or pathogens, dumping rubbish). This includes impacts from activities related to the construction or operational phase of the proposal and prescribed impacts (DPIE 2020a).
Internal Roads	Roads established and/or upgraded within the Development Corridor for the purposes of constructing, operating, maintaining and decommissioning the Project, and includes all waterway crossings where located within the Project Boundary, but does not include off-site road works areas.
Landscape assessment area	The Subject Land and the area of land within a 500-m or 1500-m buffer of the Subject Land that is determined as per Subsection 3.1.2 of the BAM. For the purposes this assessment, a 1500-m buffer has been applied to the site-based assessment areas within Stage 1 of the Project. A 500 m buffer has been applied to the linear assessment areas within Stage 1 and Stage 2 of the Project.
Locality	Land within a 30-km radius of the Subject Land.
Local Transport Route	The transport route extending from the intersection of the Cobb Highway and Jerilderie Road to the eastern-most site access point located on Northern Boundary Road, as shown in the EIS.
Matter of national environmental significance	A matter of national environmental significance (MNES) is any of the nine defined components protected by a provision of Part 3 of the EPBC Act (Commonwealth).
Micro-siting	The process of locating WTGs, battery storage, ancillary infrastructure and temporary infrastructure during detailed design without further approval, providing that: • ground disturbance is wholly contained within the Development Corridor, with the exception of meteorological masts • no WTG is moved more than 100 m from the relevant GPS coordinates

Term	Definition
	• the revised location of the blade of a WTG is at least 50 m from the canopy of existing hollow-bearing trees; or where the proposed location of the blade of a WTG is already within 50 m of the canopy of existing hollow-bearing trees, the revised location is not any closer to the existing hollow-bearing trees • meteorological masts (temporary and permanent) are installed within the Subject Land at all times and within the Development Corridor where reasonable and feasible.
Mitigation	Action to reduce the severity of an impact.
Native vegetation	Has the same meaning as in section 1.6 of the BC Act and section 60B of the LLS Act. In summary: • trees (including any sapling or shrub or any scrub) • understorey plants • groundcover (being any type of herbaceous vegetation) • plants occurring in a wetland. A plant is native to New South Wales if it was established in New South Wales before European settlement (BC Act). Native vegetation does not extend to marine vegetation (being mangroves, seagrasses or any other species of plant that at any time in its life cycle must inhabit water other than fresh water). Marine vegetation is covered by the provisions of the FM Act.
Non-associated Landholder	The owner of a non-associated residence.
Non-associated Residence	A residence on privately-owned land in respect of which the owner has not entered into a private agreement with BWF in relation to the Project's impacts. or A residence on privately-owned land in respect of which the owner has reached an agreement with BWF in relation to the Project's impacts, but the agreement does not cover the relevant impact, or the performance measure for such impact (under that agreement) has been exceeded.
NSW (Mitchell) landscape	Landscapes with relatively homogeneous geomorphology, soils and broad vegetation types, mapped at a scale of 1:250,000 (DPIE 2020a).
Off-site Road Works	Includes the following activities: • proposed upgrades to the local transport route • establishment of site access points (occurring on a staged basis, prior to commencing construction in the relevant stage • ground disturbance, clearing/pruning of vegetation associated with the activities described above.
Operational footprint	The area that will be subject to ongoing operational impacts from the proposal. This includes the road, surrounding safety verges and infrastructure, fauna connectivity structures and maintenance access tracks and compounds.
Patch size	An area of native vegetation that: • occurs on the development site or biodiversity stewardship site • includes native vegetation that has a gap of less than 100 m from the next area of native vegetation (or ≤30 m for non-woody ecosystems).

Term	Definition
	Patch size may extend onto adjoining land that is not part of the development site or biodiversity stewardship site (DPIE 2020a).
PlantNET	An online database of the flora of New South Wales which contains currently accepted taxonomy for plants found in the State, both native and exotic.
Population	A group of organisms, all of the same species, occupying a particular area (DPIE 2020a).
Predicted species	Also known as 'ecosystem credit species', these are threatened species whose occurrence can generally be predicted by vegetation surrogates and/or landscape features, or that have a low probability of detection using targeted surveys. The TBDC identifies the threatened species assessed for ecosystem credits. A targeted survey is not required to identify or confirm the presence of ecosystem credit species.
Prescribed impact	Means the prescribed impacts identified in clause 6.1 of the BC Regulation. Prescribed impacts can be direct or indirect impacts (DPIE 2020a).
Project Area	The Project Area encompasses all land within and including the Project Boundary.
Project Boundary	The outer boundary of the Project Area. The Project Boundary is the maximum spatial extent of potential land access defined by the boundaries of the host landholder properties (i.e. all agreed lots owned by host landholders).
Rehabilitation	The restoration of land disturbed by the Project to its former condition (as much as practicable), to ensure it is safe, stable, and non-polluting.
Residence	Has the same meaning as a 'dwelling' as defined under the Standard Instrument – Local Environmental Plan, and also includes: • Residences that have development consent, but have yet to commence or complete construction. • Proposed residences that are subject to a development application that has been lodged prior to the DA for the Project but is yet to be determined. • A residence does not include moveable dwellings (i.e. tents, caravans or other portable devices used for human habitation), or any derelict dwelling or dwelling that has been built illegally, as confirmed by the relevant Council.
Serious and irreversible impact	Impacts likely to contribute significantly to the risk of a threatened species or ecological community becoming extinct in accordance with the principles set out in clause 6.7(2) of the BC Regulation.
Spatial datasets	Spatial databases required to prepare a BDAR: • BioNet NSW (Mitchell) Landscapes – Version 3.1 • NSW Interim Biogeographic Regions of Australia (IBRA region and sub-regions) – Version 7 • NSW soil profiles • hydrogeological landscapes • acid sulfate soils risk • digital cadastral database • Vegetation Information Systems maps • Geological sites of NSW.

Term	Definition
Species credit species	Threatened species or components of species habitat that are identified in the Threatened Species Data Collection as requiring assessment for species credits (DPIE 2020a). This is analogous with the definition of 'candidate species'.
Species credits	The class of biodiversity credits created or required for the impact on threatened species that cannot be reliably predicted to use an area of land based on habitat surrogates. Species that require species credits are listed in the Threatened Biodiversity Data Collection (DPIE 2020a).
Species polygon	An area of land identified in Chapter 5 (of the BAM) that contains habitat or is occupied by a threatened species (DPIE 2020a).
Stage 1 Development Footprint	Portions of the Development Footprint which will be directly impacted as part of Stage 1 of the Project. Stage 1 of the Project includes the construction and operation of the Project south of North Boundary Road, as well as offsite disturbance areas.
Stage 2 Development Footprint	Portions of the Development Footprint which will be directly impacted as part of Stage 2 of the Project. Stage 2 of the Project includes the construction and operation of the Project north of North Boundary Road.
Subject Land	The land subject to the proposed development. For the purposes of this assessment, the Subject Land is the area within which all proposed Project infrastructure will be placed, and all Project-related ground disturbance will occur. The Subject Land is equivalent to the 'Development Corridor' described within the EIS. The Subject Land is of variable width (to avoid key site constraints) and has been designed to provide some flexibility for micro-siting.
Substation	Infrastructure required to collect the internal electrical reticulation to increase the voltage for transmission to connect to the grid. Typically includes step-up transformers, an array of cable marshalling, busbars, various voltage and current transformers, operation and facilities building (with parking), communication facilities and tower, diesel generator, lighting, a buried earth grid, lightning masts, power conditioning equipment, a reactive power control system, and network support equipment as required and agreed with Transgrid (or other transmission network system operator).
Telecommunications facility	A telecommunications facility is any part of the infrastructure of a telecommunications network or any line, cable, optical fibre, equipment, apparatus, tower, mast, antenna, dish, tunnel, duct, hole, pit, pole or other structure in connection with a telecommunications network. Telecommunications facilities provide for transmission of voice, data, image, graphic and video information between or among points by wire, cable, optical fibre, microwave, radio, satellite or similar facilities.
Temporary facilities	Temporary facilities used for the construction, repowering and/or decommissioning of the Project, including but not limited to the temporary workforce accommodation, site offices, amenities, construction compounds and laydown areas (including stockpiling and materials storage areas), on-site borrow pits, rock crushing facilities, concrete or asphalt batching plants, minor 'work front' construction access roads and temporary meteorological masts.
Threatened Biodiversity Data Collection	A publicly assessable online database (registration required) which contains information for listed threatened species, populations and ecological communities (DPIE 2020a). Part of the BioNet database, published by the EHG and accessible from the BioNet website at <www.bionet.nsw.gov.au>.

Term	Definition
Vegetation integrity (score)	The condition of native vegetation assessed for each vegetation zone against the benchmark for the PCT. The vegetation integrity score is the quantitative measure of vegetation condition calculated by the BAM-C (DPIE 2020a).
Vegetation zone	A relatively homogeneous area of native vegetation on a development site, clearing site, land to be biodiversity certified or biodiversity stewardship site that is the same PCT and has the same broad condition state (DPIE 2020a).

Table of Contents

Declarations i

Executive Summary ix

Abbreviations xvi

Glossary xviii

1.0 Introduction 1

1.1 Proposed Project Background 1

1.2 Identification of the Subject Land 2

1.2.1 Location and Size 2

1.2.2 Identification of Development and Operational Footprints 2

1.2.3 BWF Amendment Report (WTG Removal) 9

1.3 Purpose and Scope of this Report 11

1.3.1 Secretary's Environmental Assessment Requirements (SEARs) and CPHR Submission 11

1.3.2 EPBC Act Assessment Requirements 26

1.3.3 Excluded Impacts 30

1.4 Statutory Considerations 35

1.5 Information Sources 38

1.5.1 BAM Guidance Documents 38

1.5.2 Datasets 38

1.5.3 Survey Guidelines 41

1.5.4 Aerial Imagery 43

1.6 Limitations of the Assessment 43

2.0 The Project 44

2.1 Project Overview 44

2.2 Project Location and Context 44

2.3 Key Project Features 44

3.0 Site Context 47

3.1 Assessment Areas 47

3.2 Landscape Features 49

3.3 Native Vegetation Cover 74

4.0 Native Vegetation, Threatened Ecological Communities and Vegetation Integrity 79

4.1 Methodology 79
4.1.1 Background Research 79
4.1.2 Vegetation Survey and Assessment 79
4.1.3 Approach to Confirming Land Categorisation Mapping 90
4.1.4 Patch Size 90
4.1.5 Use of Benchmark Data 91
4.1.6 Limitations 98
4.2 Native Vegetation Extent 98
4.3 Plant Community Types 98
4.3.1 Overview of Plant Community Types 98
4.3.2 PCT 10: River Red Gum - Black Box woodland wetland of the semi-arid (warm) climatic zone (mainly Riverina Bioregion and Murray Darling Depression Bioregion) 104
4.3.3 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) 107
4.3.4 PCT 17: Lignum shrubland wetland of the semi-arid (warm) plains (mainly Riverina Bioregion and Murray Darling Depression Bioregion) 109
4.3.5 PCT 24: Canegrass swamp tall grassland wetland of drainage depressions: lakes and pans of the inland plains 113
4.3.6 PCT 26: Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion 116
4.3.7 PCT 28: White Cypress Pine open woodland of sand plains, prior streams and dunes mainly of the semi-arid (warm) climate zone 120
4.3.8 PCT 44: Forb-rich Speargrass - Windmill Grass - White Top grassland of the Riverina Bioregion 124
4.3.9 PCT 46: Curly Windmill Grass - speargrass - wallaby grass grassland on alluvial clay and loam on the Hay Plain: Riverina Bioregion 127
4.3.10 PCT 160: Nitre Goosefoot shrubland wetland on clays of the inland floodplains 130
4.3.11 PCT 164: Cotton Bush open shrubland of the semi-arid (warm) zone 133
4.4 Vegetation Zones and Vegetation Integrity Score 135
4.5 Threatened Ecological Communities 138
4.5.1 Overview 138
4.5.2 Sandhill Pine Woodland in the Riverina, Murray-Darling Depression and NSW South Western Slopes bioregions 148
4.5.3 Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions 151
4.5.4 Weeping Myall Woodlands 154

4.5.5 Natural Grasslands of the Murray Valley Plains 158
4.6 Groundwater Dependent Ecosystems 167
4.7 Other Vegetation 172
5.0 Threatened Species 173
5.1 Ecosystem Species 173
5.1.1 Identification of Ecosystem Credit Species 173
5.1.2 Assessment of Habitat Suitability 179
5.2 Species Credit Species 189
5.2.1 Identification of Species Credit Species 189
5.2.2 Assessment of Habitat Suitability 195
5.3 Threatened Species Survey Method 208
5.3.1 Review of Existing Information 208
5.3.2 General Weather Conditions During the Surveys 209
5.3.3 Habitat Assessment 213
5.3.4 Threatened Flora Surveys 228
5.3.5 Threatened Fauna Surveys 334
5.3.6 Expert Reports 370
5.3.7 More Appropriate Local Data 370
5.3.8 Limitations 370
5.4 Threatened Species Results 371
5.4.1 Ecosystem Credit Species Recorded During the Field Surveys 371
5.4.2 Species Credit Species Recorded During the Field Surveys 377
5.4.3 Description of Species Polygons 382
5.5 Aquatic Habitat and Threatened Species 429
5.5.1 Habitat Assessment 429
5.5.2 Threatened Species 429
5.5.3 Endangered Ecological Communities 431
5.5.4 Aquatic Results 431
6.0 Identification of Prescribed Impacts 434
7.0 Avoid and Minimise Impacts 437
7.1 Avoidance and Minimisation of Direct and Indirect Impacts on Native Vegetation, Threatened Species, Threatened Ecological Communities and Their Habitat 437
7.1.1 Overview of Refinements 437
7.1.2 Project Location 441
7.1.3 Project Design and Planning 441
7.2 Avoidance and Minimisation of Prescribed Impacts 451

7.2.1 Project Location 451
7.2.2 Project Design 451
7.3 Other Measures Considered 454
7.3.1 Do Nothing Option 454
7.4 Minimisation and Management of Impacts 456
7.4.1 Bird and Bat Adaptive Management Plan 456
7.4.2 Construction Environmental Management Plan 461
7.4.3 Biodiversity Management Plan 461
8.0 Impact Assessment 463
8.1 Impacts Associated with the Removal of Native Vegetation, Threatened Ecological Communities, Threatened Species and Their Habitat 463
8.1.1 Direct Impacts on Native Vegetation and Threatened Ecological Communities 463
8.1.2 Direct Impacts to Threatened Species 475
8.2 Indirect Impacts 481
8.2.1 Indirect impacts 481
8.2.2 Proximity of Wind Turbines to Large Intact Patches of Woody Vegetation 487
8.3 Prescribed Biodiversity Impacts 489
8.3.1 Human-Made Structures and Non-Native Vegetation 489
8.3.2 Habitat Connectivity 491
8.3.3 Water Bodies, Water Quality and Hydrological Processes 494
8.3.4 Wind Turbine Strikes 499
8.3.5 Vehicle Strike 502
8.4 Serious and Irreversible Impacts (SAII) 504
8.4.1 Assessment for Serious and Irreversible Impacts on Biodiversity Values 504
8.4.2 Additional Impact Assessment Provisions for TECs at Risk of an SAII 505
8.4.3 Additional Impact Assessment Provisions for Threatened Species at Risk of an SAII 505
8.5 Matters of National Environmental Significance 514
8.5.1 Threatened Ecological Communities 514
8.5.2 Threatened Species 514
8.5.3 Migratory Species 516
8.5.4 Consideration of Obstacle Lighting Impacts to Wildlife 516
8.6 Aquatic Impacts 517
8.6.1 Threatened Species 517
8.7 Cumulative Impacts 517
8.7.1 Off-site Road Works Areas 521

9.0 Mitigation 522
9.1 Mitigation Measures 522
9.2 Adaptive Management for Uncertain Impacts 531
9.2.1 Monitoring Program and Adaptive Management 532
9.2.2 Adaptive Management of Bird and Bat Strike 534
10.0 Impact Summary 535
10.1 Determining an Offset Requirement for Impacts 535
10.1.1 Impacts on Native Vegetation and TECs (Ecosystem Credits) 535
10.1.2 Impacts on Threatened Species and Their Habitat (Species Credits) 539
10.1.3 Indirect Impacts 541
10.1.4 Prescribed impacts 541
10.2 Additional and Appropriate Measures 543
10.2.1 Determining Offset Requirements for Impacts to Plains-wanderer Supplementary Habitat 543
10.2.2 Additional and Appropriate Measures – Plains-wanderer and Black Falcon 544
10.3 Impacts That Do Not Need Further Assessment 547
11.0 Biodiversity Credit Reports 548
11.1 Ecosystem Credits 548
11.2 Species Credits 550
12.0 Biodiversity Offset Strategy 551
12.1 Biodiversity Offset Strategy 551
12.2 Bilateral Agreement 552
13.0 References 553

Figures

Figure 1.1 Regional Context 4
Figure 1.2.1 Operational and Construction Boundaries 5
Figure 1.3 Amended Project Layout 10
Figure 1.4.1 Draft Land Categorisation Mapping 31
Figure 3.1.1 Site Map 53
Figure 3.2.1 Location Map 57
Figure 3.3 Rivers, Streams, Estuaries, and Wetlands Downstream of the Subject Land 61
Figure 3.4.1 Habitat Connectivity 62
Figure 3.5.1 Important Habitat Mapping 66
Figure 3.6.1 Biodiversity Values Map 70
Figure 3.7.1 Native Vegetation Extent 75

Figure 4.1.1	Assessment of Vegetation	84
Figure 4.2.1	Plant Community Types Present within the Subject Land	100
Figure 4.3.1	Distribution of Threatened Ecological Communities listed under BC Act across the Subject Land	140
Figure 4.4.1	Distribution of Threatened Ecological Communities listed under EPBC Act across the Subject Land	144
Figure 4.5.1	Groundwater Dependent Ecosystems	168
Figure 5.1	Weather Conditions for the Survey Period	211
Figure 5.2	Combined Drought Indicator for Powheep County between March 2023 and February 2025	212
Figure 5.3.1	Habitat Values Present Within the Subject Land and Project Area	215
Figure 5.4.1	Threatened Flora Surveys – *Calotis moorei*	240
Figure 5.5.1	Threatened Flora Surveys – *Austrostipa wakoolica*	245
Figure 5.6.1	Threatened Flora Surveys – *Pilularia novae-hollandiae*	251
Figure 5.7.1	Threatened Flora Surveys – *Convolvulus tedmoorei*	256
Figure 5.8.1	Threatened Flora Surveys – *Maireana cheelii*	262
Figure 5.9.1	Threatened Flora Surveys – *Brachyscome muelleroides*	267
Figure 5.10.1	Threatened Flora Surveys – *Leptorhynchos orientalis*	272
Figure 5.11.1	Threatened Flora Surveys – *Brachyscome papillosa*	277
Figure 5.12.1	Threatened Flora Surveys – *Diuris tricolor*	283
Figure 5.13.1	Threatened Flora Surveys – *Swainsona plagiotropis*	289
Figure 5.14.1	Threatened Flora Surveys – *Swainsona sericea*	295
Figure 5.15.1	Threatened Flora Surveys – *Swainsona murryana*	301
Figure 5.16.1	Threatened Flora Surveys – *Cullen parvum*	307
Figure 5.17.1	Threatened Flora Surveys – *Eleocharis obicis*	313
Figure 5.18.1	Threatened Flora Surveys – *Sclerolaena napiformis*	318
Figure 5.19.1	Threatened Flora Surveys – *Lepidium monoplocoides*	325
Figure 5.20.1	Threatened Flora Surveys – *Eucalyptus leucoxylon* subsp. *pruinosa*	330
Figure 5.21.1	Threatened Fauna Surveys	339
Figure 5.22.1	Plains-wanderer Habitat Mapping	355
Figure 5.23.1	Threatened Species Recorded Within the Subject Land – Ecosystem Credit Species	373
Figure 5.24.1	Threatened Species Recorded Within the Subject Land – Species Credit Species	392
Figure 5.25.1	Species Polygon – *Maireana cheelii*	396
Figure 5.26.1	Species Polygon – *Swainsona sericea*	400
Figure 5.27.1	Species Polygon – *Swainsona murrayana*	404
Figure 5.28.1	Species Polygon – *Eleocharis obicis*	408
Figure 5.29.1	Species Polygon – *Lepidium monoplocoides*	412
Figure 5.30.1	Species Polygon – Little Eagle	416
Figure 5.31.1	Species Polygon – Barking Owl	420
Figure 5.32.1	Species Polygon – Southern Bell Frog	424
Figure 5.33	Supplementary habitat – Plains-wanderer	428
Figure 7.1	Project Refinement	440
Figure 7.2	Avoid and Minimise Impacts – Early Scoping Report	445
Figure 7.3	Avoid and Minimise Impacts – Scoping Report	446
Figure 7.4	Avoid and Minimise Impacts – Early EIS	447
Figure 7.5	Avoid and Minimise Impacts – EIS	450
Figure 8.1.1	Direct Impacts to PCTs	467

Figure 8.2.1 Direct Impacts to TECs 471
Figure 8.3.1 Direct Impacts to Threatened Species 477
Figure 8.4 Proximity to Oolambeyan National Park 488
Figure 8.5.1 Location of Serious and Irreversible Impacts 510

Photos

Photo 4.1 Non-native Vegetation Within the Subject Land 172
Photo 5.1 Eucalyptus Woodland habitat adjacent to Coleambally Outfall Drain 220
Photo 5.2 Callitris Woodland Near BBUS Vantage Point 4 220
Photo 5.3 Acacia Woodland Near Bam Plot 67 221
Photo 5.4 Evidence of inundation and drying soils during surveys 250
Photo 5.5 Evidence of inundation and drying soils during surveys 250
Photo 5.6 Coleambally Outfall Drain 432
Photo 5.7 Current Bullawah Road Bridge Spanning Coleambally Outfall Drain 433
Photo 5.8 Current Unnamed Road Bridge Spanning Coleambally Outfall Drain 433

Tables

Table 1.1 SEARS Relevant to the Biodiversity Assessment 12
Table 1.2 Summary and Reference Table for CPHR Submissions 14
Table 1.3 EPBC Act Environmental Assessment Requirements for Biodiversity 27
Table 1.4 NVR Map Categories within the Subject Land 30
Table 1.5 Legislation Relevant to the Project 35
Table 1.6 Guidance Documents and Resources Relating to the NSW BOS 38
Table 1.7 NSW Guidance and Resources Reviewed 38
Table 1.8 NSW and Commonwealth Survey Guidelines 41
Table 1.9 Aerial Imagery Specifications 43
Table 3.1 Key Assessment Areas and Boundaries 47
Table 3.2 BAM-C Cases Associated with the Project 49
Table 3.3 Landscape Features 51
Table 3.4 Native Vegetation Cover in the Assessment Area 74
Table 4.1 Vegetation Zone Condition States 81
Table 4.2 BAM Plots Completed Per Survey Period 83
Table 4.3 Minimum Number of Plots Required and Completed per Vegetation Zone 88
Table 4.4 Assessment of Site Conditions Against Modified Benchmark Decision Process (DPIE, 2020d) 92
Table 4.5 Comparison of VI scores for vegetation zones utilising both WET and AVERAGE benchmarks 96
Table 4.6 PCTs Identified Within the Subject Land 99
Table 4.7 Overview of PCT 10 104
Table 4.8 Floristic and Structural Summary of PCT 10 Within the Subject Land 105
Table 4.9 Overview of PCT 13 107

Table 4.10	Floristic and Structural Summary of PCT 13 Within the Subject Land	108
Table 4.11	Overview of PCT 17	110
Table 4.12	Floristic and Structural Summary of PCT 17 Within the Subject Land	111
Table 4.13	Overview of PCT 24	113
Table 4.14	Floristic and Structural Summary of PCT 24 Within the Subject Land	115
Table 4.15	Overview of PCT 26	117
Table 4.16	Floristic and Structural Summary of PCT 26 Within the Subject Land	118
Table 4.17	Overview of PCT 28	121
Table 4.18	Floristic and Structural Summary of PCT 28 Within the Subject Land	122
Table 4.19	Overview of PCT 44	125
Table 4.20	Floristic and Structural Summary of PCT 44 Within the Subject Land	126
Table 4.21	Overview of PCT 46	128
Table 4.22	Floristic and Structural Summary of PCT 46 Within the Subject Land	129
Table 4.23	Overview of PCT 160	130
Table 4.24	Floristic and Structural Summary of PCT 160 Within the Subject Land	132
Table 4.25	Overview of PCT 164	133
Table 4.26	Floristic and Structural Summary of PCT 164 Within the Subject Land	134
Table 4.27	Vegetation Zones and Vegetation Integrity Scores	136
Table 4.28	Threatened Ecological Communities Present Within the Subject Land	139
Table 4.29	Justification of the presence of Sandhill Pine Woodland in the Riverina, Murray-Darling Depression and NSW South Western Slopes bioregions in the Subject Land	149
Table 4.30	Justification of the presence of the Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions in the Subject Land	152
Table 4.31	Justification of the absence of Weeping Myall Woodlands in the Subject Land	155
Table 4.32	Justification of the absence of Natural Grasslands of the Murray Valley Plains in the Subject Land	162
Table 5.1	Summary of Ecosystem Credit Species Considered as Part of This Assessment	174
Table 5.2	Assessment of Habitat Suitability Within the Subject Land for Ecosystem Credit Species	180
Table 5.3	Summary of Species Credit Species Considered as Part of This Assessment	190
Table 5.4	Assessment of Habitat Suitability Within the Subject Land and Assessment Approach of Retained Candidate Species	196
Table 5.5	Maximum and minimum monthly temperature data for all years – BOM Station 075019 and Average monthly rainfall data for all years – BOM Station 075173	210
Table 5.6	Habitat Constraints as Listed Within the TBDC Present Within the Subject Land	213
Table 5.7	Candidate Flora Species Survey Groups	230
Table 5.8	Summary of Targeted Surveys carried out for Candidate Threatened Flora Species	232
Table 5.9	Detailed Description of Surveys – A Burr-Daisy (*Calotis moorei*)	239
Table 5.10	Detailed Description of Surveys – A spear-grass (*Austrostipa wakoolica*)	244
Table 5.11	Detailed Description of Surveys – Austral Pillwort (*Pilularia novae-hollandiae*)	249
Table 5.12	Detailed Description of Surveys – Bindweed (*Convolvulus tedmoorei*)	255
Table 5.13	Detailed Description of Surveys – Chariot Wheels (*Maireana cheelii*)	260
Table 5.14	Detailed Description of Surveys – Claypan Daisy (*Brachyscome muelleroides*)	266
Table 5.15	Detailed Description of Surveys – Lanky Buttons (*Leptorhynchos orientalis*)	271
Table 5.16	Detailed Description of Surveys – Mossgiel Daisy (*Brachyscome papillosa*)	276
Table 5.17	Detailed Description of Surveys – Pine Donkey Orchid (*Diuris tricolor*)	281

Table 5.18	Detailed Description of Surveys – Red Darling Pea (*Swainsona plagiotropis*)	287
Table 5.19	Detailed Description of Surveys – Silky Swainson-pea (*Swainsona sericea*)	293
Table 5.20	Detailed Description of Surveys – Slender Darling Pea (*Swainsona murrayana*)	299
Table 5.21	Detailed Description of Surveys – Small Scurf-pea (*Cullen parvum*)	305
Table 5.22	Detailed Description of Surveys – Spike-rush (*Eleocharis obicis*)	311
Table 5.23	Detailed Description of Surveys – Turnip Copperburr (*Sclerolaena napiformis*)	317
Table 5.24	Detailed Description of Surveys – Winged Peppercress (*Lepidium monoplocoides*)	322
Table 5.25	Detailed Description of Surveys – Yellow Gum (*Eucalyptus leucoxylon subsp. pruinosa*)	329
Table 5.26	Summary of Targeted Surveys Carried Out for Candidate Threatened Fauna Species	335
Table 5.27	Detailed Description of Surveys – Australian Bustard	343
Table 5.28	Detailed Description of Surveys – Bush stone-curlew	343
Table 5.29	Detailed Description of Surveys – White-bellied Sea-eagle	345
Table 5.30	Detailed Description of Surveys – Little Eagle	346
Table 5.31	Detailed Description of Surveys – Pink Cockatoo	347
Table 5.32	Detailed Description of Surveys – Square-tailed Kite	349
Table 5.33	Detailed Description of Surveys – Barking Owl	350
Table 5.34	Detailed Description of Surveys – Plains-wanderer	353
Table 5.35	Detailed Description of Surveys – Superb Parrot	359
Table 5.36	Detailed Description of Surveys – Masked Owl	360
Table 5.37	Detailed Description of Surveys – Southern Bell Frog	363
Table 5.38	Detailed Description of Surveys – Grey Snake	364
Table 5.39	Detailed Description of Surveys – Koala	366
Table 5.40	Detailed Description of Surveys – Southern Myotis	368
Table 5.41	Threatened Species Credit (Ecosystem) Species Survey Results	372
Table 5.42	Threatened Species Credit (Candidate) Species Survey Results	378
Table 5.43	Summary of Species Polygons for Species Recorded Within the Subject Land	382
Table 5.44	*Maireana cheelii* – Species Polygon Details	384
Table 5.45	*Swainsona sericea* – Species Polygon Details	384
Table 5.46	*Swainsona murryana* – Species Polygon Details	385
Table 5.47	*Eleocharis obicis* – Species Polygon Details	386
Table 5.48	*Lepidium monoplocoides* – Species polygon details	386
Table 5.49	Little Eagle – Species Polygon Details	387
Table 5.50	Barking Owl – Species Polygon Details	388
Table 5.51	Southern Bell Frog – Species Polygon Details	388
Table 5.52	Plains-wanderer – Species Polygon Details	389
Table 5.53	Threatened Aquatic Species and their Likelihood of Occurrence within the Subject Land	430
Table 6.1	Prescribed Impacts Identified	434
Table 7.1	Changes in impacts to high priority constraints as a result of Project design changes	439
Table 7.2	Design Refinements that have Avoided and/or Minimised Impacts	442
Table 7.3	Refinement of Project Design – EIS Phase	448
Table 7.4	Design Refinements that have Avoided and/or Minimised Prescribed Impacts	452
Table 7.5	Conceptual BBAMP Components	457
Table 8.1	Summary of Impacts to Native Vegetation	465
Table 8.2	Impacts to Vegetation Integrity	466
Table 8.3	Summary of Direct Impacts on Threatened Species Credit Species	476

Table 8.4	Risk Matrix Criteria	481
Table 8.5	Risk Matrix	482
Table 8.6	Potential indirect impacts to biodiversity including their extent, frequency, timing, duration and consequence	483
Table 8.7	Potential Impacts on Threatened Entities Associated with Human-Made Structures and Non-Native Vegetation	490
Table 8.8	Potential Impacts on Connectivity of Habitat of Threatened Entities	491
Table 8.9	Potential Impacts to Water Quality, Water Bodies and Hydrological Processes that Sustain Threatened Entities	496
Table 8.10	Potential Impacts of Wind Turbine Strikes on Threatened and other Specified Fauna	500
Table 8.11	Residual Risk Ratings	501
Table 8.12	Potential Impacts of Vehicle Strikes on Threatened and other Specified Fauna	503
Table 8.13	SAII Impact Assessment – Plains Wanderer	506
Table 8.14	Threatened Ecological Communities Recorded in the Subject Land	514
Table 8.15	Summary of Direct and Indirect Impacts on Threatened Flora Species and the Likelihood of a Significant Impact	514
Table 8.16	Summary of Direct and Indirect Impacts on Threatened Fauna Species and the Likelihood of a Significant Impact	515
Table 8.17	Past, Present and Future Projects	518
Table 9.1	Mitigation Measures	523
Table 9.2	Proposed monitoring and adaptive management measures	532
Table 10.1	Ecosystem Credits for Impacts to Native Vegetation and TECs which Require an Offset	536
Table 10.2	Ecosystem Credits for Impacts to Native Vegetation and TECs which Require an Offset as a result of the Amended Project (removal of WTG 37 and 38)	537
Table 10.3	Species Credits for Impacts to Threatened Species which Require an Offset	539
Table 10.4	Species Credits for Impacts to Threatened Species which Require an Offset as a result of the Amended Project (removal of WTG 37 and 38)	540
Table 11.1	Like-for-like Offset Options for Ecosystem Credits	548
Table 11.2	Species Credit Class and Matching Credit Profiles	550

Appendices

Appendix A	BAM Compliance Table
Appendix B	Likelihood of Occurrence Assessment
Appendix C	Credit Reports
Appendix D	Prescribed Impact Assessment
Appendix E	MNES Report
Appendix F	Assessment of Significance (FM Act)
Appendix G	Fauna Species Recorded
Appendix H	Weather Data
Appendix I	Detailed Figure Set
Appendix J	Planted Tree Assessment
Appendix K	Small Area Assessment
Appendix L	Herbarium TS ID Confirmation Letters

1.0 Introduction

1.1 Proposed Project Background

The New South Wales (NSW) Government's Electricity Strategy and Electricity Infrastructure Roadmap (Electricity Strategy) sets out a plan to deliver the State's first five Renewable Energy Zones (REZs). These REZs will play a vital role in delivering affordable, reliable energy generation to help replace the State's existing power stations as they come to their scheduled end of operational life.

Bullawah Wind Farm Pty Ltd (BWF) proposes to develop the Bullawah Wind Farm (the Project), located approximately 36 kilometres (km) south east of Hay, within the South West Renewable Energy Zone (South West REZ). The Project is therefore strategically located in an area identified by the NSW Government as suitable for renewable energy projects and will assist the NSW government in delivering on the objectives for the Electricity Strategy and the South West REZ.

The Project will include the installation, operation, maintenance and decommissioning of up to 143 wind turbine generators (WTGs), battery storage, ancillary infrastructure and temporary facilities associated with construction of the Project. The Project design incorporates up to 143 wind turbines, with a maximum blade-tip height of 300 metres (m) above ground level.

The Project is regarded as State Significant Development (SSD) and requires approval under Division 4.7 of Part 4 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act). The consent authority for the Project is the NSW Independent Planning Commission. The Project also requires approval under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and has been declared a controlled action requiring approval from the Commonwealth Minister for the Environment and Water.

The Environmental Impact Statement (EIS) for the Project (SSD-50505215) was submitted to the NSW Department of Planning, Housing and Infrastructure (DPHI) (formerly Department of Planning and Environment (DPE)) in July 2024 and publicly exhibited between 27 August 2024 and 23 September 2024 with 87 unique submissions made by the public as well as submissions from three (3) local councils and 19 government agencies.

Since lodgement of the EIS, BWF has conducted a thorough review of the layout and optimised the design and proposed mitigation measures to enhance Project efficiency and flexibility while minimizing associated environmental and social impacts. Project changes have occurred to address government agency and community submissions and to encompass the findings of the layout review and design optimisation process. These changes include additional Port to Hay transport route options in addition to the Port of Newcastle routes previously identified in the Project EIS, including options from the Port of Adelaide.

This Amended Biodiversity Development Assessment Report (BDAR) has been prepared by Umwelt (Australia) Pty Ltd (Umwelt) and is an updated version of the report submitted with the EIS in July 2024, and forms part of the Response to Submissions (RtS) phase of the environmental impact assessment. The Amended BDAR addresses the environmental assessment requirements of the Secretary's Environmental Assessment Requirements (SEARs) as issued by DPHI, and Supplementary SEARs issued by the Commonwealth Department of Climate Change, Energy, the Environment and Water (Commonwealth DCCEEW). The Amended BDAR also responds to comments received from the Regional Delivery Division, South West of the Conservation Programs, Heritage, and Regulation (CPHR) (formerly South West Biodiversity and Conservation Division (BCD)) section of NSW Department of Climate Change, Energy, the Environment and Water (NSW DCCEEW).

This Amended BDAR sits alongside two streamlined assessment BDARs supporting the Project's transport route amendments, which are found in **Appendix J** and **Appendix K** of this report, and the Amendment Report (Umwelt 2005).

1.2 Identification of the Subject Land

1.2.1 Location and Size

The Project is located approximately 36 km south east of Hay and in the Riverina region of south western NSW, within the Hay Shire, Murrumbidgee and Edward River Local Government Areas (LGA). Oolambeyan National Park is situated immediately north of the Project Area, while South West Woodland Nature Reserve is located approximately 24 km west and 12 km south of the Project Area.

The Subject Land covers approximately 4,330 hectares (ha), comprising of a mix of native grassland and open woodland in a rural landscape. The primary land use within the Project Area is agriculture, specifically cattle and sheep grazing, with small areas also being used for irrigated cropping.

The Project Area is almost completely flat topographically as a result of occurring within the Hay Plain, renowned to be the flattest place in the Southern Hemisphere. The elevation of the Subject Land is between 94.4 m and 103.2 m Australian Height Datum (AHD), a difference of less than 10 m between the highest and lowest points of the Project Area.

The Subject Land boundary is the area within which all proposed Project infrastructure will be placed and all Project related ground disturbance will occur, it comprises a variable width buffer (to avoid key site constraints), generally in order of 200 m radius around WTG, and then select widths around ancillary infrastructure. The Subject Land boundary includes all construction and operational areas of disturbance. This area was derived as a 230 m buffer during early iterations of the Project design, and then adjusted during the EIS to suit the extent of survey and assessment represented in this BDAR. The location of the Subject Land for the Project is provided in **Figure 1.1**.

1.2.2 Identification of Development and Operational Footprints

The Development Footprint comprises the portion of the Subject Land that will be subject to temporary and permanent direct impacts for which ecosystem and threatened species credits have been calculated in accordance with the BAM. For the purpose of this BDAR, the Development Footprint therefore includes both the construction footprint and portions of the operational footprint (for example, access tracks).

The Operational Footprint comprises portions of the Subject Land that will be subject to ongoing operational use as a result of the Project which may result in impacts that are direct, indirect, or prescribed in nature. For the purposes of this BDAR, operational uses includes WTG and associated hardstands, access roads, substations, and batter energy storage system (BESS).

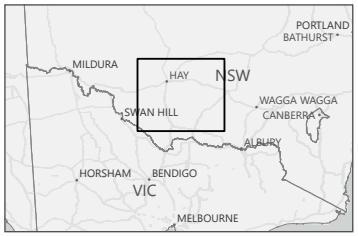
The Development and Operational Footprints in relation to the Subject Land is delineated in **Figure 1.2**.

FIGURE 1.1

Regional Context

Legend

- Project Boundary
- Development Footprint
- Local Government Area
- National Parks
- State Forest
- Road
- Railway Line
- Watercourse



0 10 20

Kilometres

Scale 1:1,000,000 at A4
GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

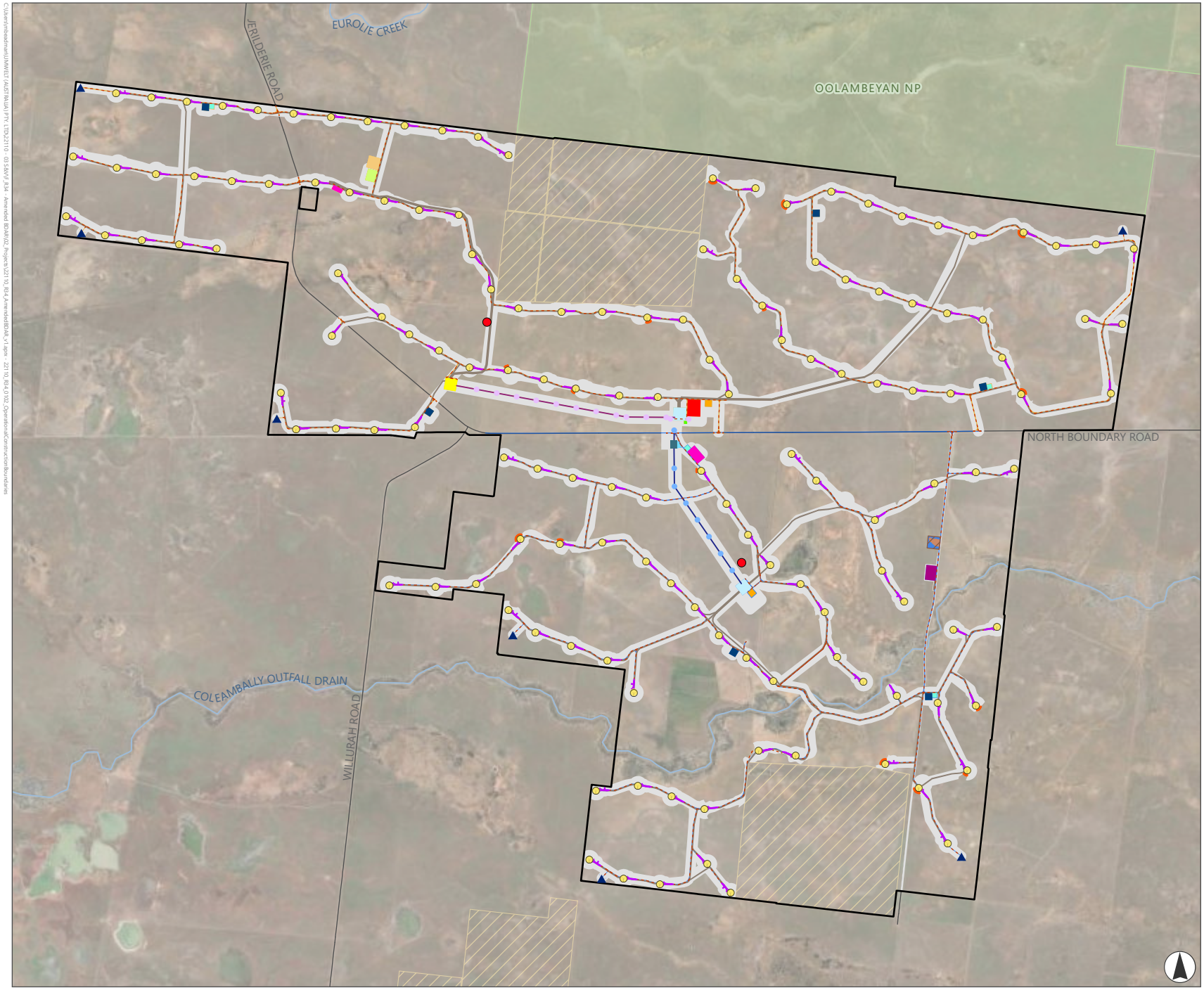
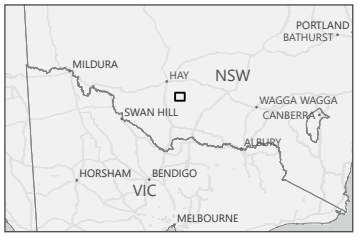


FIGURE 1.2.1

Operational and Construction Boundaries

Legend

- Project Boundary
- Subject Land
- Stage 1 (South) Development Footprint
- Stage 2 (North) Development Footprint
- Wind Turbine Generators
- 220kV Transmission Poles
- 330kV Transmission Poles
- Permanent Meteorological Masts
- Temporary Met Mast (As Built)
- Tracks Connecting Hardstands
- Hardstand Area
- Cable Corridor
- 330kV Internal Transmission Line (North to Central)
- 220kV Internal Transmission Line (Central to South)
- Blade Overhang Area
- Main Temporary Laydown
- Temporary Satelitte Laydown
- Main Temporary Construction Compound
- Temporary Construction Compound
- Temporary Accommodation Compound
- Operation and Maintenance Buildings
- Collector Substation
- Switchyard
- Switchyard Laydown Area
- Main Substation
- Main Substation Temporary Laydown
- BESS Facility
- Quarry South (Current)
- Quarry South (Proposed)
- Quarry North
- Conservation Agreement Area
- NPWS Reserves
- Road
- Hydroline



0 2,000 4,000

Meters

Scale 1:110,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

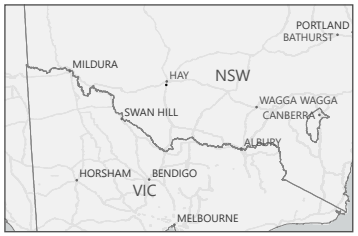
Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

FIGURE 1.2.2

Operational and Construction Boundaries

Legend

- Stage 1 (South) Development Footprint
- Road



0 100 200

Meters

Scale 1:5,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

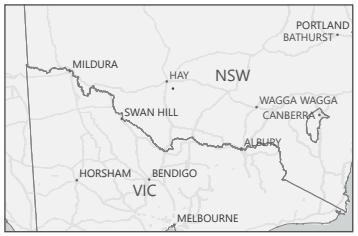
C:\Users\mbeadman\UMWELT (AUSTRALIA) PTY LTD\2110 - 03.SAVY_R34 - Amended IBDAR\02. Projects\2110_R34 Amended IBDAR_v1.aprx - 2110_R34_0102_OperationalConstructionBoundaries

FIGURE 1.2.3

Operational and Construction Boundaries

Legend

- Stage 1 (South) Development Footprint
- Road



0 100 200

Meters

Scale 1:5,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

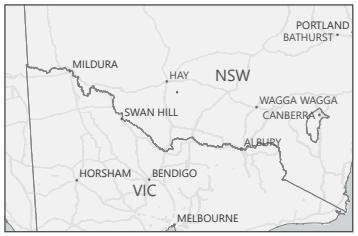
C:\Users\mbeadman\UMWELT (AUSTRALIA) PTY LTD\22110 - 03.SAVY, R34 - Amended IBDAR\02. Projects\22110_R34_AmendedIBDAR_v1.aprx - 22110_R34_0102_OperationalConstructionBoundaries

FIGURE 1.2.4

Operational and Construction Boundaries

Legend

- Stage 1 (South) Development Footprint
- Road
- Hydroline



0 100 200

Meters

Scale 1:5,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

C:\Users\mbeadman\UMWELT (AUSTRALIA) PTY LTD\22110 - 03.SKKY..R34 - Amended IBDAR\02. Projects\22110_R34_AmendedIBDAR_v1.aprx - 22110_R34_0102_OperationalConstructionBoundaries

1.2.3 BWF Amendment Report (WTG Removal)

Based on the outcomes of the Project's blade throw assessment conducted for the Amendment Report, BWF has committed to the removal of two (2) WTGs from the EIS Project i.e. the 143 WTG layout assessed for the Project EIS and associated BDAR. The WTG that are to be removed are WTG 37 and WTG 38.

This information was received late in the process of finalising the Amended BDAR such that it includes the full assessment of the maximum proposed impacts, being the 143 WTG layout assessed in the Project EIS.

Accordingly, and through consultation with DPHI, this Amended BDAR highlights this design amendment in **Figure 1.3** and **Section 10.0**, and clearly presents the offset liability for the Project following the removal of these two (2) WTGs. DPHI are supportive of this approach.

This approach ensures that the Amended BDAR identifies the changes in impacts to PCTs and associated ecosystem and species credit requirements. The revised offset liability for the Project are presented in a manner consistent with a typical consent condition for an SSD wind farm.

The BAM-C reflects the 143 WTG layout as submitted in support of this Amended BDAR, and was not re-opened to calculate the credit liability for the Amended Project layout (i.e. 141 WTG design).

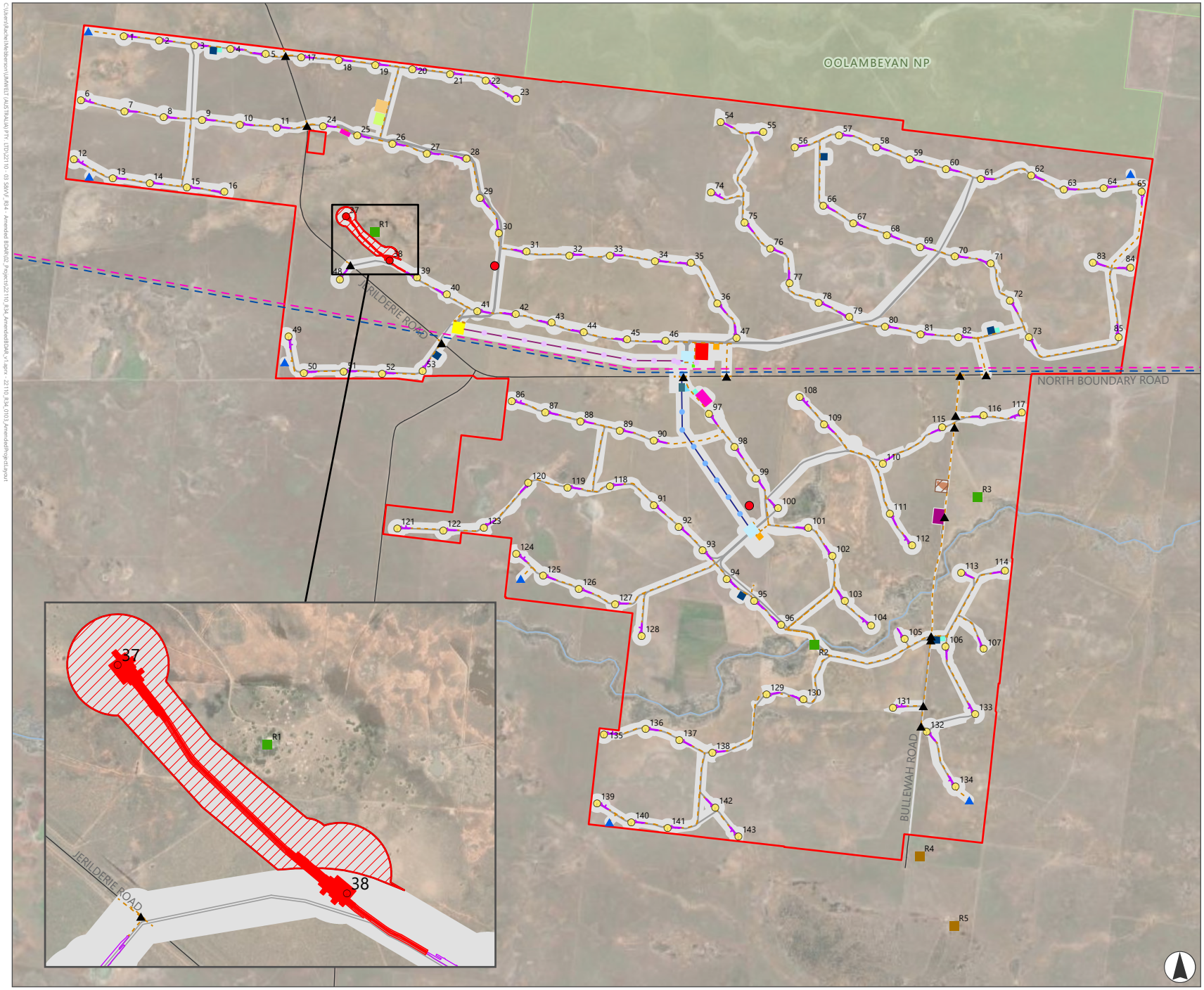


FIGURE 1.3

Amended Project Layout

Legend

- Project Boundary
- Development Corridor
- Wind Turbine Generators
- Host Residence
- Associated Residence (Visual Impact)
- 220kV Transmission Poles
- 330kV Transmission Poles
- Site Access Points
- Permanent Meteorological Masts
- Temporary Met Mast (As Built)
- Tracks Connecting Hardstands
- Hardstand Area
- Cable Corridor
- 330kV Project Energy Connect Line
- 220kV External Transmission Line
- 330kV Internal Transmission Line (North to Central)
- 220kV Internal Transmission Line (Central to South)
- Main Temporary Laydown
- Temporary Satelitte Laydown
- Main Temporary Construction Compound
- Temporary Construction Compound
- Temporary Workers Accommodation Compound
- Operations and Maintenance Facility
- Collector Substation
- 220 kV Switchyard
- Switchyard Laydown Area
- Main Substation
- Main Substation Temporary Laydown
- Battery Storage
- Quarry South (Current)
- Quarry South (Proposed)
- Quarry North
- NPWS Reserves
- Road

To Be Removed

- Wind Turbine Generators
- Development Corridor
- Disturbance Footprint

0 1 2

Kilometres

Scale 1:110,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

1.3 Purpose and Scope of this Report

1.3.1 Secretary's Environmental Assessment Requirements (SEARs) and CPHR Submission

This Amended BDAR has been prepared by Umwelt on behalf of BWF and forms part of the documentation for the Project to address the SEARs in relation to biodiversity for the proposed wind farm. The matters raised within the SEARs and addressed in this BDAR are detailed in **Table 1.1**. Submissions from the Regional Delivery Division, South West of CPHR have been addressed in this Amended BDAR and a summary of these responses is provided in **Table 1.2**. This report provides an assessment of the biodiversity values within the Subject Land, documents the application of the avoid, minimise and offset framework and assesses the likely biodiversity impacts of the Project.

This Amended BDAR has been prepared in accordance with the NSW *Biodiversity Conservation Act 2016* (BC Act) and Biodiversity Assessment Method (BAM) (DPIE, 2020a) under the NSW Biodiversity Offset Scheme (BOS). The Project is regarded as SSD under Division 4.7 of Part 4 of the EP&A Act and is therefore required to be accompanied by a BDAR in accordance with section 7.9 of the BC Act.

The Regional Delivery Division, South West of CPHR has been consulted during the assessment process via teleconferences, written communication, and offer of an onsite visit. Where feasible and appropriate, advice from CPHR has been adopted and is reflected in this report accordingly.

Figures within this BDAR have been presented as a single page map within the body of the report itself, with a set of detailed multipage figures presented in **Appendix I**. The BAM requires that figures be presented at a scale of 1:1000 or finer; however, due the size of BWF a total of 1500 pages would be required to show a single figure at a 1:1000 scale. With over 40 figures within the BDAR, this was considered impractical. Instead, figures within **Appendix I** are presented at a scale of 1:20,000. At this scale, a single figure is shown across 27 pages and retains necessary detail to be legible and meaningful to the reader.

Table 1.1 SEARS Relevant to the Biodiversity Assessment

Key Issue	Requirement (Specific Assessment Requirements in Addition to the General Requirements)	Section Addressed
SEARs		
Biodiversity	An assessment of the biodiversity values and the likely biodiversity impacts of the project, including impacts associated with transport route road upgrades and indirect impacts on Oolambeyan Nation Park in accordance the BC Act, the BAM 2020 and documented in a BDAR.	The BDAR itself. Impacts associated with transport route upgrades are contained within the Work Area 1 and Work Area 2 Streamlined BDARs
	The BDAR must including a detailed description of the proposed regime for avoiding, minimising, managing and reporting on the biodiversity impacts (including on grasslands) of the development over time, and a strategy to offset any residual impacts of the development in accordance with the BC Act.	**Section 7.0**, **Section 8.7.1**, and **Section 12.0** of this BDAR.
	An assessment of the likely impacts on listed aquatic threatened species, populations or ecological communities, scheduled under the *Fisheries Management Act 1994*, and a description of the measures to minimise and rehabilitate impacts, including impacts to Abercrombie Creek, Eurolie Creek, Nyangay Creek and Coleambally Outfall Drain	**Section 8.6** of this BDAR.
	An assessment of the impacts of the development on birds and bats, including blade strike, low air pressure zones at the blade tips (barotrauma), alteration to movement patterns, and cumulative impacts of other wind farms in the vicinity	**Section 8.3.4** and **Appendix D** of this BDAR.
	A cumulative impact assessment of biodiversity values in the region from nearby developments	**Section 8.7** of this BDAR.
	If an offset is required, include details of the measures proposed to address the offset obligation.	**Section 12.0** of this BDAR.
Biodiversity Conservation Division (BCD) Submission		
Biodiversity	Biodiversity impacts related to the proposed development are to be assessed in accordance with section 7.9 of the BC Act using the BAM 2020 and documented in a BDAR. The BDAR must include information in the form detailed in the BC Act (s6.12), Biodiversity Conservation Regulation 2017 (s6.8) and the BAM, unless DPE determines that the proposed development is not likely to have any significant impact on biodiversity values.	The BDAR itself.
	The BDAR must document the application of the avoid, minimise and offset framework including assessing all direct, indirect, uncertain and prescribed impacts in accordance with the BAM.	**Section 7.0** and **Section 8.7.1** of this BDAR.
	The BDAR must include details of the measures proposed to address the offset obligation as follows a. The total number and classes of biodiversity credits required to be retired for the development/project b. The number and classes of like-for-like biodiversity credits proposed to be retired c. The number and classes of biodiversity credits proposed to be retired in accordance with the variation rules	**Section 10.0**, **Section 11.0**, and **Section 12.0** of this BDAR.

Key Issue	Requirement (Specific Assessment Requirements in Addition to the General Requirements)	Section Addressed
	d. Any proposal to fund a biodiversity conservation action e. Any proposal to make a payment to the Biodiversity Conservation Fund (BCF). 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.	
	The BDAR must be submitted with all digital spatial data associated with the survey and assessment as per Appendix K of the BAM.	Submitted to agencies with BDAR
	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.	**Declarations ii** (page 6) of this BDAR.
	The EIS must assess the impact of wind turbine strikes on protected animals including a) Predict the likelihood of impact on aerial species resident in, or likely to fly over, the Project Area, including but not limited to bat/bird strike and barotrauma. b) Predict the rate of impact per turbine per year for species likely to be affected. c) Justify predictions of likelihood of impact and rates of impact with reference to relevant literature and other published sources of information. d) Predict the consequences of impacts for the persistence of bioregional populations, with reference to relevant literature and other published sources of information. e) Predict and map the likely zone of disturbance around wind turbines for aerial species resident in, or likely to fly over, the Project Area, with reference to relevant literature and other published sources of information. f) Map significant landscape and habitat features within the zone of disturbance for species likely to be affected, including but not limited to hollow bearing trees, nest trees, microbat habitat and important habitat for migratory species. g) Predict the likelihood and describe the nature of indirect impacts on aerial species resident in, or likely to fly over, the Project Area including but not limited to barriers to migratory pathways and breeding, feeding and resting resources. h) For migratory species, predict the impact of avoidance behaviour relative to migration distances and the availability of suitable habitat for breeding, feeding and resting over the migration route, with reference to relevant literature and other sources of published information. i) Justify prediction of likelihood and nature of impact, with reference to relevant literature and other published sources of information. j) Predict the cumulative impact of the project together with existing wind farms with respect to movement patterns and the use of adjacent habitat and provide justification for these predictions.	**Section 8.3.4** and **Appendix D** of this BDAR.

Table 1.2 Summary and Reference Table for CPHR Submissions

Key Assessment Issues	CPHR Submission	Summary of approach	Reference to where it has been addressed
A BBAMP based on sufficient survey data and documenting commitments to monitor, mitigate and offset residual impacts to avifauna, is yet to be provided.			
4	A draft Bird and Bat Management Plan needs to be to be prepared. *Recommendation:* *4.1. Provide a draft BBAMP as an Appendix to the BDAR as required by section 2.7 of the BAM Operational Manual Stage 2.*	Section 7.4.1 of the BDAR detailed a comprehensive Bird and Bat Adaptive Management Plan (BBAMP) framework to inform the preparation of the BBAMP following approval of the EIS. The framework includes details of surveys proposed (including methods and frequency) as part of operational monitoring of turbine strike on avifauna, as well as details on impact triggers and associated response procedures for both threatened and nonthreatened species, mitigation measures, and reporting requirements. Preparing a BBAMP prior to Project approval and the finalisation of detailed design risks unnecessary rework as key design elements have yet to be designed. Furthermore, both NSW and Commonwealth agencies will have the opportunity to review and comment of the BBAMP as part of agency consultation prior to the BBAMP being adopted and implemented. In lieu of a complete BBAMP, Umwelt has supplemented the detail which would be included within the BBAMP in Section 7.4.1 of this Amended BDAR, as well as provided a Table of Contents for the BBAMP in Appendix D.	**Section 7.4.1** and **Appendix D** of this Amended BDAR.
5	Additional Bird and Bat Utilisation Survey (BBUS) effort is needed to ensure that the BBUS can be used to reliably inform the draft BBAMP. *Recommendations:* *5.1. Establish a BBUS survey program with sufficient coverage of the site in line with best practice (i.e. 80 per cent of the project area).* *5.2. Revise the collision risk assessment for all species.*	In August 2022, Umwelt consulted with CPHR regarding the proposed BBUS methodology. As part of this consultation, CPHR was provided with the Bird and Bat Utilisation Survey and Assessment Method (Umwelt, 2022) for review and comment. A meeting was also held between CPHR and Umwelt to discuss the methodology. CPHR provided a written response to the BBUS methodology on 5 September 2022 (Reference: DOC22-477467) which stated *"BCD is satisfied that the proposed BBUS methodology has been designed to record the required information to inform preapproval survey and assessment"*.	**Appendix D**

Key Assessment Issues	CPHR Submission	Summary of approach	Reference to where it has been addressed
		Following the release of *'Draft Wind Farm Assessment Guidance - South West REZ Projects'* in July 2023, Umwelt clarified the need to implement the new guidance, specifically the 'Suggested BBUS Method' (i.e. 80 percent of the project area, as referred to in CPHR's RtS comments), given August 2022 consultation and advice. CPHR provided a written response via email dated 6 February 2024 which stated *"BCD is satisfied with the BBUS methodology and does not require amendments based on guidance required".* The advice provided by CPHR as part of the RtS submission of the BDAR is not consistent with previous advice. On this basis, Umwelt is not proposing carrying out further BBUS surveys to inform the turbine strike prescribed impact assessment. In order to address recommendation 5.2, Umwelt has reviewed and where necessary updated the collision risk assessment prepared in Appendix D.	
The BDAR requires additional information to demonstrate that impacts have been avoided and minimised, including to SAII entities.			
6	The BDAR needs to be revised to include more detail to demonstrate that biodiversity impacts have been avoided or minimised. *Recommendations:* *6.1. Revise maps and tables in Section 7.1 to clearly demonstrate how priority biodiversity constraints have been avoided, including Plains-wanderer important habitat, TECs and land managed for conservation.* *6.2 Identify where and how breeding habitat for raptors has been avoided.*	Further information relating to how the Project has avoided and minimised impacts has been provided in **Section 7.0.** Specifically, • Tabulated avoidance data has been provided for different design iterations to quantitatively show a reduction in biodiversity related impacts • Additional figures which more clearly demonstrate how the project has been designed to avoid impacts to key biodiversity constraints • Further information regarding how the Project has avoided breeding habitat for raptors, including Black Falcon has been provided.	**Section 7.1** and **Section 7.2**

Key Assessment Issues	CPHR Submission	Summary of approach	Reference to where it has been addressed
Plant Community Type (PCT), Threatened Ecological Communities (TEC), and vegetation zone identification and mapping need to be revised, and the biodiversity credit calculation updated.			
7	The outcomes of the TEC assessment need to be clear, and all criteria are to be applied. *Recommendations:* *7.1. Update all TEC justification tables to include all assessment criteria at the patch scale and outcomes for each vegetation zone assessed.* *7.2 Clarify if the occurrence of the Weeping Myall TEC is consistent with vegetation zone 4 or 5 or both.*	Additional information relating to the detailed TEC consideration and analysis against vegetation recorded, identified and assessed on the Project has been provided. Regarding the Weeping Myall Woodlands EEC under the EPBC Act, Vegetation Zone 6 (Moderate to Good) of PCT 26 intersecting the Subject Land conforms with Weeping Myall Woodlands, while all patches of Vegetation Zone 5 (DNG) do not.	**Section 4.5** **Section 4.5.4**
8	Wet benchmarks have been applied to all vegetation integrity (VI) survey periods which may affect the ecosystem credit liability. *Recommendations:* *8.1. Provide the preceding 12 months of rainfall data for each VI plot survey period to support the use of either wet or dry benchmarks.* *8.2 Create a separate vegetation zone for VI plots collected in May 2024 to account for average benchmarks instead of wet benchmarks.*	In order to address recommendation 8.1, Umwelt has added the preceding 12 months of rainfall data for each VI plot survey period to **Table 4.2** in **Section 4.1.2.3**. Umwelt carried out a detailed analysis to assess the suitability of the benchmark attributed for each vegetation zone, the impact of WET versus AVERAGE rainfall benchmarks on VI scores as detailed in **Section 4.1.5**. For plots carried out in 2023, the composition and structure scores within the BAM VI plots collected within the Subject Land exceeded the AVERAGE benchmark values within BioNet Vegetation Classification for the PCTs recorded within the Subject Land for the key structural components of each PCT (i.e. grass richness and cover) indicating that the significant and above average rainfall has resulted in an overestimation of vegetation condition values. The WET benchmark values better reflect the composition and structure scores of the BAM VI plots collected onsite, indicating that they are more representative of VI during the 2023 survey period. As such, WET benchmarks can be where available.	**Table 4.2** in **Section 4.1.2.3** and **Section 4.1.5**.

Key Assessment Issues	CPHR Submission	Summary of approach	Reference to where it has been addressed
		Plots surveyed in 2024 have been treated in the following way: • The plot in PCT 17 Moderate-good that was surveyed in 2024 was removed, and the VI score calculated utilising WET benchmarks. The removal of this plot did not affect the minimum plot requirements for this vegetation zone required under the BAM. • AVERAGE benchmarks were applied to PCT 160 Moderate-good as all plots were carried out in 2024 when the total rainfall for the preceding 12-month period did not exceed the WET rainfall threshold for the PCT in question. • WET benchmarks were applied to all vegetation zones within PCT 26, PCT 28 and PCT 164 as the analysis demonstrated that the VI scores derived from both WET and AVERAGE benchmarks were essentially the same for the 2024 plots.	
9	Additional information is needed to justify the PCT selection. *Recommendation:* *9.1. Include a short list of PCTs considered for each PCT, why certain PCTs were discarded and why the final PCT is the best fit.*	Further information has been provided in this Amended BDAR relating to the process undertaken to consider, analsye and finalise PCT classificiation for the Project has been provided in the subsections of **Section 4.3**. Specifically, a 'Justification of PCT Selection' is provided with regard to each PCT.	**Section 4.3**
Targeted survey methods are to be correctly applied and species polygons correctly prepared to ensure the credit calculation is accurate.			
10	There needs to be a consistent approach to adding and removing predicted species in the BAM calculator (BAM-C). *Recommendations:* *10.1. Ensure any ecosystem or candidate species added to the BAM-C due to observations on site are then retained in at least one vegetation zone in the BAM-C habitat suitability: predicted tab.*	The list of candidate species considered in the Amended BDAR has been reviewed and considered with regard to habitat availability across vegetation zones, and where necessary updated in the Amended BDAR and BAM-C to ensure consistency in approach. All species which have been added to the BAM-C have had at least one vegetation zone retained in the 'habitat suitability: predicted tab' of the BAM-C.	Section 5.1.2 and BAM-C child cases.

Key Assessment Issues	CPHR Submission	Summary of approach	Reference to where it has been addressed
	10.2. Review vegetation zones for predicted species and retain all vegetation zones where suitable foraging and/or breeding habitat occurs in the BAM-C.		
11	Retain Plains-wanderer as a candidate species for survey. *Recommendations:* *11.1. Retain Plains-wanderer as a candidate species in the BAM-C child cases even though the proponent has avoided important mapped habitat.*	Plains-wanderer has been retained as a candidate species for survey in the BAM-C child cases.	**Section 5.4.3.10**
12	Survey conditions for Austral Pillwort are unknown. *Recommendation:* *12.1. Provide further evidence about the specific drying mud conditions for Austral Pillwort to show that the survey conditions for the species were suitable in October and November 2023 or address the requirements set out in section 5.2.3 of the BAM*	Further evidence and justification relating to the survey conditions for Austral Pillwort have been provided in **Table 5.11**.	**Table 5.11** in Section **5.3.4**.
13	Species grouped together for targeted flora surveys should share the same or similar habitat requirements. *Recommendation:* *13.1. Provide further evidence addressing section 5.2.3 of the BAM to support flora species groupings where specific survey requirements or microhabitats do not overlap.*	Further evidence and justification relating to how threatened flora surveys groups were derived has been provided in **Table 5.7.**	**Table 5.7** in **Section 5.3.4.**
14	Additional survey is needed to demonstrate compliance with threatened fauna targeted survey requirements. *Recommendation:* *14.1. Provide additional evidence that threatened fauna species are absent or assume candidate fauna species to be present.*	Additional targeted fauna surveys were carried out between September 2023 and March 2025. Details of these surveys have been documented in **Section 5.3.5.** Targeted surveys for hollow dependent bird species credit species (e.g. superb parrot, pink cockatoo) were carried out between September to November 2024. The surveys comprised of targeted searches of suitable	**Section 5.3.5**

Key Assessment Issues	CPHR Submission	Summary of approach	Reference to where it has been addressed
		habitat within breeding season in line with EPBC survey guidelines and BAM. Details of this survey has been documented in **Section 5.3.5.5** and **Section 5.3.5.9**. Under the BAM, breeding habitat is considered to be presence of habitat constraint and presence of individual birds. Prior to investing significant time to do targeted surveys for raptor species at each stick nest located on site, it is important to determine that the species is utilising the site. Vantage point surveys are recommended survey method in Draft Wind Farm Assessment Guidance because they are an effective method to determine whether raptors are utilising a site. Little Eagle was detected during BBUS surveys (as well as incidentally) as being present within the Project Area, and offsets calculated accordingly. Targeted surveys for Bush-stone Curlew were carried out in spring 2023 in accordance with survey methods detailed within *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities (2004 Working Draft)* (DEC 2004). These surveys included flushing of the species within suitable habitat, which was carried out concurrently with the systematic flora survey transects which were walked across the Subject Land (4,330.41 ha) a total of three times of over a three-month period. A total of 4794.34 km were walked. In addition to the flushing surveys, 161 nights of acoustic call detection was carried out within areas suitable habitat. Whilst not a formally recognised as a survey method in the DEC (2004), the species is known for its vocalisation and could be easily detected via passive acoustic recording. In addition to the surveys completed in 2023, the following surveys were carried out for Bush-stone Curlew in spring/summer 2023 and autumn 2025 as documented in **Section 5.3.5.2:** • Spotlighting transects via vehicle. • Call playback.	

Key Assessment Issues	CPHR Submission	Summary of approach	Reference to where it has been addressed
Direct, indirect and prescribed impacts need to be appropriately assessed.			
15	Perimeter fencing and firebreaks need to be included in the impact assessment. *Recommendations:* *15.1. Include specifications and location for perimeter fencing, fire breaks and APZs.* *15.2. Revise the BDAR and impact assessment to include impacts to native vegetation and threatened species from perimeter fencing, fire breaks and APZs.*	All impacts associated with Asset Protection Zones (APZs) and fencing requirements have been considered within the current Project layout and designed to occur within the Disturbance Footprint assessed within this report. The APZs were established as per the Bush Fire Hazard Assessment, and their scale and extent factored into the design. A detailed fencing design/layout would be prepared during the detailed design phase of the Project.	**Section 2.3**
16	The indirect impact assessment at Table 8.6 needs to be revised. *Recommendations:* *16.1. Review and revise the indirect impacts in Table 8.6 to ensure the likelihood of impact, likelihood of consequences and indirect impact levels are realistic.* *16.2. Update Table 8.6 to list specific at-risk fauna species.* *16.3. Map the conservation agreement area (CA0465) and the Local Land Services land management agreement areas and apply appropriate buffers.*	The indirect impact assessment, including **Table 8.6,** has been reviewed and updated with regard to CPHR's comments.	**Section 8.2**
17	The indirect and prescribed impact assessment for Plains-wanderer needs revision. *Recommendations:* *17.1. Discuss the impacts of the proposal on connectivity and fragmentation for the existing Plains-wanderer conservation areas.*	Impacts on the connectivity and fragmentation of Plains-wanderer resulting from the proposal are detailed in **Section 8.3.2.1**.	**Section 8.3.2.1**

Key Assessment Issues	CPHR Submission	Summary of approach	Reference to where it has been addressed
	17.2. Discuss the potential for areas of Plains-wanderer important mapped habitat to be sterilised as they may be isolated by proposed infrastructure, in the context of maintaining movement crucial to the species life cycle. *17.3. Review the application of the SAII assessment criteria for Plains-wanderer to consider indirect impacts including fragmentation.*		
18	Revise the prescribed impact assessment to adequately consider flight paths and connectivity. *Recommendations:* *18.1. Map flight paths across the project site, discuss potential impacts on these and where avoidance or minimisation would be applied.* *18.2. Update Figure 3.4 to map all connectivity features across the site.*	Flyway and flight path data can only be accurately collected via radar or smart cameras. Any data which maps flight paths without the use of specialist technology is not an accurate data provision, which may understate impacts and/or overstate avoidance measures. Noting the inherent uncertainty around turbine strike risk assessment, Umwelt had opted to ensure the assessment is accurate as possible and provide alternative data. Specifically, Figure 8.1 to 8.7 within Appendix G of the BDAR showed the distance and direction of bird observations from the observer which provides indicative bird utilisation patterns across the Project Area. In order to provide additional information with regard to landscape scale movements of avifauna, Appendix G has been revised to include the following: • Figure 8.1 to Figure 8.7 of Appendix G have been revised so that bird observation records also depict flight direction and height. Key habitat features have also been included on figures to provide additional context. • Additional figures have been provided detailing indicative landscape scale movement pathway for avifauna across the Project Area, and indicative migration pathways for migratory and nomadic fauna. Additional detail has also been provided **Section 8.3.2** with regard to impacts on connectivity to avifauna. Furthermore, **Figure 3.4** has been updated to include indicative connectivity corridors across the Project Area.	**Section 8.3.2, Figure 3.4** and **Appendix G**

Key Assessment Issues	CPHR Submission	Summary of approach	Reference to where it has been addressed
19	The prescribed impact assessment for vehicle strike requires revision and needs to consider all vehicle strike impacts. *Recommendations:* *19.1. Revise the assessment to include all additional species at risk of vehicle strike and update in Table 6.1 and include in a table similar to Tables 8.7 to 8.9.* *19.2. Assess vehicle strike impacts for all roads and tracks constructed or used for the project.* *19.3. Detail the nature, extent and timing of vehicle movement and include in the assessment of prescribed impacts.*	Additional detail has been provided in **Section 6.0**, **Section 7.2.2** and **Section 8.3.5** as requested by CPHR. Specifically: • **Table 6.1** has been updated to consider vehicle strike as a prescribed impact and provide additional detail regarding species at risk of impact • **Table 7.4** has been revised to provide additional detail regarding Plains-wanderer and raptor species • A risk assessment has been provided within **Section 8.3.5** for all species considered to be at risk of vehicle strikes. Impacts associated with the Project's transport routes are included within two Streamlined BDARs in **Appendix J** and **Appendix K**. As such, these works are not discussed this report.	**Section 6.0**, **Section 7.2.2** and **Section 8.3.5**
20	Prescribed impacts need to be assessed for each impacted entity. *Recommendations:* *20.1. Assess the risk of sedimentation (from construction and operation) on threatened species habitat for individual species during and after high rainfall events when water is moving through the landscape.* *20.2. Revise Table 6.1 identify specific prescribed impact risks to individual entities.* *20.3. Update Table 6.1 to list all threatened entities that may be dependent on or use the habitat features associated with each prescribed impact.*	Additional detail has been provided in **Section 6.0** and **Section 8.3** as requested by CPHR. Specifically: • **Table 8.9** has been updated described the outcomes of the Water Resources Impact Assessment (WRM, 2024) to support the discussion relating to risks associated with sedimentation on threatened species habitat during construction and operation. • **Table 6.1** has been revised to list all threatened species which may be dependent on the habitat features associated with each prescribed impact and identifies specific prescribed impact risks for individual entities.	**Section 6.0** and **Section 8.3**
Proposed offsets for prescribed impacts need to be explained and agreed.			
21	Offsets for prescribed impacts needs to be fully explored. *Recommendation:*	There is no current policy, guideline or mechanism in NSW to facilitate the offsetting of prescribed impacts such as turbine strike impacts.	**Section 10.1.4.1**

Key Assessment Issues	CPHR Submission	Summary of approach	Reference to where it has been addressed
	21.1. Review and update section 10.1.4.1 to include feasible conservation actions that are separate to those required for mitigation measures.	The mechanism proposed in **Section 10.1.4.1** is considered the only feasible offset approach for turbine strike prescribed impacts as it is widely considered that the biodiversity credit scheme is not a suitable mechanism. The primary reason being that it does not allow for an equitable credit calculation between species-credit species and ecosystem-credit species. It is not considered appropriate or possible to finalise the feasible conservation actions to offset prescribed impacts from turbine strike as the conservation actions should be specifically tailored to the species or species' that are impacted. Those impacts will only be realised, if they occur, during the implementation of the operational monitoring through the BBAMP. At which time, consultation with relevant agencies will ensure conservation actions are appropriately designed. However the approach and examples presented in this Amended BDAR provide suitable level of clarity for CPHR to ensure the conservation actions that will be considered are suitable and fit for purpose: • Funding of a PhD Project. • Funding of existing research programs, such as the Difficult Bird Research Group. • Funding of Saving our Species conservation projects. • Funding of breeding programs. • Funding of local habitat enhancements programs. • Funding the implementation and monitoring of operational mitigation measures (such as curtailment) to assess the interaction with birds and bats.	

Key Assessment Issues	CPHR Submission	Summary of approach	Reference to where it has been addressed
Mitigation measures need to include more detail to demonstrate that impacts will be successfully managed.			
22	Mitigation measures are to be detailed in the BDAR to demonstrate impacts will be effectively effective managed and to give confidence that the offset liability is adequate. *Recommendation:* *22.1. Update Section 9 of the BDAR (including Table 9.1) to detail auditable mitigation and management measures that follow the SMART principles.*	The wording within **Table 9.1** has been reviewed and updated to remove ambiguous language and incorporate smart goals where applicable. It is noted that the use of 'where possible' in BIO12 refers to vegetation within the Development Footprint thus its use is appropriate within this context.	**Section 8.7.1**
Matters of National Environmental Significance			
23	Areas of EPBC Act listed Natural Grasslands of the Murray Valley Plains TEC may be underestimated because it has not been assessed at the patch scale. *Recommendations:* *23.1. Review the Key Diagnostic Characteristics and Condition Thresholds in the Australian Government listing advice for the Natural Grasslands of the Murray Valley Plains TEC across the combined areas of PCT 44 and 46.* *23.2. If required, calculate impacts to the Natural Grasslands of the Murray Valley Plains TEC and assess impacts.*	Vegetation surveys for the BWF were carried out across a two-year period and consisted of the collection of detailed data as part of BAM VI plots, and RMPs. Data was captured across all four seasons in order to capture the seasonal variation of native vegetation composition. Furthermore, data was collected following durations of good rainfall and not during time of drought. An assessment against the Conservation Advice found that patches of PCT 44 and PCT 46, both as patches of each vegetation zone (PCT) and as patches of the vegetation class Riverine Plain Grasslands, do not conform with Natural Grasslands of the Murray Valley Plains CEEC.	**Section 4.5.5**
24	Impacts and potential offsets to Plains-wanderer habitat outside the important mapped areas is unknown. *Recommendations:* *24.1. Develop Spring 2024 survey methods for Plains-wanderer outside the important mapped areas in consultation with the species Accountable Officer and the Australian Government DCCEEW.*	NSW Important habitat for Plains Wanderer has been mapped within the Project Area but impacts avoided i.e. there are no areas of NSW Important Habitat Mapping within the Subject Land or Disturbance Footprint.	**Section 7.0, Section 5.4.3.10** and **Section 11.2**

Key Assessment Issues	CPHR Submission	Summary of approach	Reference to where it has been addressed
	24.2. Use the outcomes of targeted surveys to apply additional avoidance of Plains-wanderer habitat. *24.3. Consult with the Australian Government DCCEEW on requirements for any additional offsets for Plains-wanderer.*	Targeted surveys for Plains-wanderer and then detailed assessment has been completed in Spring 2024 to identify supplementary habitat for Plains-wanderer within the Subject Land and extent of impacts from the Project. This facilitated identifying areas of supplementary habitat for Plains-wanderer that are avoided by the Project, as shown in **Figure 5.33**. A species-credit liability for the species has then been generated on the basis of impacts on that supplementary habitat.	
25	A complete MNES assessment should be provided to address the Assessment Bilateral requirements. *Recommendation:* *25.1. Amend Appendix E of the BDAR and specifically address each of the bilateral assessment requirements as detailed in Attachment C to this response.*	This Amended BDAR, specifically **Section 8.5** and **Appendix E** have been updated to provide a complete MNES assessment for the Project.	**Section 8.5, 12.2** and **Appendix E**
Other administrative matters			
26	Vegetation zone and species polygon impact areas need to be consistent with the figures in the spatial data. *Recommendation:* *26.1. Update the spatial data, BDAR and BAM-C to ensure all areas entered for each stage, vegetation zone and species polygon match the spatial data.*	A comprehensive re-analysis of the BAM – Vegetation Integrity Plots undertaken for the Project against the PCTs and associated Vegetation Zones has occurred as part of this Amended BDAR. In addition to this, reanalysis of the areas of impact and interaction with BAM-C assessment cases have been updated accordingly.	**Section 4.1.2.3** and **Section 8.1**
27	Any threatened flora records should be verified by a herbarium. *Recommendation:* *27.1. Provide verification of all threatened flora from a herbarium.*	The necessary verifications have been provided in **Appendix L.**	**Appendix L**

1.3.2 EPBC Act Assessment Requirements

Preliminary investigations identified that the Project was likely to have a significant impact on biodiversity protected under the EPBC Act. A referral was subsequently prepared and submitted, with the Project being determined to be a controlled action (ref EPBC 2022/09423) under the EPBC Act on 20 March 2023, with the relevant controlling provisions relating to likely impacts on listed threatened species and communities (sections 18 & 18A of the EPBC Act). The assessment requirements for the Project under the EPBC Act are detailed in **Table 1.3**.

The Commonwealth DCCEEW has been consulted during the assessment process via teleconferences and written communication. Where feasible and appropriate, advice from Commonwealth DCCEEW has been adopted and is reflected in this report accordingly.

The BAM has been endorsed as the assessment method for Matters of National Environmental Significance (MNES) under a Bilateral Agreement made under the EPBC Act. The Australian Government is the decision-maker for whether the Project will be approved under the EPBC Act. Nationally-listed threatened species, threatened ecological communities (TECs) have been considered and assessed as part of this BDAR and in a separate MNES Assessment provided in. Whilst not listed as a controlling provision, potential impacts to migratory species have also been assessed within the MNES Assessment in line with advice from Commonwealth DCCEEW.

Table 1.3 EPBC Act Environmental Assessment Requirements for Biodiversity

Key Issue	Commonwealth Assessment Requirement	Section Addressed
General Requirements		
Relevant Regulations	The EIS must address all matters outlined in Schedule 4 of the EPBC Regulations and all matters outlined below in relation to the controlling provisions.	**Appendix E** of this BDAR.
Project Description	The title of the action, background to the action and current status.	**Appendix E** of this BDAR.
	The precise location and description of all works to be undertaken (including associated offsite works and infrastructure), structures to be built or elements of the action that may have impacts on MNES.	**Appendix E** of this BDAR.
	How the action relates to any other actions that have been, or are being taken in the region affected by the action	**Appendix E** of this BDAR.
	How the works are to be undertaken and design parameters for those aspects of the structures or elements of the action that may have relevant impacts on MNES.	**Section 2.0** and **Appendix E** of this BDAR.
Impacts	The EIS must include an assessment of the relevant impacts of the action on the matters protected by the controlling provisions, including: i. a description and detailed assessment of the nature and extent of the likely direct, indirect and consequential impacts, including short term and long term relevant impacts ii. a statement whether any relevant impacts are likely to be unknown, unpredictable or irreversible iii. analysis of the significance of the relevant impacts iv. any technical data and other information used or needed to make a detailed assessment of the relevant impacts.	**Appendix E** of this BDAR.
Avoidance, mitigation and offsetting	For each of the relevant matters protected that are likely to be significantly impacted by the action, the EIS must provide information on proposed avoidance and mitigation measures to manage the relevant impacts of the action including: i. a description, and an assessment of the expected or predicted effectiveness of the mitigation measures ii. any statutory policy basis for the mitigation measures iii. the cost of the mitigation measures iv. an outline of an environmental management plan that sets out the framework for continuing management, mitigation and monitoring programs for the relevant impacts of the action, including any provisions for independent environmental auditing v. the name of the agency responsible for endorsing or approving each mitigation measure or monitoring program.	**Section 7.0**, **Section 8.7.1** and **Appendix E** of this BDAR.

Key Issue	Commonwealth Assessment Requirement	Section Addressed
	Where a significant residual adverse impact to a relevant protected matter is considered likely, the EIS must provide information on the proposed offset strategy, including discussion of the conservation benefit associated with the proposed offset strategy.	**Appendix E** of this BDAR.
	For each of the relevant matters likely to be impacted by the action the EIS must provide reference to, and consideration of, relevant Commonwealth guidelines and policy statements including any: i. conservation advice or Recovery Plan for the species or community ii. relevant threat abatement plan for the species or community iii. wildlife conservation plan for the species iv. any strategic assessment. Note: the relevant guidelines and policy statements for each species and community are available from the Department of the Environment Species Profiles and Threats Database. http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl]	**Appendix E** of this BDAR.
	In addition to the general requirements described above, specific information is required with respect to each of the determined controlling provisions. These requirements are outlined below under Biodiversity (threatened species and communities) - Assessment Requirements.	**Appendix E** of this BDAR.
Biodiversity (threatened species and communities)		
Assessment Requirements	The EIS must identify each EPBC Act listed threatened species and community likely to be impacted by the action. For any species and communities that are likely to be impacted, the proponent must provide a description of the nature, quantum and consequences of the impacts. For species and communities potentially located in the Project Area or in the vicinity that are not likely to be impacted, provide evidence why they are not likely to be impacted.	**Section 8.5** and **Appendix E** of this BDAR.
	For each of the EPBC Act listed threatened species and communities likely to be impacted by the action the EIS must provide a separate: i. description of the habitat (including identification and mapping of suitable breeding habitat, suitable foraging habitat, important populations and habitat critical for survival), with consideration of, and reference to, any relevant Commonwealth guidelines and policy statements including listing advice, conservation advice and Recovery Plans ii. details of the scope, timing and methodology for studies or surveys used and how they are consistent with (or justification for divergence from) published Australian Government guidelines and policy statements iii. description of the relevant impacts of the action having regard to the full national extent of the species or community's range	**Appendix G** of this BDAR.

Key Issue	Commonwealth Assessment Requirement	Section Addressed
	iv. description of the specific proposed avoidance and mitigation measures to deal with relevant impacts of the action v. identification of significant residual adverse impacts likely to occur after the proposed activities to avoid and mitigate all impacts are taken into account vi. a description of any offsets proposed to address residual adverse significant impacts and how these offsets will be established vii. details of how the current published BAM has been applied in accordance with the objects of the EPBC Act to offset significant residual adverse impacts.	
	Any significant residual impacts not addressed by the BAM may need to be addressed in accordance with the EPBC Act 1999 Environmental Offset Policy. http://www.environment.gov.au/epbc/publications/epbc-act-environmental-offsets-policy.	Not applicable to the Project

1.3.3 Excluded Impacts

The BC Act (at Clause 6.8(3)) specifies that the BAM is to exclude the assessment of the impacts of any clearing of native vegetation and loss of habitat on Category 1-Exempt Land (as defined in Part 5A of the *Local Land Services Act 2013* (LLS Act)), other than prescribed impacts (as defined in clause 6.1 of the NSW Biodiversity Conservation Regulation 2017 (BC Regulation)).

Under Part 5A of the LLS Act and the supporting regulation, a Native Vegetation Regulatory (NVR) map showing the extent of categorised land in NSW is to be published by the Environment Agency Head (EAH). The NVR map underpins the legislative framework for native vegetation clearing in rural areas by categorising land in NSW. However, the map applies only to the following zones (if they are not in an excluded LGA): Zone RU1 Primary Production, Zone RU2 Rural Landscape, Zone RU5 Primary Production Small Lots and Zone RU6 Transition. The circumstances under which land is to be designated as Category 1 – Exempt Land and Category 2 – Regulated Land are set out in s.60H-60J of the LLS Act and cl.109-114 of the LLS Regulation.

The NSW Government has undertaken a transitional approach to the release of the NVR map, which currently includes releasing transitional and draft mapping, but not final mapping of areas of Category 1 – Exempt Land. The Subject Land falls within the Riverina, an area within which draft mapping has been released. The draft NVR Map does not have any legal effect.

The assessment of Category 1 – Exempt Land under the BAM during this transitional period has been dealt with in BAM Assessor Updates (No. 22, 6 September 2019 and No. 3, 6 August 2018). The guidance provided identified that accredited assessors were responsible for determining areas of Category 1 – Exempt Land for developments affecting rural land. These areas were identified as not requiring impact assessment offset calculations relating to vegetation integrity and habitat suitability.

The Subject Land is zoned RU1 Primary Production and is therefore eligible to be mapped and categorised on the NVR map. The NVR Map categories which occur within the Subject Land, and their respective areas, are described in **Table 1.4** and shown in **Figure 1.4**.

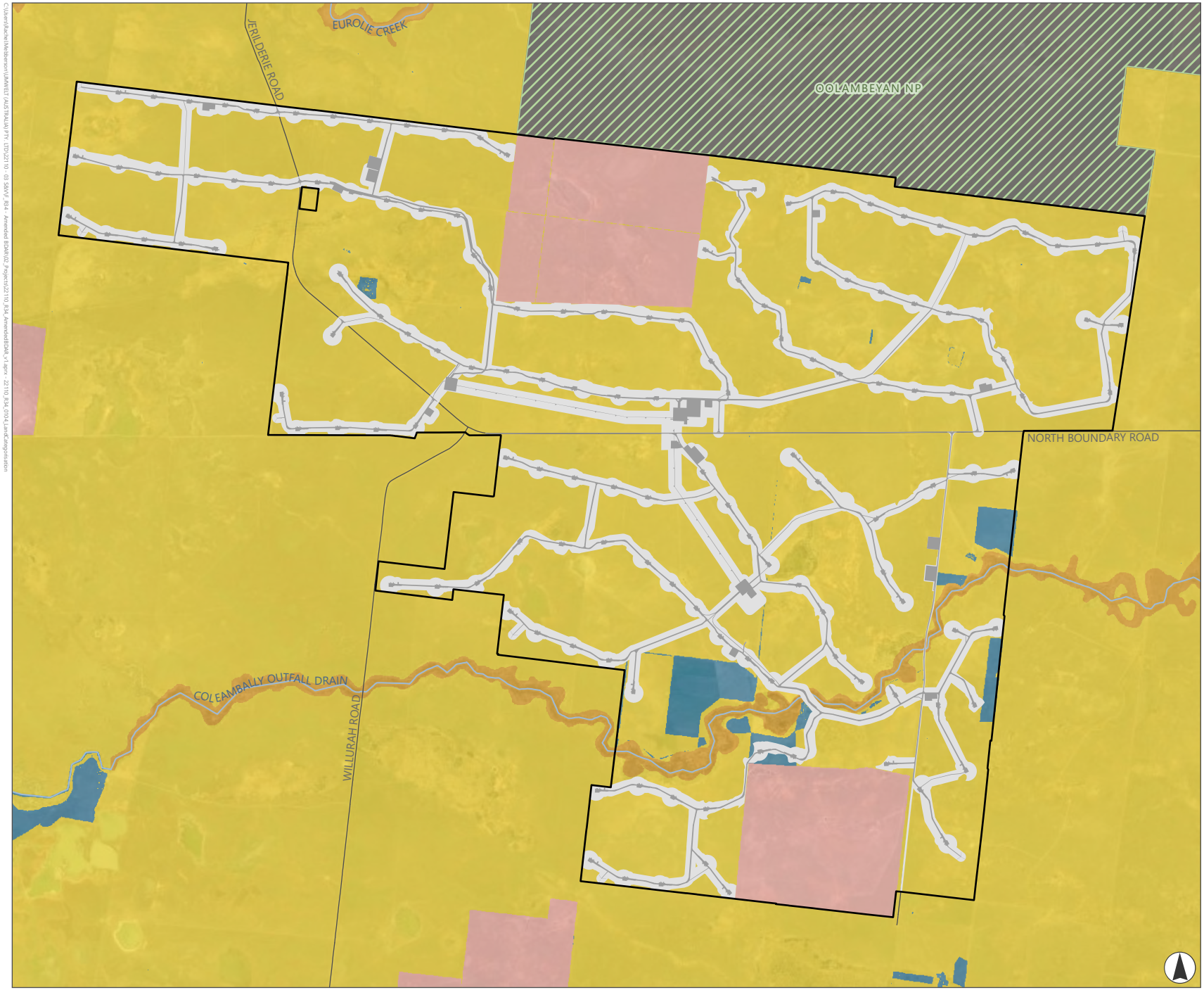
Table 1.4 NVR Map Categories within the Subject Land

NVR Map category	Area (ha)
Category 1 – Exempt Land	47.15
Category 2 – Regulated Land	4,263.08
Category 3 – Sensitive Regulated Land	1.67

For the purposes of this assessment, the BDAR has adopted the draft NVR Map as published, however both the transition NVR Map and the draft NVR Map were reviewed. A detailed description of how the vegetation, including native vegetation extent and approach to confirming land categorisation mapping, is provided within **Section 4.1**. About half of the land mapped as Category 1 – Exempt Land was found to contain non-native vegetation, while the remaining half was comprised of native vegetation. As such, the BAM has been applied across the entire Subject Land, irrespective of land categorisation.

FIGURE 1.4.1

Draft Land Categorisation Mapping



Legend

- Project Boundary
- Subject Land
- Development Footprint
- NPWS Reserves
- Road
- Watercourse

Native Vegetation Regulatory Map

- Category 1 - Exempt Land
- Category 2 - Regulated Land
- Category 2 - Vulnerable Regulated Land
- Category 2 - Sensitive Regulated Land
- Category 2 - Sensitive and Vulnerable Land
- Category 2 - Land Excluded from the LLS Act

0 2,000 4,000

Meters

Scale 1:110,000 at A4

GDA 1994 NSW Lambert

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

C:\Users\RachelMeberson\UMWELT (AUSTRALIA) PTY. LTD\22110 - 03 S86VF R34 - Amended BDAR\02_Projects\22110_R34_AmendedBDAR_v1.aprx - 22110_R34_0104_LandCategorisation

FIGURE 1.4.2

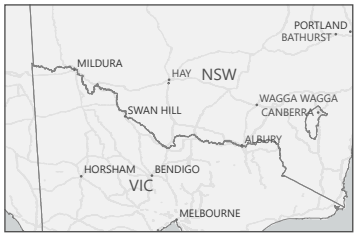
Draft Land Categorisation Mapping

Legend

- Development Footprint
- Road

Native Vegetation Regulatory Map

- Category 1 - Exempt Land
- Category 2 - Regulated Land
- Category 2 - Vulnerable Regulated Land
- Category 2 - Sensitive Regulated Land
- Category 2 - Sensitive and Vulnerable Land
- Category 2 - Land Excluded from the LLS Act



0 100 200

Meters

Scale 1:5,000 at A4

GDA 1994 NSW Lambert

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

C:\Users\RachelMeiberg\on\UMWELT (AUSTRALIA) PTY. LTD\22110 - 03 S86VF R44 - Amended BDAR\02_Projects\22110_R34_AmendedBDAR_v1.aprx - 22110_R34_0104_LandCategorisation

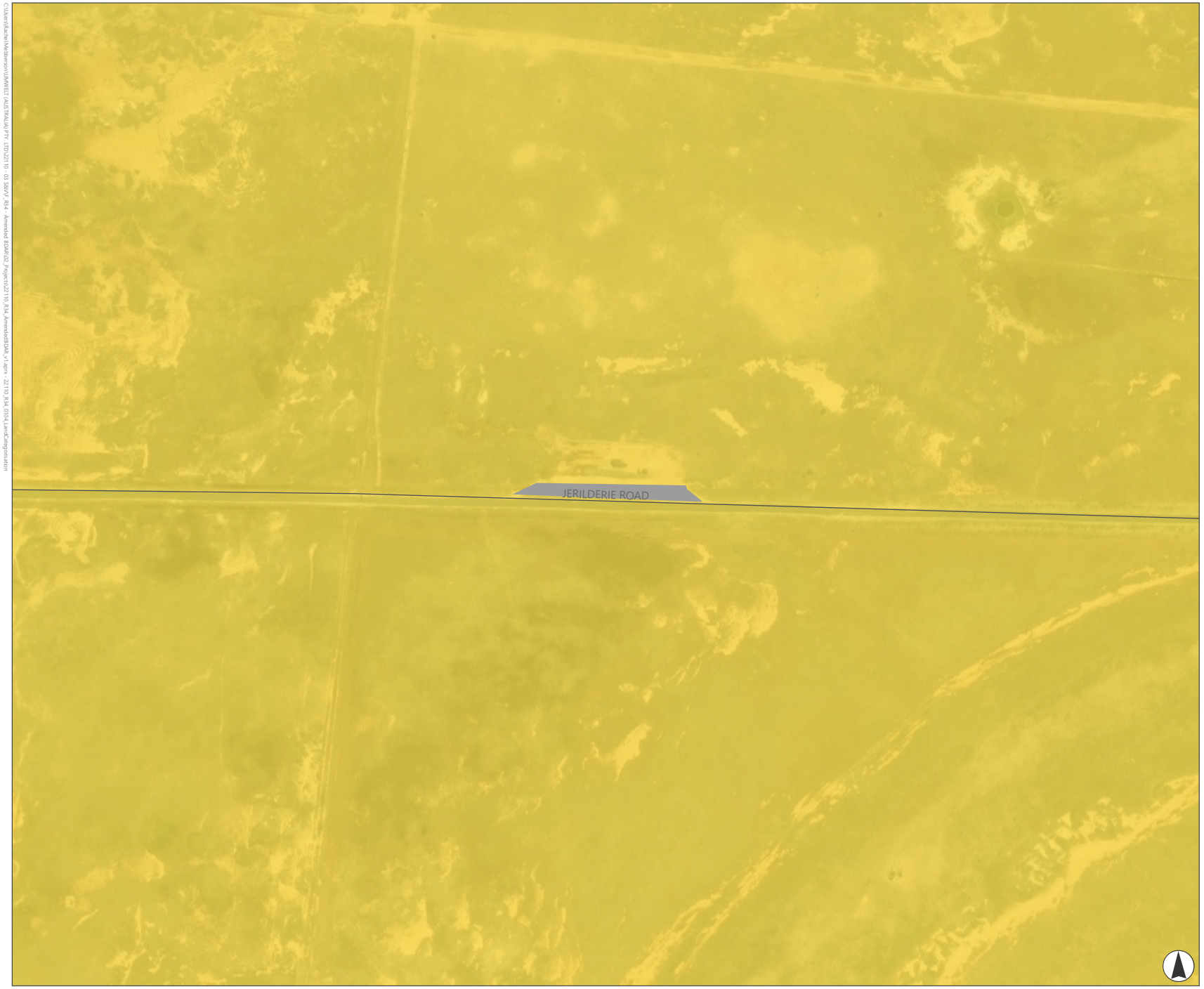


FIGURE 1.4.3

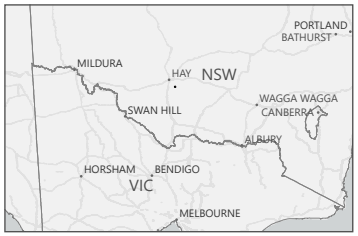
Draft Land Categorisation Mapping

Legend

- Development Footprint
- Road

Native Vegetation Regulatory Map

- Category 1 - Exempt Land
- Category 2 - Regulated Land
- Category 2 - Vulnerable Regulated Land
- Category 2 - Sensitive Regulated Land
- Category 2 - Sensitive and Vulnerable Land



0 100 200

Meters

Scale 1:5,000 at A4

GDA 1994 NSW Lambert

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

C:\Users\RachelMeiberon\UMWELT (AUSTRALIA) PTY. LTD\22110 - 03 SWVF R04 - Amended BDAR\02_Projects\22110_R34_AmendedBDAR_v1.aprx - 22110_R34_0104_LandCategorisation

FIGURE 1.4.4

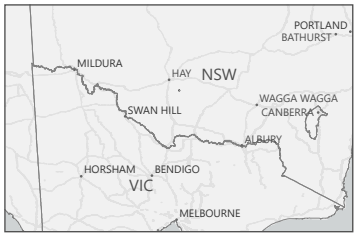
Draft Land Categorisation Mapping

Legend

- Development Footprint
- Road
- Watercourse

Native Vegetation Regulatory Map

- Category 1 - Exempt Land
- Category 2 - Regulated Land
- Category 2 - Vulnerable Regulated Land
- Category 2 - Sensitive Regulated Land
- Category 2 - Sensitive and Vulnerable Land



0 100 200

Meters

Scale 1:5,000 at A4

GDA 1994 NSW Lambert

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

C:\Users\RachelMeiberon\UMWELT (AUSTRALIA) PTY. LTD\22110 - 03 SWVF R04 - Amended BDAR\02_Projects\22110_R34_AmendedBDAR.v1.aprx - 22110_R34_0104_LandCategorisation

1.4 Statutory Considerations

Commonwealth and State Legislation relevant to this biodiversity constraints assessment report is described in **Table 1.5.**

Table 1.5 Legislation Relevant to the Project

Relevant Legislation	Governing Agency	Summary
Commonwealth Legislation		
***Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)**	Commonwealth DCCEEW	The EPBC Act is the Commonwealth Government's primary piece of environmental legislation and is administered by the Australian Government – DCCEEW. It is designed to protect national environmental assets, known as MNES, which include threatened species of flora and fauna, endangered ecological communities, and migratory species, as well as other protected matters. It defines the categories of threat for threatened flora and fauna, identifies key threatening processes and provides for the preparation of Recovery Plans for threatened flora, fauna, and communities. Actions that may adversely affect MNES may be deemed to be a controlled action under the EPBC Act. The significance of the proposed action on MNES can be determined through self-assessment using *Significant Impact Guidelines 1.1 - Matters of National Environmental Significance* (Department of the Environment, Water, Heritage and the Arts, 2013a). A referral is required for proposed actions that may affect nationally listed threatened species, TECs, and migratory species. The Project was deemed a controlled action under the EPBC Act on 20 March 2023. The BAM has been endorsed as the assessment method for MNES under a Bilateral Agreement made under the EPBC Act. The Commonwealth Assessment Requirements and where this BDAR addresses each requirement are summarised in **Table 1.3**.
State Legislation		
***Environmental Planning and Assessment Act 1979* (EP&A Act)**	DPHI	The EP&A Act is the overarching planning legislation in NSW that provides for the creation of planning instruments that guide land use. The EP&A Act also provides for the protection of the environment, including the protection and conservation of native animals and plants. This includes threatened species, populations and ecological communities, and their habitats of biodiversity values as listed in the BC Act and FM Act.

Relevant Legislation	Governing Agency	Summary
		Section 4.36 of the EP&A Act provides for the declaration of a project as SSD. Under the EP&A Act, the declaration of a project as SSD can be made by meeting the requirements of a State Environmental Planning Policy (SEPP) or by the Minister for Planning and Public Spaces. Clause 20 of Schedule 1 of Planning Systems SEPP prescribes that development for the purpose of 'electricity generating works' that has a capital investment value of more than $30 million is SSD. The Project has a capital investment value of greater than $30 million. As SSD, the Project would be assessed under Part 4 Division 4.7 section 4.36 of the EP&A Act. The consent authority for the SSD will be Minister for Planning and Public Spaces, or alternatively, the Independent Planning Commission (if certain criteria are met). The consent authority is required to take into consideration the matters listed under section 4.15 of the EP&A Act when determining the development application (DA). The SEARs and where this BDAR addresses each requirement are summarised in **Table 1.1**.
***Biodiversity Conservation Act 2016* (BC Act)**	NSW DCCEEW	The BC Act and its supporting regulations commenced on 25 August 2017. The BC Act repealed the *Threatened Species Conservation Act 1995* (TSC Act) along with other natural resource management legislation, while retaining the TSC Act species list. The BC Act sets out the environmental impact assessment framework for threatened species, TECs and Areas of Outstanding Biodiversity Value (AOBV) (formerly critical habitat) for Major Projects, Part 5 activities, and local development. The BC Act provides a framework to avoid, minimise and offset the impacts of proposed development and established a methodology for assessing the likely impacts on biodiversity values and calculating measure to offset those impacts (the BAM). Sections 7.9 of the BC Act requires that SSD under Part 4 of the EP&A Act that triggers the BOS must be accompanied by a BDAR prepared by an accredited assessor in accordance with the BAM.
***National Parks and Wildlife Act 1974* (NPW Act)**	NSW DCCEEW	The NPW Act provides for the protection of Aboriginal sites and designated conservation areas as well as the flora and fauna within conservation areas. There are no conservation areas declared under the NPW Act that are within Project Area, however the Oolambeyan National Park is adjacent to Project Boundary in the northern section of the wind farm. The objective of the NPW Act is to consolidate and amend the law relating to the establishment, preservation and management of national parks, historic sites, certain other areas, and the protection of certain fauna, native plants and Aboriginal objects.
***Fisheries Management Act 1994* (FM Act)**	Department of Primary Industries and Regional Development (DPIRD) - Fisheries	The objectives of the FM Act are to conserve, develop and share the fishery resources of NSW for the benefit of present and future generations. More detailed objectives relevant to the Project include: • to conserve fish stocks and key fish habitats • to conserve threatened species, populations and ecological communities of fish and marine vegetation

Relevant Legislation	Governing Agency	Summary
		• to promote ecologically sustainable development, including the conservation of biological diversity. An Aquatic Assessment which includes an assessment of the likely impacts on listed aquatic threatened species, populations and ecological communities under the FM Act is provided in **Section 5.5** below.
***Local Land Services Act 2013* (LLS Act)**	Local Land Services (LLS)	The LLS Act, supported by the Local Land Services Regulation 2014 (LLS Regulation), established 11 regional LLS organisations to provide biosecurity, natural resources management and agricultural advisory services. Under Part 5A of the LLS Act and the supporting regulation, a NVR map showing the extent of categorised land in NSW is to be published by the EAH. The NVR map underpins the legislative framework for native vegetation clearing in rural areas by categorising land in NSW. However, the map applies only to the following zones (if they are not in an excluded LGA): Zone RU1 Primary Production, Zone RU2 Rural Landscape, Zone RU5 Primary Production Small Lots and Zone RU6 Transition. Currently, various map categories have been released under staged transitional arrangements. Currently a draft NDR map has been released as part of the staged transitional arrangements. During the transition period landholders and/or proponents must determine if their land is Category 1 or Category 2 under the LLS Act. The BAM does not need to be applied to land mapped as Category 1 – Exempt Land. Portions of the Development Footprint have been mapped as Category 1 – Exempt Land on the extract of the Draft Native Vegetation Regulatory map, provided by the NSW Government for this Project.
Biosecurity Act 2015	DPIRD	The Biosecurity Act replaced the *Noxious Weeds Act 1993* on 1 July 2017. The Biosecurity Act is a wide-ranging legislation that outlines the requirements of government, councils, private landholders, and public authorities in the management of biosecurity matters. Priority weeds are regulated under the Biosecurity Act with a general biosecurity duty to prevent, eliminate or minimize any biosecurity risk they may pose. Some priority weeds have additional management obligations which may apply generally, or under specific circumstances. Any person who deals with any plant, who knows (or ought to know) of any biosecurity risk, has a duty to ensure the risk is prevented, eliminated or minimised as is reasonably practicable.
State Environmental Planning Policy (Biodiversity and Conservation) 2021	DPHI	SEPP (Biodiversity and Conservation) 2021 commenced in March 2022 and includes a number of previous planning policies including Koala Habitat Protection 2019 and Koala Habitat Protection 2021, Chapter 3 and 4, respectively. Schedule 2 identifies that the provisions of chapters 3 and 4 apply in the Edward River LGA. For all RU1 (Primary Production), RU2 (Rural Landscape) or RU3 (Forestry) zoned land outside of the Sydney Metropolitan Area and Central Coast, SEPP Koala Habitat Protection 2020 continues to apply, though it does not establish any specific obligations or considerations for SSD. Koala SEPP 2021 does not apply in Hay or Murrumbidgee LGAs.

1.5 Information Sources

1.5.1 BAM Guidance Documents

The guidance documents and resources specific to the BAM reviewed as part of preparation of this BDAR are detailed in **Table 1.6**.

Table 1.6 Guidance Documents and Resources Relating to the NSW BOS

Resource	Source
Biodiversity Assessment Method (2020a)	NSW Department of Planning, Industry and the environment (DPIE) (superseded) https://www.environment.nsw.gov.au/research-and-publications/publications-search/biodiversity-assessment-method-2020
Biodiversity Assessment Method 2020 Operational Manual – Stage 1 (2022a)	DPE https://www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Animals-and-plants/Biodiversity/biodiversity-assessment-method-2020-operational-manual-stage-1-220279.pdf
Biodiversity Assessment Method Operational Manual – Stage 2 (2023)	DPE https://www.environment.nsw.gov.au/research-and-publications/publications-search/biodiversity-assessment-method-operational-manual-stage-2
Determining native vegetation land categorisation for application in the Biodiversity Offsets Scheme	DPE https://www.environment.nsw.gov.au/research-and-publications/publications-search/determining-native-vegetation-land-categorisation-for-application-in-the-biodiversity-offsets-scheme

1.5.2 Datasets

The NSW and Commonwealth datasets reviewed as part of preparation of this BDAR are detailed in **Table 1.7**.

Table 1.7 NSW Guidance and Resources Reviewed

Resource	Source	Search Parameter
NSW Datasets		
BioNet Vegetation Classification, vegetation information system (VIS)	NSW DCCEEW	Plant Community Type (PCT) descriptions

Resource	Source	Search Parameter
	https://www.environment.nsw.gov.au/topics/animals-and-plants/biodiversity/nsw-bionet – 10/02/2025	
BioNet Threatened Biodiversity Data Collection (TBDC)	NSW DCCEEW https://www.environment.nsw.gov.au/topics/animals-and-plants/biodiversity/nsw-bionet - date accessed 12/02/2025	Threatened entities
BioNet Atlas	NSW DCCEEW https://www.environment.nsw.gov.au/topics/animals-and-plants/biodiversity/nsw-bionet - date accessed 20/01/2025	30 km buffer around the Project Area All valid threatened flora, fauna, ecological community records
Important Area Maps	NSW DCCEEW https://customer.lmbc.nsw.gov.au/assessment/s/userlogin?startURL=%2Fassessment%2Fs%2F – date accessed 05/01/2025	Project Area
Biodiversity Assessment Method Calculator (BAM-C)	NSW DCCEEW (https://customer.lmbc.nsw.gov.au/assessment/s/userlogin?startURL=%2Fassessment%2Fs%2F – date accessed April 2025.	Subject Land
Transitional NVR Map	NSW DCCEEW https://www.lmbc.nsw.gov.au/Maps/index.html?viewer=NVRMap – date accessed 15/02/2025	Project Area
Draft NVR Map	NSW DDCCEW https://www.lmbc.nsw.gov.au/Maps/index.html?viewer=DraftNVRmap – date accessed 15/02/2025	Project Area
Biodiversity Values Map	NSW DCCEEW https://www.lmbc.nsw.gov.au/Maps/index.html?viewer=BOSETMap – date accessed 17/02/2025	Project Area
SEED - The Central Resource for Sharing and Enabling Environmental Data in NSW	NSW DCCEEWhttps://www.seed.nsw.gov.au/ – date accessed 10/01/2025	Project Area
eSPADE v2.0	NSW DCCEEW https://www.environment.nsw.gov.au/eSpade2WebApp - date accessed 10/01/2025	Project Area
NSW WeedWise	DPI (https://weeds.dpi.nsw.gov.au/ - date accessed 10/02/2025	Project Area

Resource	Source	Search Parameter
PlantNet - NSW Flora Online	The Royal Botanic Gardens (https://plantnet.rbgsyd.nsw.gov.au/ - date accessed 13/02/2025	Species descriptions
Register of Declared Areas of Outstanding Biodiversity Value (AOBV)	NSW DCCEEW https://www.environment.nsw.gov.au/topics/animals-and-plants/biodiversity/areas-of-outstanding-biodiversity-value/area-of-outstanding-biodiversity-value-register - date accessed 10/01/2025	Project Area
Commonwealth Datasets		
Protected Matters Search Tool (PMST)	Commonwealth DCCEEW https://www.awe.gov.au/environment/epbc/protected-matters-search-tool - date accessed 20/01/2025	30 km buffer around the Project Area
Register of Critical Habitat	Commonwealth DCCEEW https://www.environment.gov.au/cgi-bin/sprat/public/publicregisterofcriticalhabitat.pl - date accessed 20/01/2025	Project Area
National Flying-fox Viewer	Commonwealth DCCEEW https://www.environment.gov.au/webgis-framework/apps/ffc-wide/ffc-wide.jsf - date accessed 20/01/2025	30 km buffer around the Project Area
Atlas of Groundwater Dependent Ecosystems (GDEs)	Bureau of Meteorology (BoM) http://www.bom.gov.au/water/groundwater/gde/ - date accessed 10/03/2025	Project Area
Climate Data Online	BoM http://www.bom.gov.au/climate/data/?ref=ftr – date accessed 10/03/2025	Hay (Bedarbidgal) (075173) Hay Airport AWS (075019)
Directory of Important Wetlands	Commonwealth DCCEEW https://www.awe.gov.au/water/wetlands/australian-wetlands-database/directory-important-wetlands - date accessed 20/01/2025	30 km buffer around the Project Area
Other		
Atlas of Living Australia Spatial Portal	Atlas of Living Australia https://www.ala.org.au/ - date accessed 20/01/2025	NA

1.5.3 Survey Guidelines

The NSW and Commonwealth surveys guidelines referred to as part of preparation of this BDAR are detailed in **Table 1.8**.

Table 1.8 NSW and Commonwealth Survey Guidelines

Resource	Source
NSW Survey Guidelines	
Threatened reptiles biodiversity assessment method survey guide (2022c)	DPE https://www.environment.nsw.gov.au/research-and-publications/publications-search/threatened-reptiles-biodiversity-assessment-method-survey-guide
Koala *Phascolarctos cinereus* biodiversity assessment method survey guide (2022b)	DPE https://www.environment.nsw.gov.au/research-and-publications/publications-search/koala-phascolarctos-cinereus-biodiversity-assessment-method-survey-guide
Surveying threatened plants and habitats NSW survey guide biodiversity assessment method (2020c)	DPIE https://www.environment.nsw.gov.au/research-and-publications/publications-search/surveying-threatened-plants-and-their-habitats-survey-guide-for-the-biodiversity-assessment-method
Flora species with specific survey requirements (XLS)	NSW DCCEEW https://view.officeapps.live.com/op/view.aspx?src=https%3A%2F%2Fwww.lmbc.nsw.gov.au%2Fbamcalc%2Fapp%2Fassets%2FSurveyMonthsConditions_BAMC_Version1.1.xlsx&wdOrigin=BROWSELINK
Species credit threatened bats and their habitats NSW guide for biodiversity assessment method (2018)	NSW Office of Environment and Heritage (OEH) (superseded) https://www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Animals-and-plants/Threatened-species/species-credit-threatened-bats-survey-guide-180466.pdf
Species credit threatened bats and their habitats NSW guide for biodiversity assessment method (DPIE 2021a)	DPIE https://www.environment.nsw.gov.au/research-and-publications/publications-search/species-credit-threatened-bats-nsw-survey-guide-for-biodiversity-assessment-method
NSW survey guide for threatened frogs (2020b)	DPIE https://www.environment.nsw.gov.au/research-and-publications/publications-search/nsw-survey-guide-for-threatened-frogs
Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities (2004 Working Draft)	NSW Department of Environment and Conservation (DEC) (superseded) https://www.environment.nsw.gov.au/research-and-publications/publications-search/threatened-biodiversity-survey-and-assessment

Resource	Source
Threatened species survey and assessment guidelines: field survey methods for fauna. Amphibians (2009).	NSW Department of Environment and Climate Change (DECC) (superseded) https://www.environment.nsw.gov.au/research-and-publications/publications-search/threatened-species-field-survey-methods-for-fauna-amphibians
Commonwealth Survey Guidelines	
Commonwealth of Australia (2010a), Survey guidelines for Australia's threatened bats: Guidelines for detecting bats listed as threatened under the EPBC Act.	Commonwealth DCCEEW https://www.dcceew.gov.au/environment/epbc/publications/survey-guidelines-australias-threatened-bats
Commonwealth of Australia (2010b), Survey guidelines for Australia's threatened birds (awe.gov.au).	Commonwealth DCCEEW https://www.dcceew.gov.au/sites/default/files/documents/survey-guidelines-birds-april-2017.pdf
Commonwealth of Australia (2011a), Survey Guidelines for Australia's threatened frogs (awe.gov.au).	Commonwealth DCCEEW https://www.dcceew.gov.au/sites/default/files/documents/survey-guidelines-frogs.pdf
Commonwealth of Australia (2011b), Survey guidelines for Australia's threatened mammals (awe.gov.au).	Commonwealth DCCEEW https://www.dcceew.gov.au/environment/epbc/publications/survey-guidelines-australias-threatened-mammals
Commonwealth of Australia (2011c), Survey guidelines for Australia's threatened reptiles (awe.gov.au).	Commonwealth DCCEEW https://www.dcceew.gov.au/environment/epbc/publications/survey-guidelines-australias-threatened-reptiles
Commonwealth of Australia (2011d), Survey guidelines for Australia's threatened fish (awe.gov.au).	Commonwealth DCCEEW https://www.dcceew.gov.au/environment/epbc/publications/survey-guidelines-australias-threatened-fish
Commonwealth of Australia (2013b), Draft survey guidelines for Australia's threatened orchids (awe.gov.au).	Commonwealth DCCEEW https://www.dcceew.gov.au/resource/draft-survey-guidelines-australias-threatened-orchids

1.5.4 Aerial Imagery

The aerial imagery used was taken from ESRI, which sources the imagery from Maxar. Relevant details for the aerial imagery are provided in **Table 1.9**.

Table 1.9 Aerial Imagery Specifications

Release Name	Maps 2023.R06
Date (YYYYMMDD)	15/03/2015 (eastern portion of the site in 2019)
Resolution (m)	0.5
Accuracy (m)	5
Source	Maxar
BlockName	Vivid_Standard_AU24_23Q1

1.6 Limitations of the Assessment

Field surveys for this BDAR were carried out periodically over an approximate 2-year period between May 2022 and May 2024. Additional field surveys were carried out as part of RtS between September 2024 and March 2025.

However, as is the case with all surveys, there are factors that can influence the effectiveness in detecting the full spectrum of flora and fauna species as well as ecological processes likely to occur on the Subject Land. In addition to the surveys undertaken, the full spectrum of flora and fauna species and ecological processes likely to occur on the Subject Land were considered by assessing the potential species to occur on the Subject Land based on previous records, the type and condition of habitats present, the historical and recent land use practices as well as the broader landscape context.

As stated by the DEC (2004) 'The absence of a species from survey data does not necessarily mean it does not inhabit the survey area. It may simply mean that the species was not detected at that time with the survey method adopted and the prevailing seasonal or climatic conditions.' Accordingly, the relative brevity of the survey and its timing mean that the full spectrum of flora and fauna species, as well as ecological processes, likely to occur on the Subject Land cannot be fully quantified or described in this report.

The data produced by the surveys undertaken for the current assessment is intended only to be indicative of the types of species that could occur and not an absolute census of all fauna and flora species of the Subject Land. Although many species were detected during field surveys, additional species are likely to be present that have not been observed.

Factors such as seasonality including drought, current land use practices such as grazing, population density and cryptic life histories can all affect the ability to detect species on ground.

To address the above limitations, surveys were conducted at specific times of year to optimise detectability, in accordance with relevant guidelines, and where appropriate, a precautionary approach was used to assess impacts to threatened species. All species were assessed on the basis of the presence of their habitat and the likely significance of that habitat in supporting a viable local population.

Any specific limitation relating to native vegetation assessment and threatened species surveys are detailed within **Section 4.1** and **Section 5.3** accordingly.

2.0 The Project

2.1 Project Overview

The Project is a proposed wind farm which includes the installation, operation, maintenance and decommissioning of up to 143 WTGs (see note below), battery storage, ancillary infrastructure and temporary facilities associated with construction of the Project.

Section 1.2.3 above describes a design update that is being considered for the Project, where the proposed layout of a 143 WTGs is being revised to 141 WTG through the removal of WTG 37 and 38. Given this design change has occurred late in the revised assessment phase for the Project, this Amended BDAR includes the maximum proposed impacts for the Project associated with the larger 143 WTG layout. DPHI have been consulted and are supportive of this approach.

A detailed description of the Project can be found within Appendix 1 of the Amendment Report.

2.2 Project Location and Context

The Project is located on the Hay Plains of south western NSW, within the South West REZ. The Project is located approximately 36 km south east of Hay, 66 km north east of Deniliquin and 100 km south west of Griffith. Smaller townships of Darlington Point, Coleambally and Jerilderie are located to the north east and south east of the Project.

The Project Area encompasses approximately 20,629 ha of predominantly grazing land and adjoins the Oolambeyan National Park, which is located directly north. The Project Area is zoned as RU1 Primary Production within the Hay Local Environment Plan (LEP) 2011, the Murrumbidgee LEP 2013 and Conargo LEP 2013. The Disturbance Footprint considered in this BDAR is 660.96 ha, comprising:

- 642 ha of disturbance wholly contained within the Project's Development Corridor, to facilitate the construction of WTGs, ancillary infrastructure and temporary facilities, which equates to approximately 3% of the total Project Area
- ~19 ha of disturbance associated with off-site road works on the Project's Local Transport Route.

Separate BDARs have been prepared relating to off-site road works on the Project's Port to Hay Transport Routes (**Appendix J** and **Appendix K**). As such, these works are not discussed further in this report.

2.3 Key Project Features

The key components of the Project include:

- Up to 143 (three blade) WTGs, with a maximum blade-tip height of 300 m above ground.
- A 359 MW / 718 MWh (two-hour) battery energy storage facility.

- Permanent ancillary infrastructure including internal roads, hardstands, main and collector substations, switchyards, operations and maintenance facilities, underground and overhead electricity transmission lines and poles, telecommunications facilities and utility services, permanent meteorological masts and water storage tanks.

- Temporary facilities including the temporary workforce accommodation (TWA), site offices, amenities, construction compounds and laydown areas, on-site borrow pits, rock crushing facilities, concrete or asphalt batching plants, minor 'work front' construction access roads, environmental management and monitoring and signage.

- Off-site road works, involving upgrades to the proposed local transport route and establishment of site access points to facilitate delivery of wind turbine components to the Project Area as required. This includes 14 site access points off Jerilderie Road, North Boundary Road and Bullawah Road. Of these, 13 site access points would be designed and constructed to accommodate oversize, overmass (OSOM) vehicle movements and one would provide vehicle access to the TWA, via Bullawah Road.

- Peak construction workforce of approximately 380 Full FTE positions (estimated average 182 FTE positions over the duration of construction).

- Operational workforce of 40 FTE positions.

- Construction timeframe is approximately 35 months, indicatively commencing in Q4 of 2025 and concluding in Q4 of 2028.

- Construction and decommissioning activities will occur between 7:00 am to 6:00 pm Monday to Friday, and 8:00 am to 1:00 pm Saturday, except during specific circumstances.

- During the operational phase, the Project would operate 24 hours per day, seven days per week.

All impacts associated with Asset Protection Zones (APZs) and fencing requirements have been considered within the current Project layout and designed to occur within the Disturbance Footprint assessed within this report. The APZs were established as per the Bush Fire Hazard Assessment, and their scale and extent factored into the design. A detailed fencing design/layout would be prepared during the detailed design phase of the Project.

Staged Construction and Grid Connection

BWF is seeking approval to construct, operate and decommission the proposed Project under a single development consent. However, BWF is seeking flexibility to construct, operate, re power and/or decommission the Project in stages of various sizes or permutations within the limits of the development consent, should the Project be approved. Staging would be determined post development consent and subject to detailed design and procurement processes.

- For the purposes of assessment in this EIS, it has been assumed that the Project will be constructed and operated in two (2) stages: Stage 1 (South) would involve the construction and operation of all Project infrastructure located south of North Boundary Road, including 58 WTGs (WTG 86 to WTG 143). Stage 1 (South) would connect to the existing Transgrid 220 kilovolt (kV) transmission line which runs through the Project Area in an east to west direction. Stage 1 (South) therefore includes all proposed 220 kV transmission infrastructure, including a small portion which extends north of North Boundary Road.

- Stage 2 (North) would involve the construction and operation of all other Project infrastructure located north of North Boundary Road, including 85 WTGs (WTG 1 to WTG 85). Stage 2 (North) will connect to the 330 kV Eastern Section of Project EnergyConnect, which is now under construction, which will also run through the Project Area in an east to west direction.

BWF has identified that construction of Stage 2 (North) is likely to commence sooner than was previously indicated in the Project EIS, and may commence prior to Stage One (South). In the event that Stage 2 (North) commences first, then the TWA facility, which is physically located within Stage 1 (South) would need to be established as part of Stage 2 (North). Final Project staging, and associated disturbance footprints, would be confirmed during detailed design.

The commencement of each stage will be dependent on BWF securing the necessary access rights for grid connection in each stage.

Turbine Dimensions

Some aspects of the design may change during detailed design. This flexibility will allow the final Project design to be optimised and the most appropriate and efficient infrastructure selected while still ensuring the Project's impacts remain generally in accordance with (or less than) those assessed in this Amended BDAR.

Following further optimisation of the Project layout and design, BWF has identified a maximum alternative turbine size (being a tip height of up to 233 m, a hub height of up to 148 m and a blade length of up to 80 m). The alternative turbine size was utilised for the purposes of identifying and assessing required road upgrades to the Port to Hay Transport Routes. However, due to the extent of renewable energy development proposed within the South West Renewable Energy Zone (REZ), it is possible that road upgrades to accommodate a larger turbine (with a blade length exceeding 80 m) will be undertaken along some or all of the proposed Port to Hay Routes either by the NSW Government or by a third party developer. Should these upgrades be undertaken prior to the Project's construction period, BWF is seeking flexibility to transport and install a larger turbine, provided that:

- The proposed WTG dimensions do not trigger the need for any additional off-site road works.
- The maximum WTG dimensions do not exceed a tip height of 300 m, a hub height of 200 m and a blade length of 100 m.

Relevant assessments in the Project EIS and subsequent Amendment Report have therefore considered the 'worst case' for each of the Project components (such as WTG height and blade length, etc). Accordingly, this Amended BDAR has adopted the following approach:

- The Disturbance Footprint and blade overhang areas are conservatively based on the maximum proposed turbine dimensions (being a tip height of 300 m).
- The Prescribed Impact Assessment (**Appendix D**) considers two (2) turbine dimension scenarios, based on tip heights of 300 m and 233 m.

3.0 Site Context

3.1 Assessment Areas

The following key assessment areas and boundaries used in this BDAR are detailed in **Table 3.1**.

Table 3.1 Key Assessment Areas and Boundaries

Name	Details	Area (ha)	Figure reference
Project Area	The Project Area encompasses all land within and including the Project Boundary.	20,627.56	**Figure 1.2**
Project Boundary	The outer boundary of the Project Area. The Project Boundary is the maximum spatial extent of potential land access defined by the boundaries of the host landholder properties (i.e. all agreed lots owned by host landholders).	-	**Figure 1.2**
Subject Land	The land subject to the proposed development. For the purposes of this assessment, the Subject Land is the area within which all proposed Project infrastructure will be placed, and all Project-related ground disturbance will occur. The Subject Land is equivalent to the 'Development Corridor' described within the EIS. The Subject Land is of variable width (to avoid key site constraints) and has been designed to provide some flexibility for micro-siting.	4,330.41	**Figure 3.1**
Development Footprint	The area of land that is directly impacted by the proposed development. The Development Footprint is equivalent to the total area of impact for the Disturbance Footprint (~642 ha) and Local Area Transport Route (~19 ha) identified within the EIS. The Disturbance Footprint identified in the EIS is indicative. The actual location and extent of the Disturbance Footprint will be determined prior to construction, subject to the micro-siting provisions outlined in the EIS.	660.96	**Figure 3.1**
Stage 1 Development Footprint	Portions of the Development Footprint which will be directly impacted as part of Stage 1 of the Project. Stage 1 of the Project includes the construction and operation of the Project south of North Boundary Road, as well as the majority of proposed disturbance associated with offsite road works.	292.84	**Figure 3.1**
Stage 2 Development Footprint	Portions of the Development Footprint which will be directly impacted as part of Stage 2 of the Project. Stage 2 of the Project includes the construction and operation of the Project north of North Boundary Road, including the associated site access points.	368.12	**Figure 3.1**
Operational Footprint	The Operational Footprint comprises portions of the Subject Land that will be subject to ongoing operational use as a result of the Project which may result in impacts that are direct, indirect, or prescribed in nature.	664.79	**Figure 1.2**

Name	Details	Area (ha)	Figure reference
Blade Overhang Areas	Areas within the Project Area within which WTG blades fall outside with Subject Land. These areas will be subject to ongoing prescribed impacts from potential bird and bat strike and barotrauma during Project operation.	3.83	**Figure 1.2**
Landscape assessment area	The Subject Land and the area of land within a 500-metre or 1500-metre buffer of the Subject Land that is determined as per Subsection 3.1.2 of the BAM. For the purposes this assessment, a 1500-metre buffer has been applied to the site-based assessment areas within Stage 1 of the Project. A 500 m buffer has been applied to the linear assessment areas within Stage 1 and Stage 2 of the Project.	22,111.82	**Figure 3.2**
Locality	Land within a 30-km radius of the Subject Land.	503,592.70	**Figure 3.1**

Section 3.1.2 of the BAM requires the assessor to determine the assessment area around the Subject Land based on whether the project is linear, or site based. The BAM defines the following development types:

- Linear-shaped development: development that is generally narrow and extends across the landscape; for example, major roads, rail lines.
- Multiple fragmentation impact development: developments such as wind farms and coal seam gas extraction that require multiple extraction points (wells) or turbines, and a network of associated development such as roads, tracks, gathering systems/flow lines and transmission lines.
- Site-based development: a development other than a linear-shaped development, or a multiple fragmentation impact development.

The assessment area forms part of the landscape assessment within which per cent native vegetation cover is calculated, as described within Section 3.2 of the BAM. The method of assessment (linear or site-based) also affects whether the biodiversity values are assessed across one or more IBRA subregions when the Subject Land falls across multiple. Both IBRA subregion selection and per cent native vegetation cover are used as filters within the BAM-C to predict threatened species likely to occur or use habitat on the Subject Land.

Within the Project Area, the Subject Land is comprised of a single ~230-m-wide corridor with an area of approximately 4,312 ha. All project related infrastructure, including WTG pads, access roads and ancillaries are located within the Subject Land. That corridor is comprised of multiple arms across an area of approximately 22.5 km from east to west, and 15 km from north to south. As this portion of the Subject Land is linear and multiple fragmentation in nature, this assessment has adopted the linear assessment method, with a 500 m buffer placed around the 230-m-wide Subject Land corridor within the Project Area, in accordance with Section 3.1.2 of the BAM (**Figure 3.1**).

Outside the Project Area, the Subject Land is comprised of three discreet disturbance areas that will be used as laydowns and ancillary sites to support Stage 1 construction. The offsite disturbance areas vary in width and length but are not linear in shape or multiple fragmentation in nature. As this portion of the Subject Land is not linear and multiple fragmentation in nature, this assessment has adopted the site-based assessment method, with a 1,500 m buffer placed around each of the offsite disturbance areas, in accordance with Section 3.1.2 of the BAM (**Figure 3.2**).

All parts of the Subject Land (i.e. the section of the Subject Land which falls within the Project Area, as well as the offsite disturbance areas) fall within the Riverina IBRA bioregion and Murrumbidgee IBRA subregion. Furthermore, the per cent native vegetation cover for all the discrete portions of the Subject Land exceeds >70% (see **Section 3.3** below). As such, the threatened species that are predicted to likely to occur or use habitat on the Subject Land would be the same irrespective of whether the linear assessment approach or site-based assessment approach was selected.

- For the purposes of assessment in the Amended BDAR, it has been assumed that the Project will be constructed and operated in two (2) stages:

- Stage 1 (South) would involve the construction and operation of all Project infrastructure located south of North Boundary Road, including 58 WTGs (WTG 86 to WTG 143). Stage 1 (South) would connect to the existing Transgrid 220 kilovolt (kV) transmission line which runs through the Project Area in an east to west direction. Stage 1 (South) therefore includes all proposed 220 kV transmission infrastructure, including a small portion which extends north of North Boundary Road.

- Stage 2 (North) would involve the construction and operation of all other Project infrastructure located north of North Boundary Road, including 85 WTGs (WTG 1 to WTG 85). Stage 2 (North) will connect to the 330 kV Eastern Section of Project EnergyConnect, which is now under construction, which will also run through the Project Area in an east to west direction.

Due to the Project being staged, and the assessment adopting both linear and site-based assessment approaches, three BAM-C child-cases were completed for this assessment. The relevant details for each case are provided in **Table 3.2**.

Table 3.2 BAM-C Cases Associated with the Project

Assessment Area	Case Number	Assessment Approach
Stage 1 – Linear	00047468/BAAS18032/24/00047469	Linear
Stage 1 – Site based	00047468/BAAS18032/24/00047471	Site based
Stage 2 – Linear	00047468/BAAS18032/24/00047470	Linear

3.2 Landscape Features

The Subject Land is approximately 4,330 ha in size, comprising of a mix of native grassland and open woodland in a rural landscape. The elevation of the Subject Land is between 94.4 m and 103.2 m Australian Height Datum (AHD), a difference of less than 10 m between the highest and lowest points of the Project Area.

The Subject Land is located within the Murrumbidgee IBRA Subregion, in the Riverina Bioregion of NSW. The Riverina Bioregion is an ancient riverine plain and alluvial fan composed of unconsolidated sediments with evidence of former stream channels. Vegetation across the bioregion consists of River Red Gum and Black Box forests, box woodlands, saltbush shrublands, extensive grasslands and swamp communities.

The Murrumbidgee Subregion blankets four Mitchell landscapes: Murrumbidgee Depression Plains, Murrumbidgee Scalded Plains, Murrumbidgee Source-bordering Dunes, and Murrumbidgee Channels and Floodplains. The Murrumbidgee Subregion is characterised by alluvial fan with distributary channels and floodplains, undulating plains with depressions. Vegetation consists of River Red gum and River Cooba on channels with Black Box, Lignum, and Old Man Saltbush on floodplains. White Cypress appears on dunes, with Myall, grasses, and saltbush formally being widespread on back plains.

The majority of the Subject Land is primarily comprised of native grassland and chenopod shrubland, with a smaller proportion of the vegetation consisting of a mosaic of freshwater wetlands and open woodland. River Red Gum – Black Box Woodland wetland of the semi-arid (warm) climatic zone, fringes the Coleambally Outfall Drain throughout the Subject Land. The vegetation within the Subject Land is subject to ongoing agricultural disturbance, primarily cattle and sheep grazing and low levels of pasture improvement. A small proportion of Subject Land is comprised of cleared and disturbed land, which is sown with exotic grasses.

No Important Wetlands occur within the Subject Land (**Figure 3.3**). The closest wetland areas of significance are the mid-Murrumbidgee Wetlands located approximately 25 km north of the Subject Land. Booligal Swamp is located approximately 130 km north of the Subject Land. One wetland of international importance, NSW Central Murray Forests, is located approximately 80 km south west of the Project Area. The Coleambally Outfall Drain is an east to west connectivity irrigation drain that provides outflow to creeks south-west of Coleambally. It provides outflow to Eurolie Creek to the west, Carroonboon Creek and Werkenbergal Swap wetland areas to the south-west of the Project Area and traverses through South West Woodland Nature Reserve. It also provides connectivity to Blind Creek to the east of the Project Area and Bowna Swamp, then connecting to Bublebundie Creek.

Oolambeyan National Park is located along the north-eastern boundary of the Project Area, approximately 200 m north of the Subject Land. The vegetation along the boundary of the national park is consistent with that within the Subject Land, consisting of native grassland and chenopod shrubland. Two conservation agreements have been established within the bounds of the Project Area. These include;

- A conservation agreement (CA0465) made under the BC Act.
- Land management agreements made by Murray Local Land Services (LLS) under the Regional Land Partnerships Program.

The purpose of each of these agreements is to conserve and maintain existing primary habitat for the Plains-wanderer which is present in patches of suitable habitat types across the Subject Land. The Project's Development Footprint has been specifically designed to avoid all areas of mapped Plains-wanderer primary habitat, and existing land management practices within the areas of primary habitat would be maintained over the life of the Project, consistent with the obligations of those agreements. There are no areas of karst, caves, crevices, cliffs, rocks or other geological features of significance in the Project Area. Soils found within the Project Area are Chromosols and Rudosols, forming scattered patches within the Subject Land of areas with very severe wind erosion capabilities and moderate to severe acidification hazard capabilities.

Landscape features are described in **Table 3.3**.

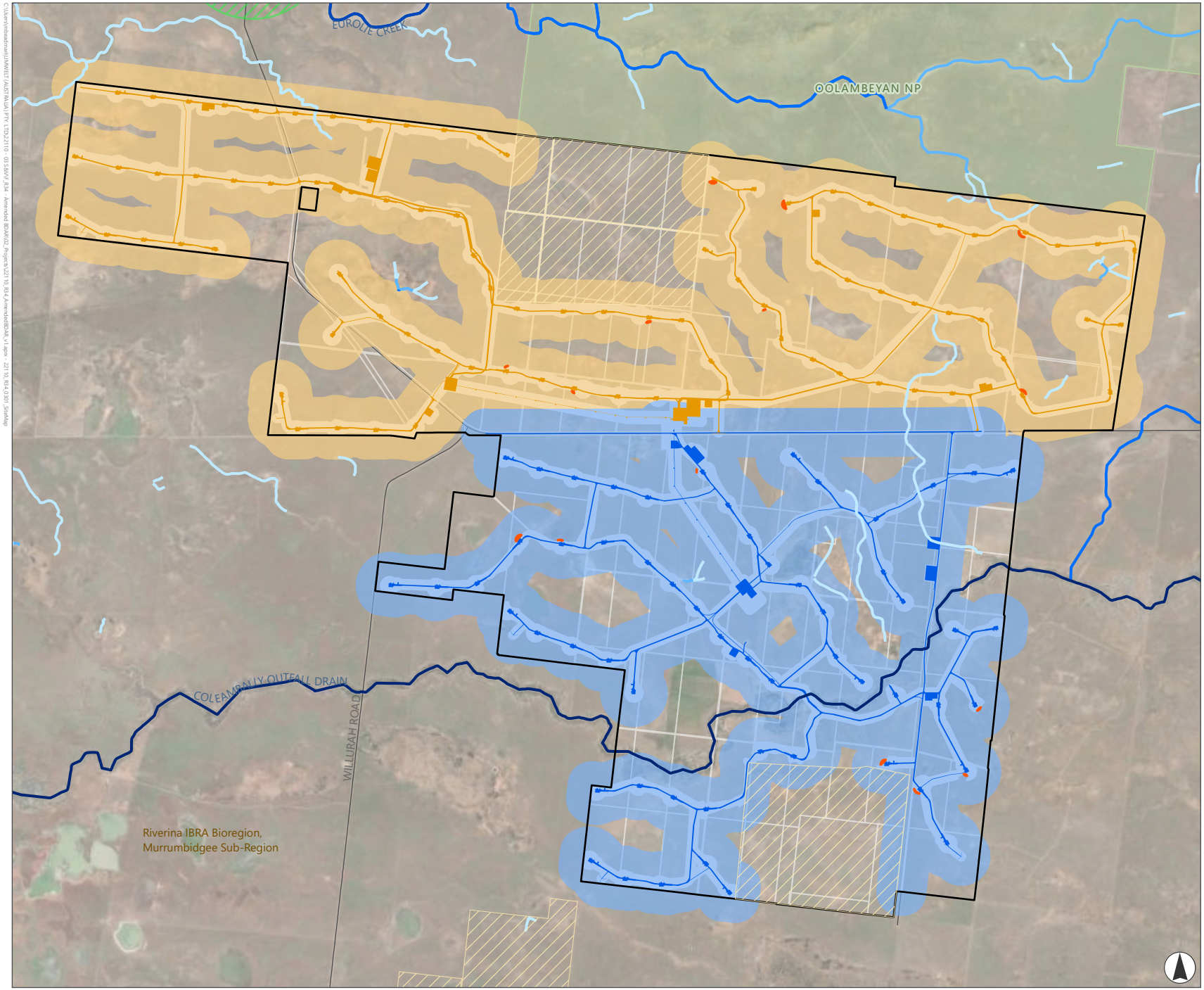
Table 3.3 Landscape Features

Landscape Feature	Landscape Assessment Area
IBRA bioregions and subregions	• Bioregion – Riverina • Subregion – Murrumbidgee.
NSW (Mitchell) landscapes	• Murrumbidgee Depression Plains • Murrumbidgee Scalded Plains • Murrumbidgee Source-bordering Dunes • Murrumbidgee Channels and Floodplains.
Native vegetation cover class	• >70%
Cleared areas	Within the Subject Land, there are minor areas of cleared land associated with residential dwellings, access tracks, farm dams, and isolated paddocks where exotic grasses are sown, presumably for livestock feed.
Rivers, streams and estuaries	• Coleambally Outfall Drain occurs within the Subject Land. • Eurolie Creek, Nyangay Creek and Abercrombie Creek another three named waterways that occur in the Project Area. • A number of ephemeral first order streams are present within the Subject Land and Project Area.
Wetlands	One wetland of international importance, NSW Central Murray Forests, is located approximately 80 km south west of the Project Area. The Murrumbidgee catchment includes several floodplains and wetlands, including the mid-Murrumbidgee River Wetlands. The mid-Murrumbidgee Wetlands are of national importance, located along the Murrumbidgee River between Narrandera and Carrathool, approximately 25 km north of the Project Area. Wetlands occur ephemerally onsite as woodland, shrubland and grassland forms, in the following PCTs: • PCT 13 - River Red Gum - Black Box woodland wetland of the semi-arid (warm) climatic zone fringing the Coleambally Outfall Drain. • PCT17 - Lignum shrubland wetland of the semi-arid (warm) plains (mainly Riverina Bioregion and Murray Darling Depression Bioregion). • PCT24 - Canegrass swamp tall grassland wetland of drainage depressions: lakes and pans of the inland plains. • PCT160 - Nitre Goosefoot shrubland wetland on clays of the inland floodplains. The woodland form occurs primarily along the edges of the Coleambally Outfall Drain, while the shrubland and grassland forms occur throughout the Subject Land in areas of small depressions. In periods of high rainfall, it is likely that water would hold across much of the landscape for a short amount of time, due to the very small differences in elevation.

Landscape Feature	Landscape Assessment Area
Connectivity features	The Subject Land primarily contains agricultural land with grazed grasslands and small patches of shrubland. Opportunities for wildlife movement across these landscapes would be limited to more mobile species such as large sized birds. During periods of high rainfall, it is likely that much of the Subject Land would be conducive to the movement of threatened amphibian species between more permanent water sources such as farm dams. The only significant source of habitat connectivity occurs in the treed vegetation along the Coleambally Outfall Drain, and the drain itself. The area provides east-west connectivity in the southern part of the Project Area, potentially for a variety of threatened species such as woodland birds, amphibians, reptiles, and mammals. The canopy is grazed underneath, and the drain itself is a highly managed, constructed watercourse with minimal potential to provide connectivity to medium or large fish species.
Areas of geological significance and soil hazard features	• Soils prone to wind erosion. • Land capability generally has moderate-severe limitations with scattered small areas with very severe limitations. • No karsts, caves, crevices, cliffs, rocks present within the Subject Land. • No acid sulfate soils present within the Subject Land.
Areas of outstanding biodiversity value (AOBV)	No AOBV are present within the Subject Land.
Important Habitat Mapping	Important habitat for Plains Wanderer has been mapped within the Project Area. No areas of Important Habitat Mapping fall within the Subject Land (**Figure 3.5**).
Biodiversity Values Mapping	Biodiverse riparian land is mapped within the Subject Land. Areas mapped as containing Threatened species or communities with potential for serious and irreversible impacts occur within the Project Area, but not within the Subject Land (**Figure 3.6**).
National Parks Estate and Conservation Areas	Oolambeyan National Park is located along the north-eastern boundary of the Project Area, approximately 200 m north of the Subject Land. Two conservation agreements have been established within the bounds of the Project Area with the purpose of conserving and maintaining primary habitat for the Plains-wanderer. These include: • A conservation agreement (CA0465) made under the BC Act. • Land management agreements made by Murray Local Land Services (LLS) under the Regional Land Partnerships Program.
Additional landscape features identified within the SEARs	None.

FIGURE 3.1.1

Site Map



Legend

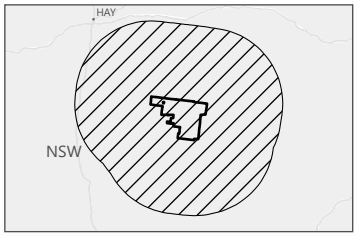
- Project Boundary
- Subject Land
- Stage 1 (South) Development Footprint
- Stage 2 (North) Development Footprint
- Blade Overhang Area
- Conservation Agreement Area
- Locality
- Property Boundaries
- NPWS Reserves
- Road
- Watercourse

Strahler Stream Order

- 1
- 2
- 3
- 4
- 5+

Assessment Area

- Stage 1 - Linear
- Stage 1 - Site Based
- Stage 2 - Linear



0 1,000 2,000

Meters

Scale 1:110,000 at A4

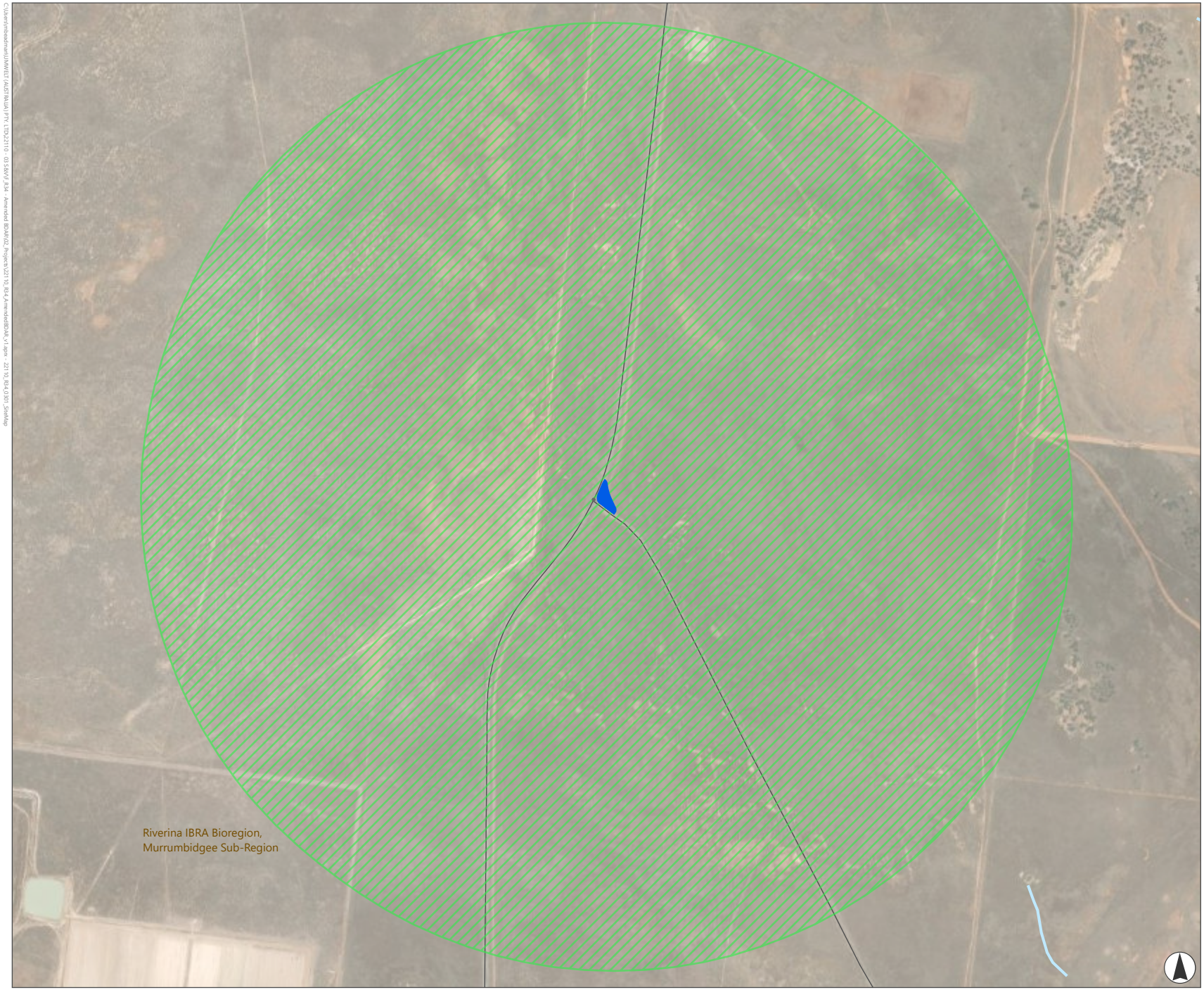
GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

FIGURE 3.1.2

Site Map



Legend

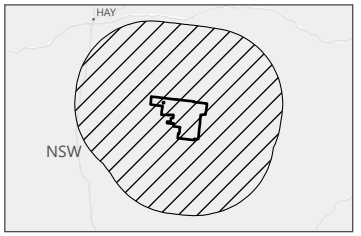
- Stage 1 (South) Development Footprint
- Locality
- Road

Strahler Stream Order

- 1

Assessment Area

- Stage 1 - Site Based



0 210 420

Meters

Scale 1:17,500 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

C:\Users\mbeadman\UMWELT (AUSTRALIA) PTY LTD\22110 - 03.5KMV_R34 - Amended IBAR\02. Projects\22110_R34 Amended IBAR.v1.aprx - 22110_R34.0301_SiteMap

FIGURE 3.1.3

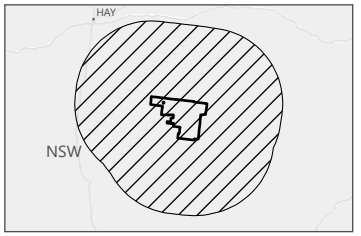
Site Map

Legend

- Stage 1 (South) Development Footprint
- Locality
- Road

Assessment Area

- Stage 1 - Site Based



0 210 420

Meters

Scale 1:17,500 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

C:\Users\mbeadman\UMWELT (AUSTRALIA) PTY LTD\22110 - 03.SAVY. R34 - Amended IBRA\02. Projects\22110_R34_AmendedIBRA\5_v1.aprx - 22110_R34_0301_SiteMap

FIGURE 3.1.4

Site Map

Legend

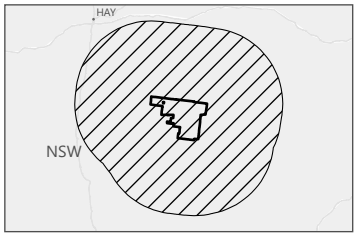
- Stage 1 (South) Development Footprint
- Locality
- Road
- Watercourse

Strahler Stream Order

- 1
- 3
- 4

Assessment Area

- Stage 1 - Site Based



0 210 420

Meters

Scale 1:17,500 at A4

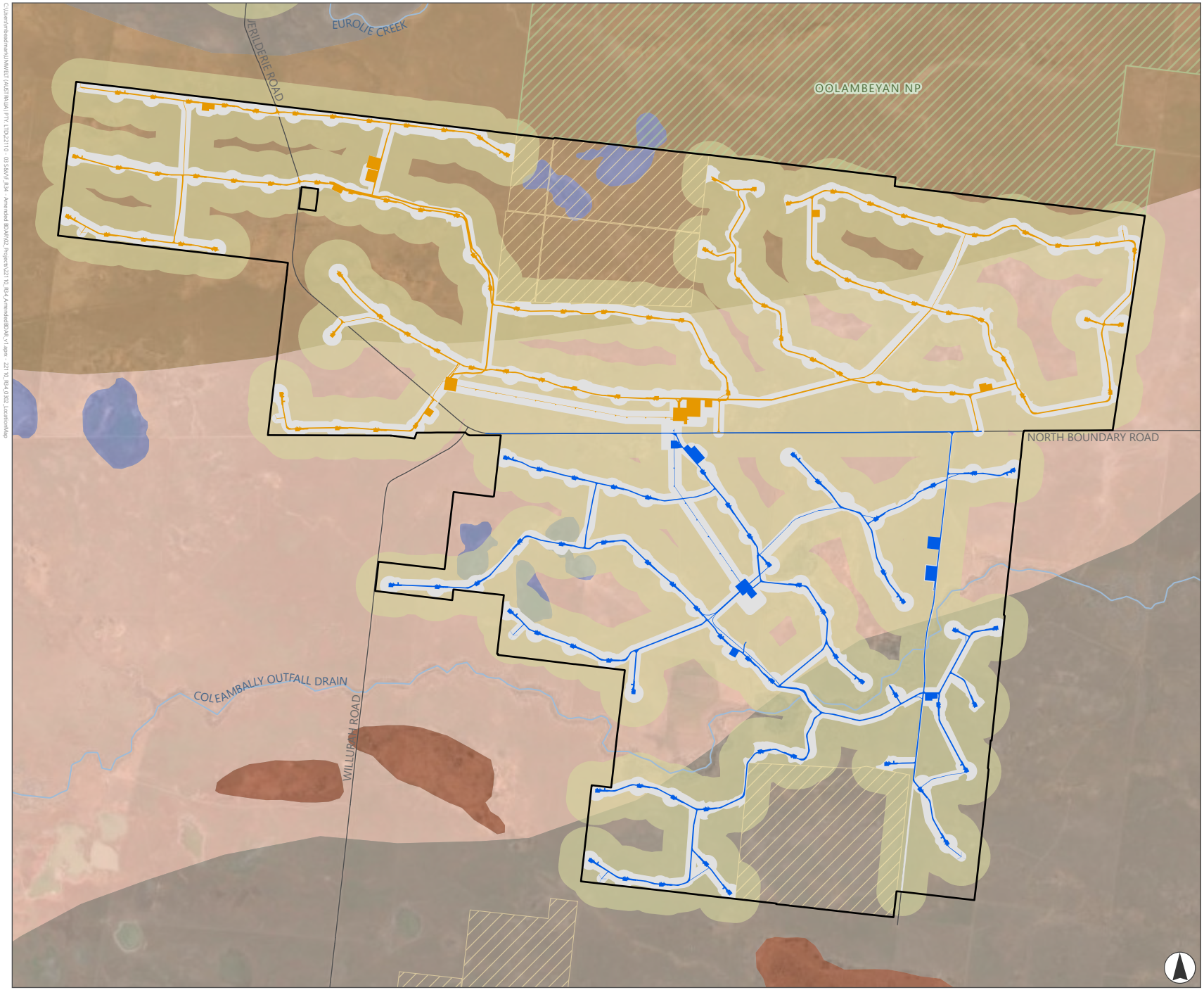
GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

FIGURE 3.2.1

Location Map



Legend

- Project Boundary
- Subject Land
- Stage 1 (South) Development Footprint
- Stage 2 (North) Development Footprint
- Assessment Area
- Conservation Agreement Area
- NPWS Reserves
- Road
- Watercourse

NSW (Mitchell) Landscapes

- Murrumbidgee Channels and Floodplains
- Murrumbidgee Depression Plains
- Murrumbidgee Lakes, Swamps and Lunettes
- Murrumbidgee Scalded Plains
- Murrumbidgee Source-bordering Dunes

0 1,000 2,000

Meters

Scale 1:110,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

FIGURE 3.2.2

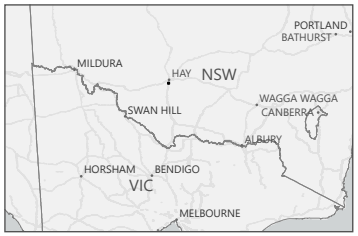
Location Map

Legend

- Stage 1 (South) Development Footprint
- Assessment Area
- Road

NSW (Mitchell) Landscapes

- Murrumbidgee Depression Plains
- Murrumbidgee Scalded Plains



0 210 420

Meters

Scale 1:17,500 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

C:\Users\mbeadman\UMWELT (AUSTRALIA) PTY LTD\22110 - 03.5.6MVF_R34 - Amended IBDAR\02_Projects\22110_R34_AmendedIBDAR_v1.aprx - 22110_R34.0302_LocationMap

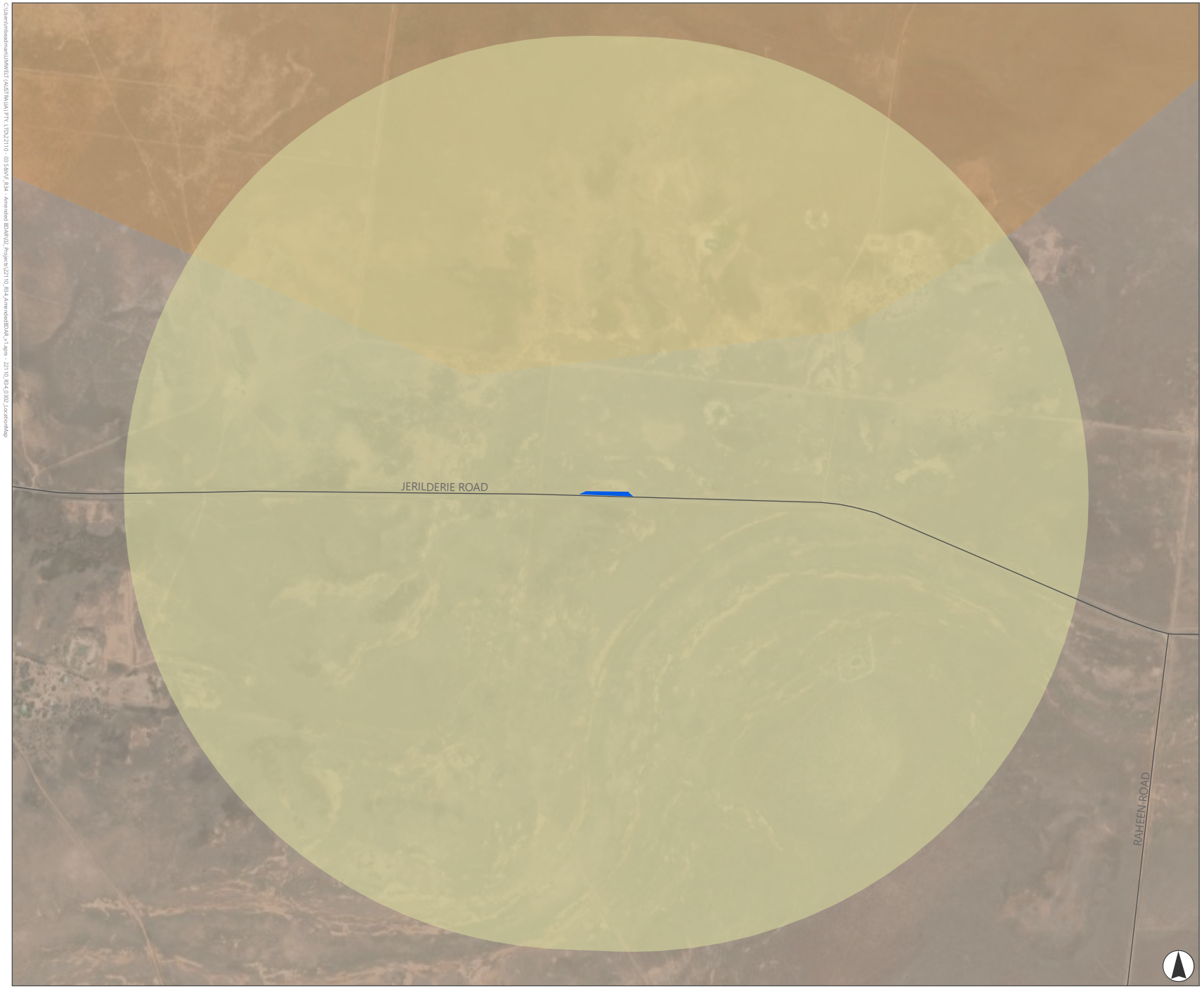


FIGURE 3.2.3

Location Map

Legend

- Stage 1 (South) Development Footprint
- Assessment Area
- Road

NSW (Mitchell) Landscapes

- Murrumbidgee Channels and Floodplains
- Murrumbidgee Scalded Plains

0 210 420

Meters

Scale 1:17,500 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

C:\Users\mbeadman\UMWELT (AUSTRALIA) PTY LTD\22110 - 03.5.6AVY_R34 - Amended BDAR\02_Projects\22110_R34_Amended BDAR_v1.aprx - 22110_R34.0302_LocationMap

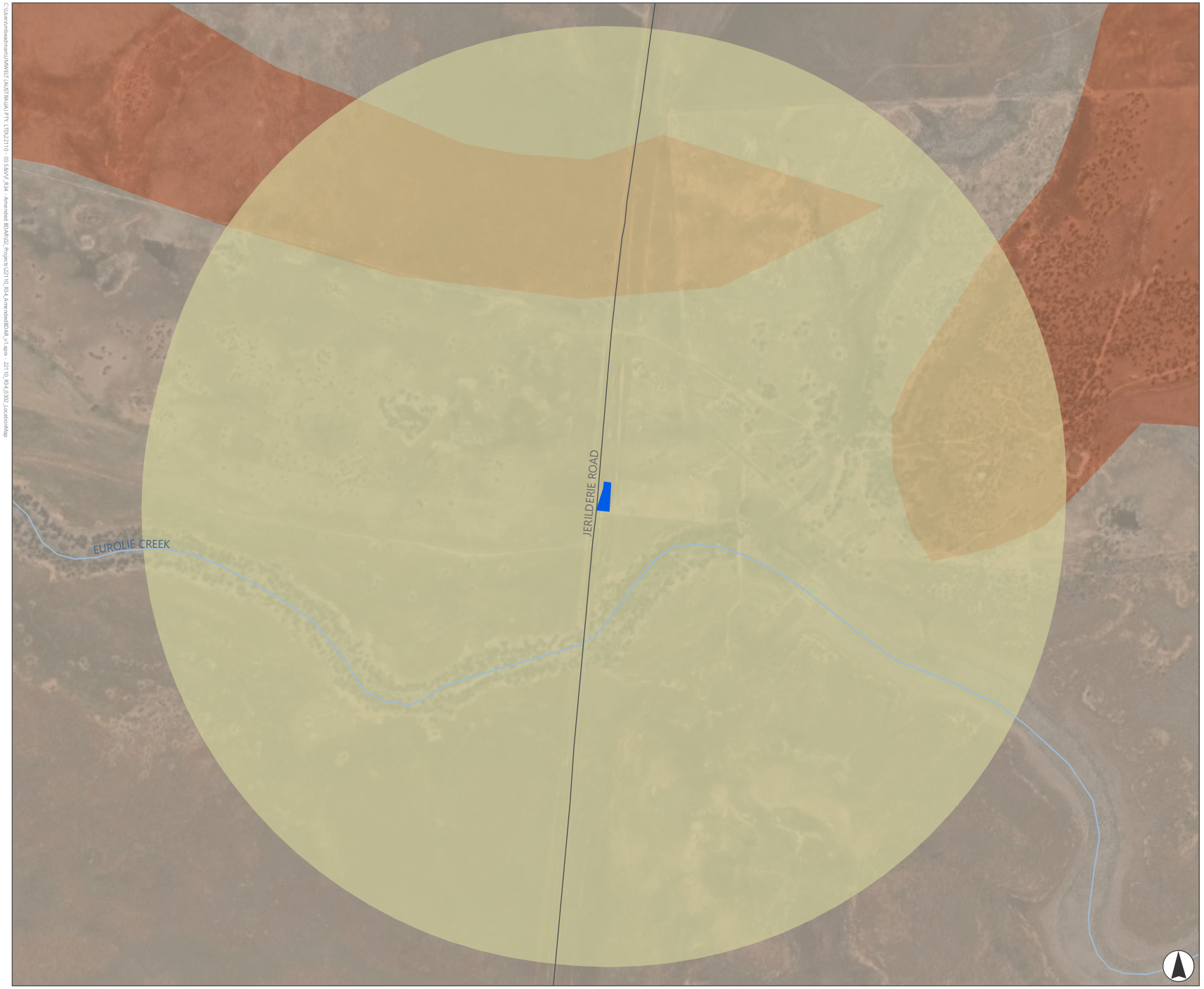


FIGURE 3.2.4

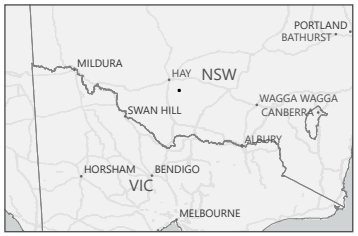
Location Map

Legend

- Stage 1 (South) Development Footprint
- Assessment Area
- Road
- Watercourse

NSW (Mitchell) Landscapes

- Murrumbidgee Scalded Plains
- Murrumbidgee Source-bordering Dunes



0 210 420

Meters

Scale 1:17,500 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

C:\Users\mbeadman\UMWELT (AUSTRALIA) PTY LTD\22110 - 03.5KV\1_R34 - Amended IBDAR\02_Projects\22110_R34_AmendedIBDAR_v1.aprx - 22110_R34_0302_LocationMap

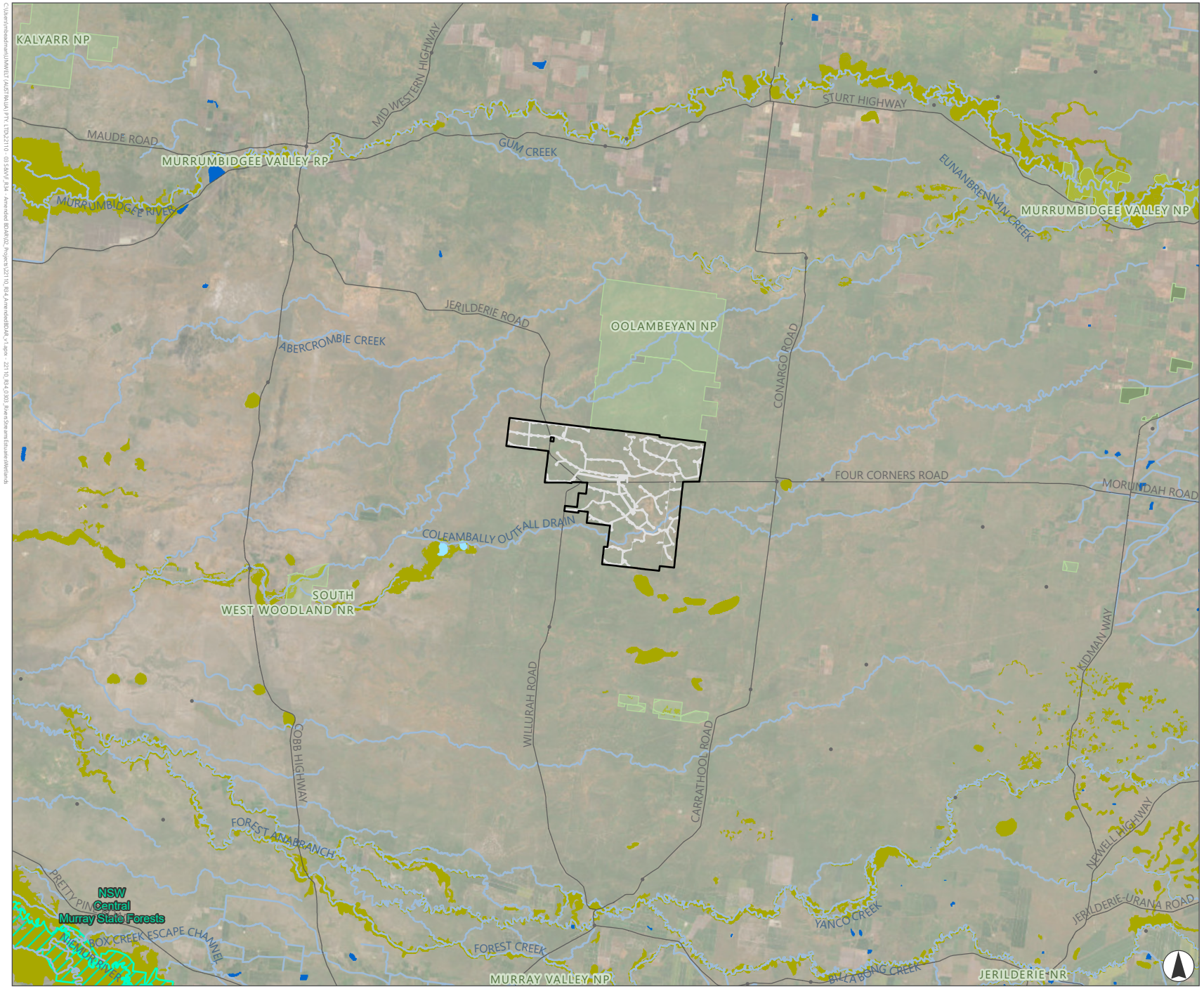
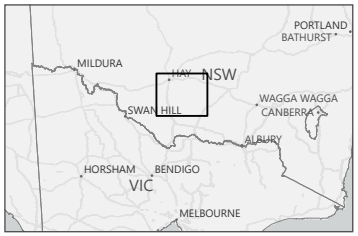


FIGURE 3.3

Rivers, streams, estuaries, and wetlands downstream of the Subject Land

Legend

- Project Boundary
- Subject Land
- NPWS Reserves
- State Forest
- Ramsar Wetlands
- Floodplain Wetland
- Freshwater Lake
- Reservoir
- Watercourse
- Road



0 5 10

Kilometres

Scale 1:600,000 at A4

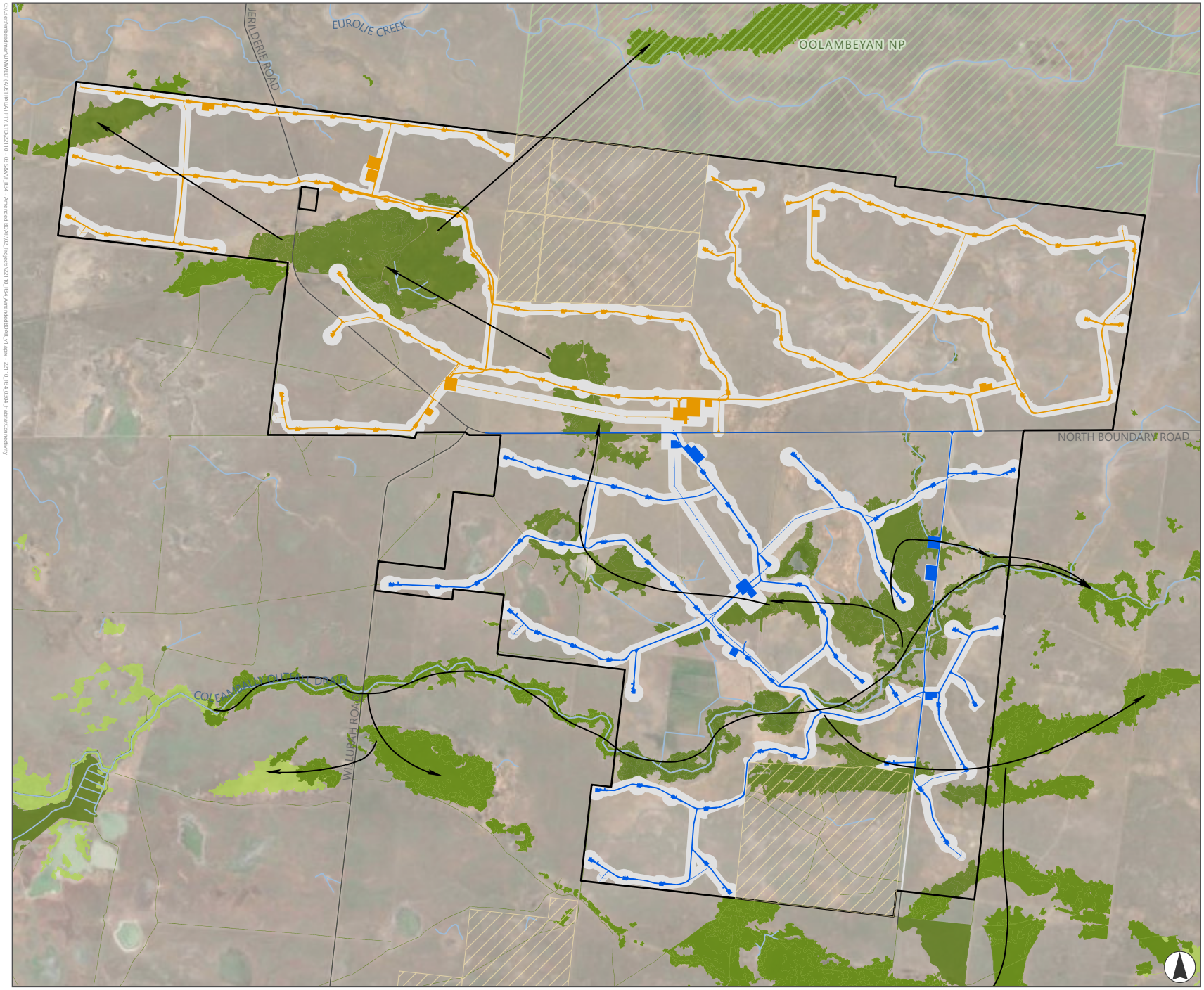
GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

FIGURE 3.4.1

Habitat Connectivity



Legend

- Project Boundary
- Subject Land
- Stage 1 (South) Disturbance Footprint
- Stage 2 (North) Disturbance Footprint
- Conservation Agreement Area
- Woody Vegetation Formation (Umwelt)
- Woody Vegetation Formation (SVTM)
- NPWS Reserves
- Habitat Connectivity
- Road
- Hydroline

0 1,000 2,000

Meters

Scale 1:110,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

FIGURE 3.4.2

Habitat Connectivity

Legend

- Stage 1 (South) Disturbance Footprint
- Woody Vegetation Formation (SVTM)
- Habitat Connectivity
- Road
- Hydroline

0 210 420

Meters

Scale 1:17,500 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

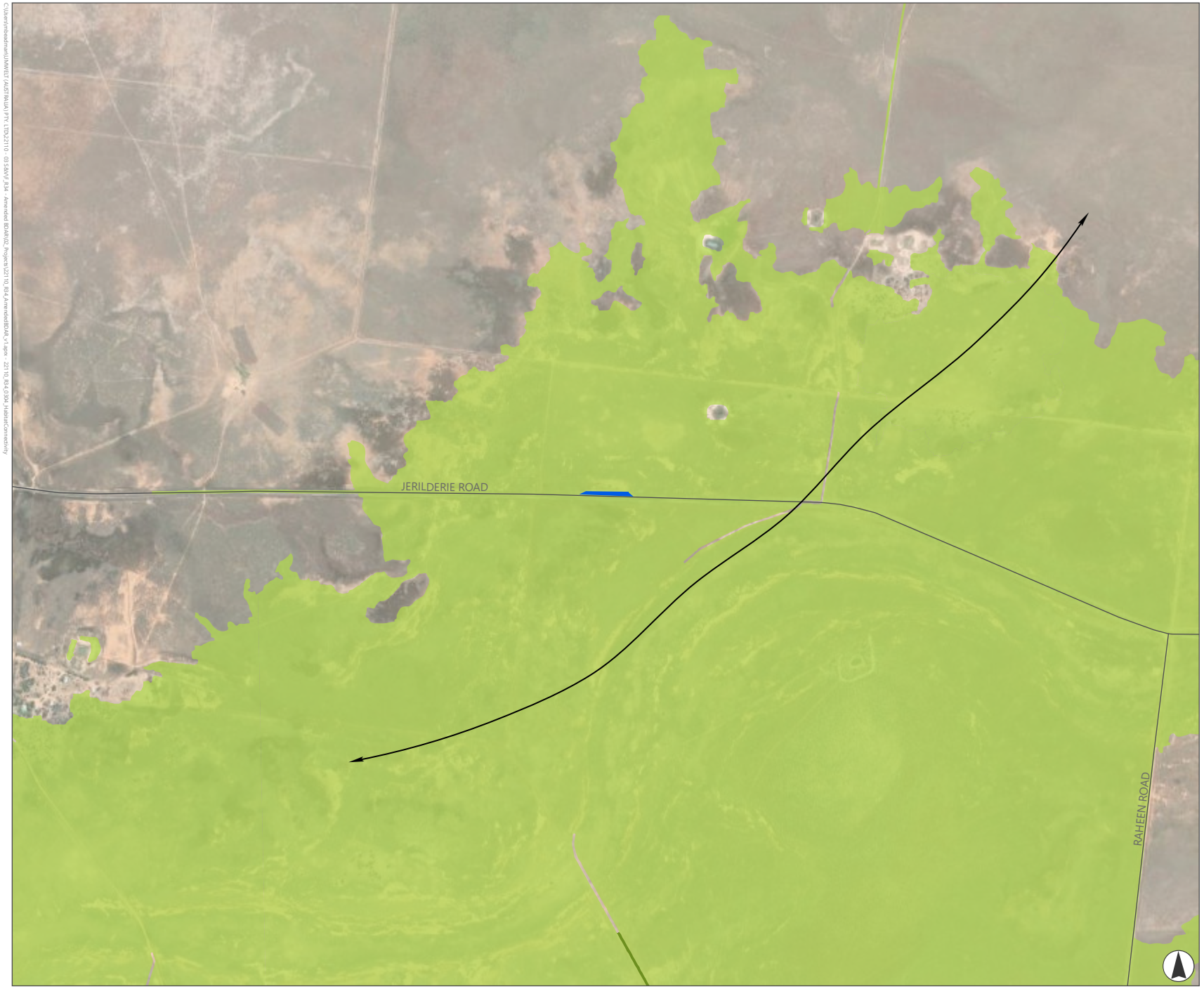
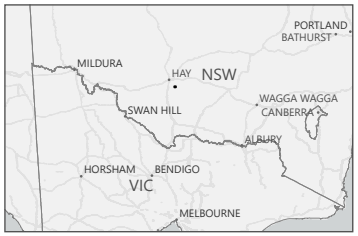


FIGURE 3.4.3

Habitat Connectivity

Legend

- Stage 1 (South) Disturbance Footprint
- Woody Vegetation Formation (Umwelt)
- Woody Vegetation Formation (SVTM)
- Road



0 210 420

Meters

Scale 1:17,500 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

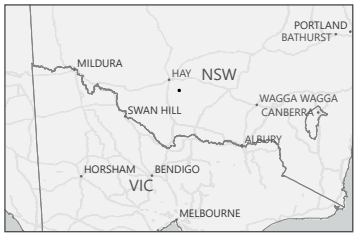
C:\Users\mbeadman\UMWELT (AUSTRALIA) PTY LTD\22110 - 03.SKKY..R34 - Amended BDAR\02. Projects\22110_R34_AmendedBDAR_v1.aprx - 22110_R34.0.004_HabitatConnectivity

FIGURE 3.4.4

Habitat Connectivity

Legend

- Stage 1 (South) Disturbance Footprint
- Woody Vegetation Formation (Umwelt)
- Woody Vegetation Formation (SVTM)
- Road
- Hydroline



0 210 420

Meters

Scale 1:17,500 at A4

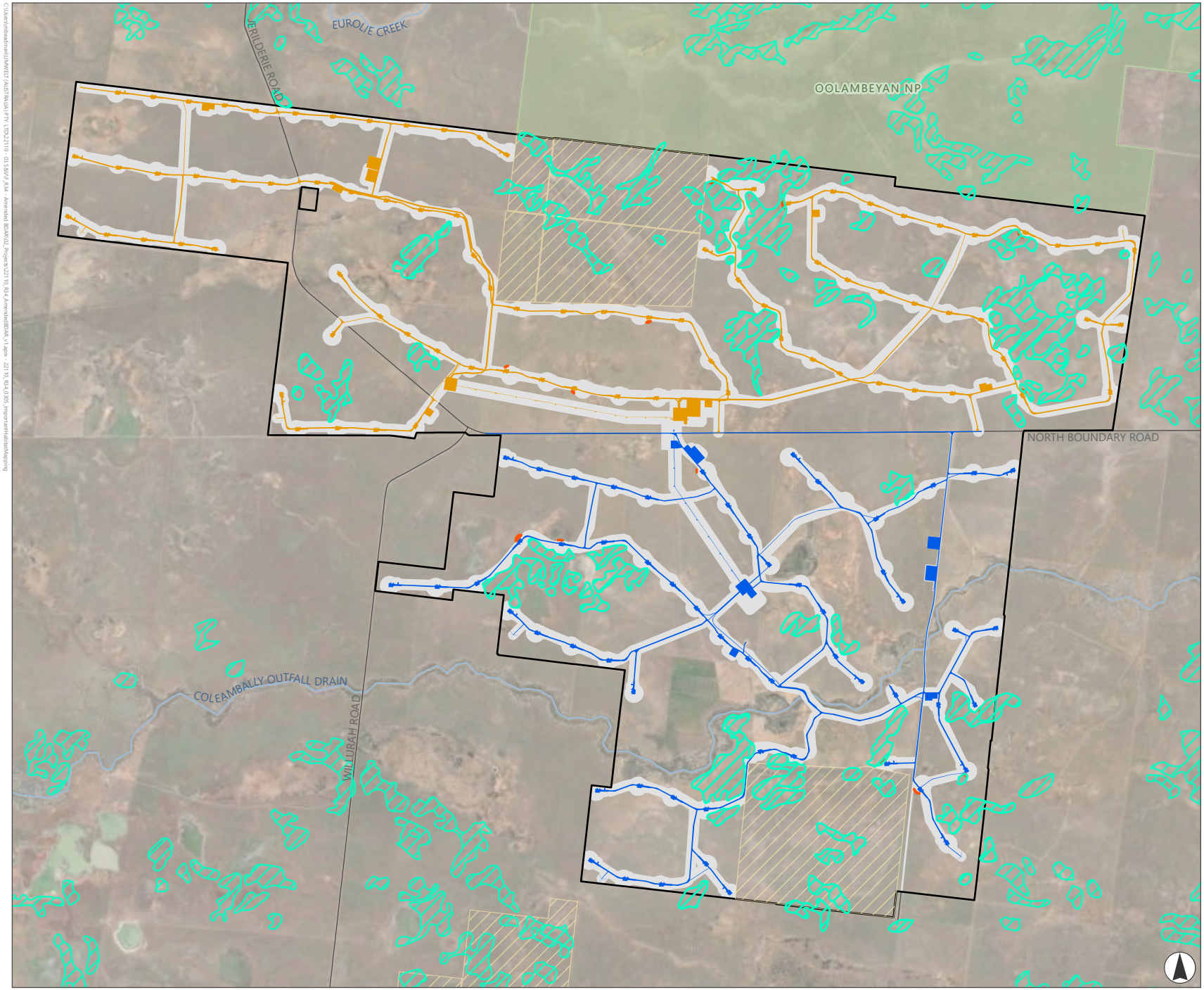
GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

FIGURE 3.5.1

Important Habitat Mapping



Legend

- Project Boundary
- Subject Land
- Stage 1 (South) Development Footprint
- Stage 2 (North) Development Footprint
- Conservation Agreement Area
- Blade Overhang Area
- NPWS Reserves
- Road
- Watercourse
- Plains Wanderer Important Habitat Mapping

0 1,000 2,000

Meters

Scale 1:110,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

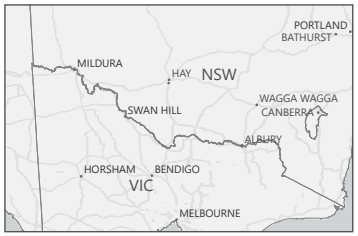
Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

FIGURE 3.5.2

Important Habitat Mapping

Legend

- Stage 1 (South) Development Footprint
- Road



0 90 180

Meters

Scale 1:5,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

C:\Users\mbeadman\UMWELT (AUSTRALIA) PTY LTD\22110 - 03.SAVY, R34 - Amended BDAR\02. Projects\22110_R34_AmendedBDAR_v1.aprx - 22110_R34_0305_ImportantHabitatMapping

FIGURE 3.5.3

Important Habitat Mapping

Legend

- Stage 1 (South) Development Footprint
- Road

0 90 180

Meters

Scale 1:5,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

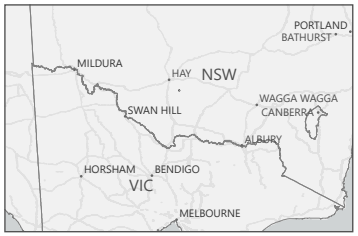
C:\Users\mbeadman\UMWELT (AUSTRALIA) PTY LTD\22110 - 03.SAVY, R34 - Amended BDAR\02. Projects\22110_R34_AmendedBDAR_v1.aprx - 22110_R34_0305_ImportantHabitatMapping

FIGURE 3.5.4

Important Habitat Mapping

Legend

- Stage 1 (South) Development Footprint
- Road
- Watercourse



0 90 180

Meters

Scale 1:5,000 at A4

GDA2020 MGA Zone 55

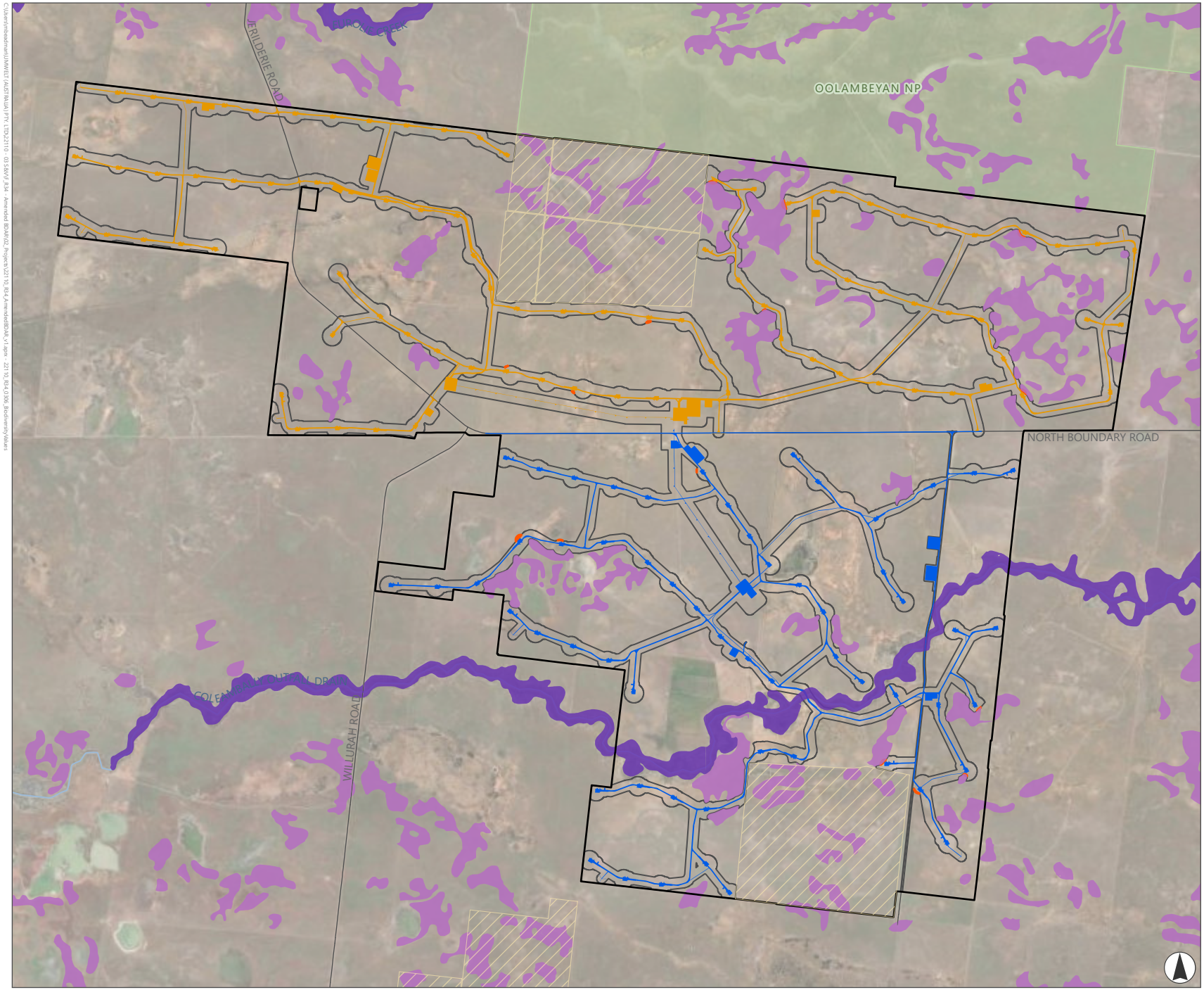
This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

C:\Users\mbeadman\UMWELT (AUSTRALIA) PTY LTD\22110 - 03.SKNY..R34 - Amended BDAR\02. Projects\22110_R34_AmendedBDAR_v1.aprx - 22110_R34_0305_ImportantHabitatMapping

FIGURE 3.6.1

Biodiversity Values Map



Legend

- Project Boundary
- Subject Land
- Stage 1 (South) Development Footprint
- Stage 2 (North) Development Footprint
- Conservation Agreement Area
- Blade Overhang Area
- NPWS Reserves
- Road
- Watercourse

Biodiversity Values

- Biodiverse riparian land
- Threatened species or communities with potential for serious and irreversible impacts

0 1,000 2,000

Meters

Scale 1:110,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

FIGURE 3.6.2

Biodiversity Values Map

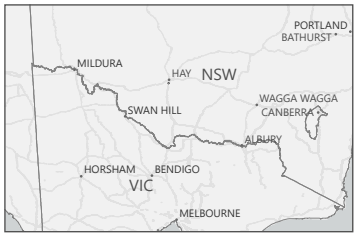
Legend

Stage 1 (South) Development Footprint

Road

Biodiversity Values

Threatened species or communities with potential for serious and irreversible impacts



0 60 120

Meters

Scale 1:5,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

C:\Users\mbeadman\UMWELT (AUSTRALIA) PTY LTD\2110 - 03.SKKY_R34 - Amended BDAR\02_Projects\2211O_R34_Amended BDAR_v1.aprx - 2211O_R34.0306_BiodiversityValues

FIGURE 3.6.3

Biodiversity Values Map

Legend

- Stage 1 (South) Development Footprint
- Road

0 60 120

Meters

Scale 1:5,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

C:\Users\mbeadman\UMWELT (AUSTRALIA) PTY LTD\22110 - 03.5KMY..R34 - Amended IBDAR\02. Projects\22110_R34_AmendedIBDAR_v1.aprx - 22110_R34_0306_BiodiversityValues

FIGURE 3.6.4

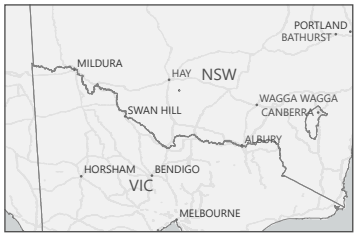
Biodiversity Values Map

Legend

- Stage 1 (South) Development Footprint
- Road
- Watercourse

Biodiversity Values

- Biodiverse riparian land



0 60 120

Meters

Scale 1:5,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

C:\Users\mbeadman\UMWELT (AUSTRALIA) PTY LTD\22110 - 03.SKKY..R34 - Amended BDAR\02. Projects\22110_R34_AmendedBDAR_v1.aprx - 22110_R34_0306_BiodiversityValues

3.3 Native Vegetation Cover

The extent of native vegetation cover within the Subject Land was confirmed and revised where necessary through surveys of the site by Umwelt through 2022 to 2024, as well as though aerial photograph interpretation using ESRI ArcGIS Pro software and the world imagery base map aerial dated 2015 and 2019. There were no differences found between the mapped vegetation extent and aerial imagery utilised by this assessment.

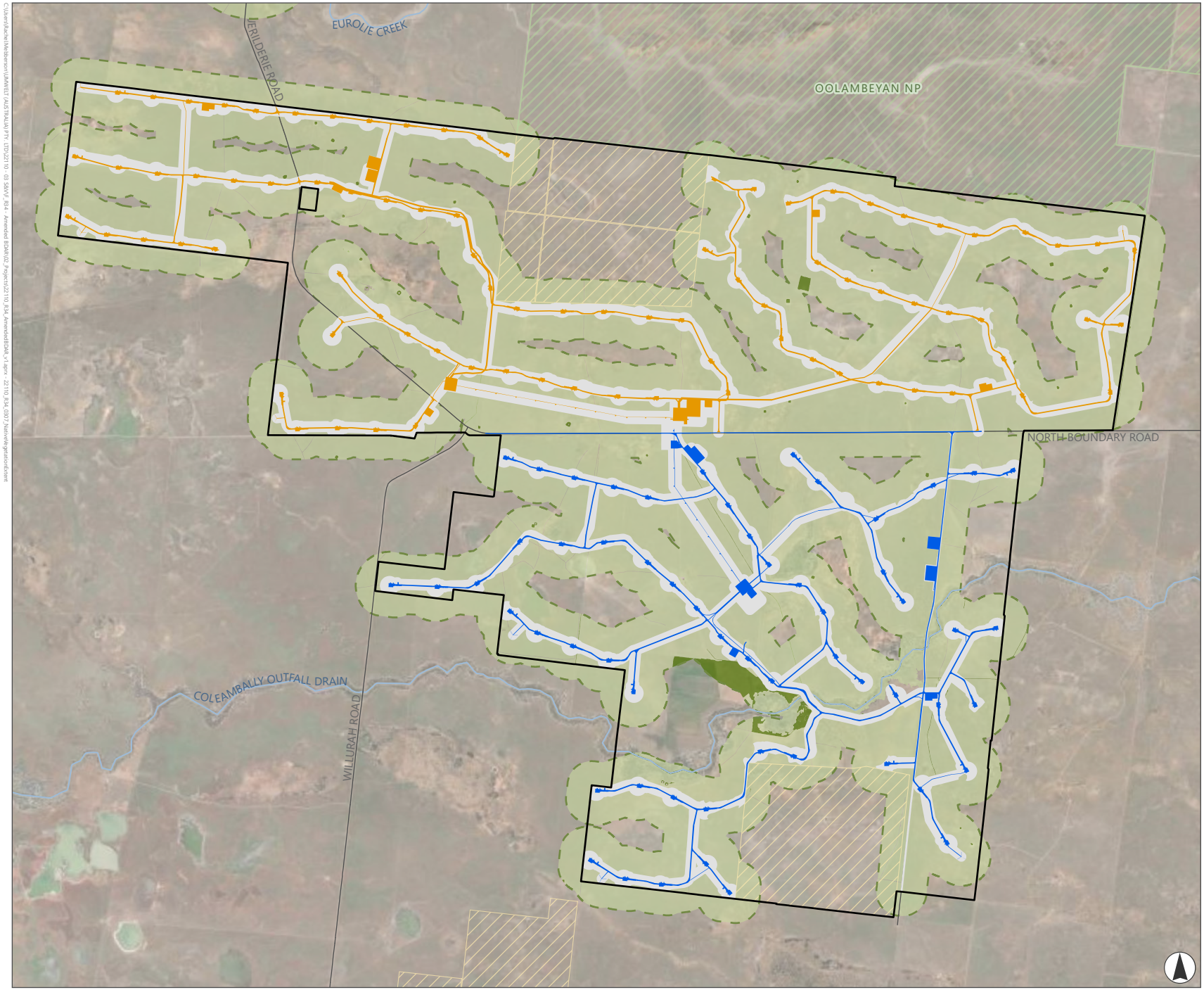
Table 3.4 summarises the extent of native vegetation cover within the assessment area and **Figure 3.7** shows the extent of native vegetation cover within the assessment area. The high percentage of native vegetation cover within the assessment area can be attributed to the past and current land use practices being native grazing and the presence of Oolambeyan Park immediately outside the Project Area.

Table 3.4 Native Vegetation Cover in the Assessment Area

Assessment Areas	Stage 1 – Linear	Stage 1 – Site-based	Stage 2 – Linear
Assessment area (ha)	9,303.20	2,256.39	10,552.23
Total area of native vegetation cover (ha)	8,553.55	2,233.19	10,469.98
Percentage of native vegetation cover (%)	92%	99%	99%
Class (0–10, >10–30, >30–70 or >70%)	>70%	>70%	>70%

FIGURE 3.7.1

Native Vegetation Extent



Legend

- Project Boundary
- Subject Land
- Stage 1 (South) Development Footprint
- Stage 2 (North) Development Footprint
- Assessment Area
- Native Vegetation Extent
- Cleared Land
- Conservation Agreement Area
- NPWS Reserves
- Road
- Watercourse

0 1,000 2,000

Meters

Scale 1:110,000 at A4

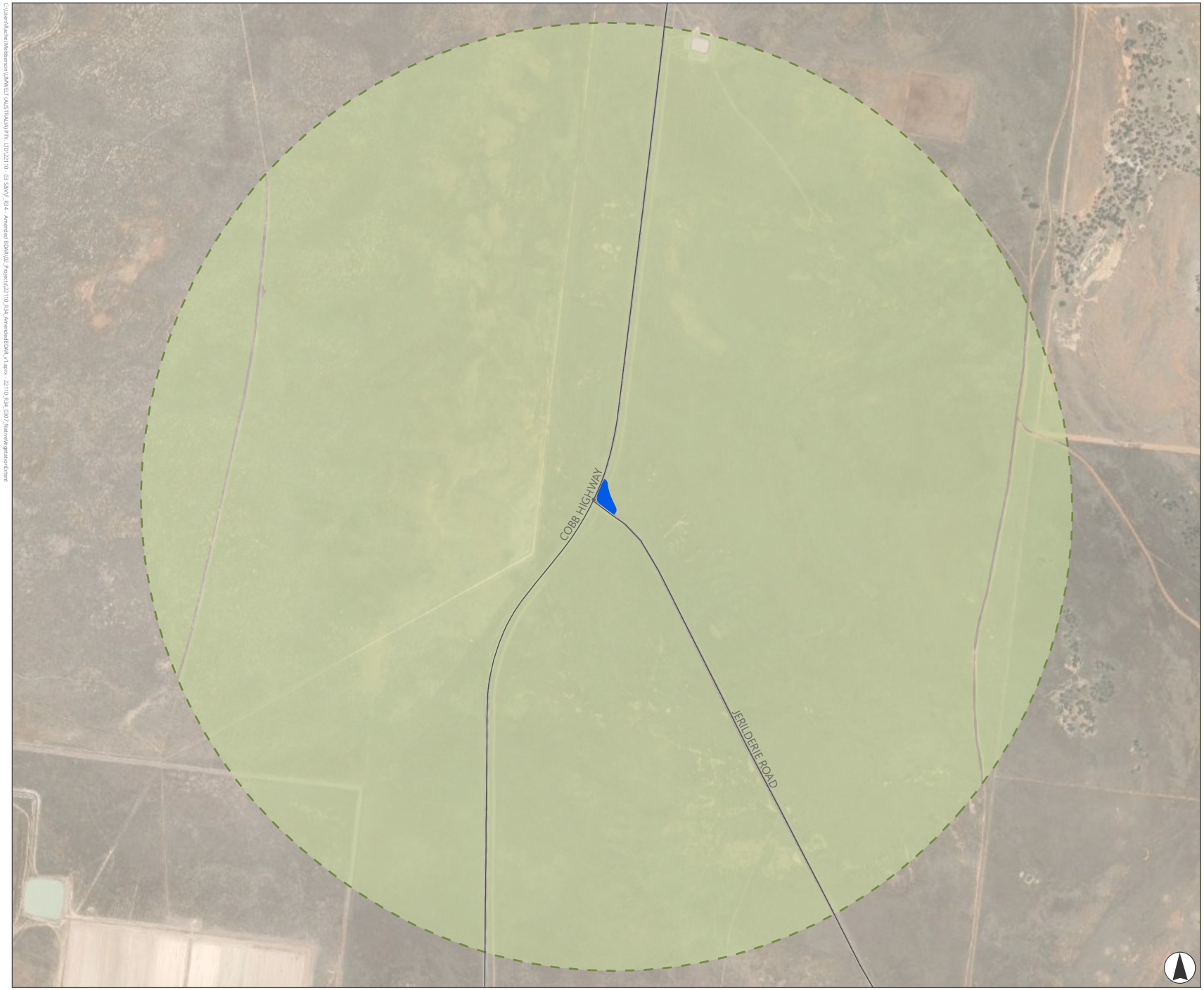
GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

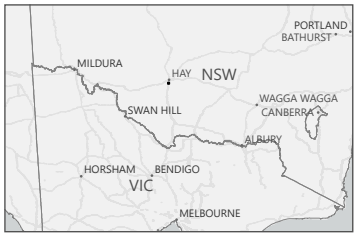
FIGURE 3.7.2

Native Vegetation Extent



Legend

- Stage 1 (South) Development Footprint
- Assessment Area
- Native Vegetation Extent
- Road



0 210 420

Meters

Scale 1:17,500 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

C:\Users\RachelMeberson\UMWELT (AUSTRALIA) PTY. LTD\22110 - 03 S86VF R44 - Amended BDAR\02_Projects\22110_R34_AmendedBDAR_v1.aprx - 22110_R34_007_NativeVegetationExtent

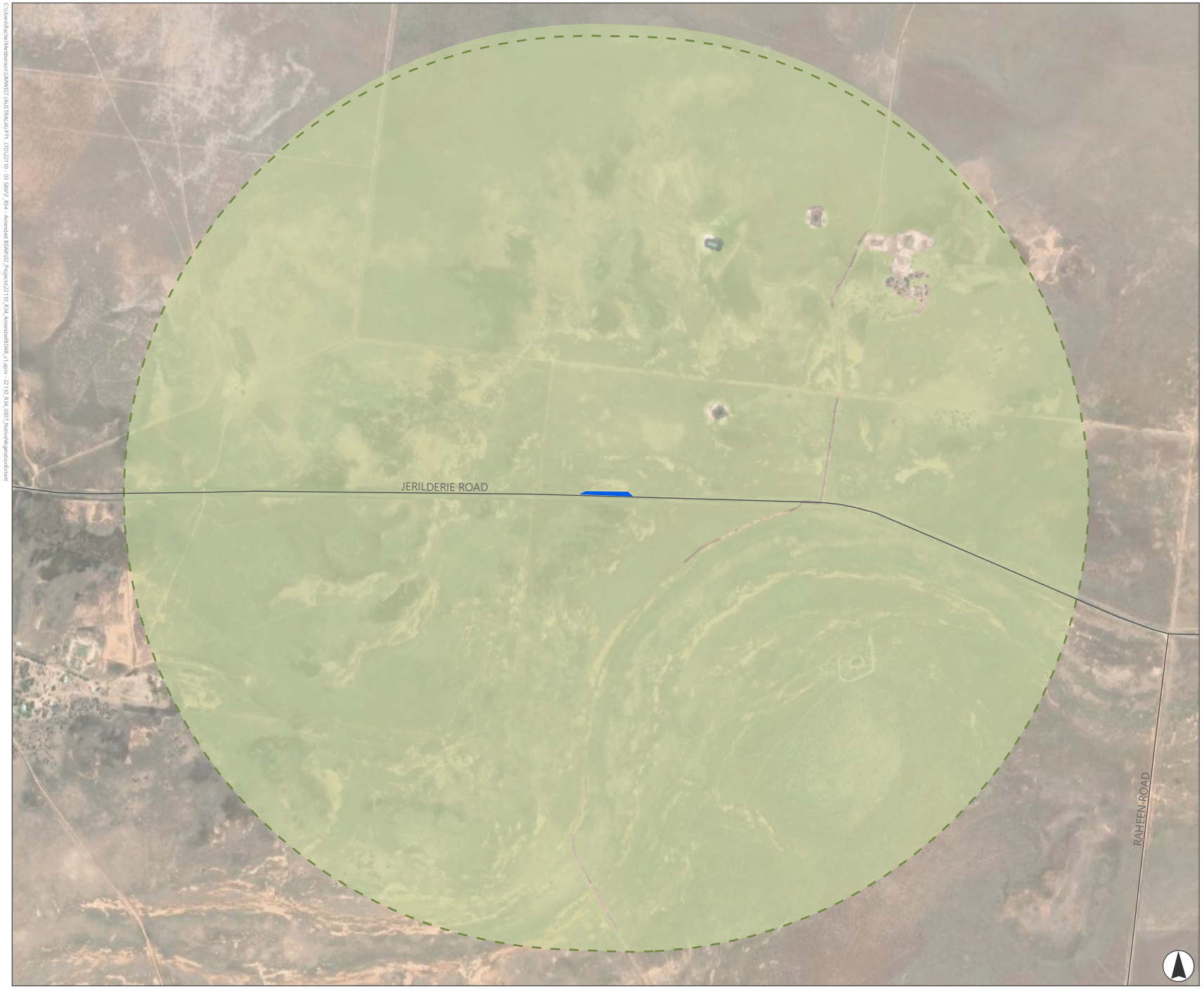
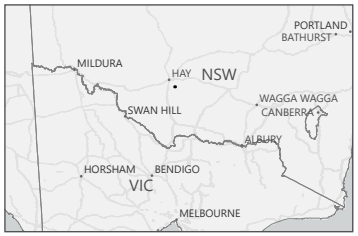


FIGURE 3.7.3

Native Vegetation Extent

Legend

- Stage 1 (South) Development Footprint
- Assessment Area
- Native Vegetation Extent
- Road



0 210 420

Meters

Scale 1:17,500 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

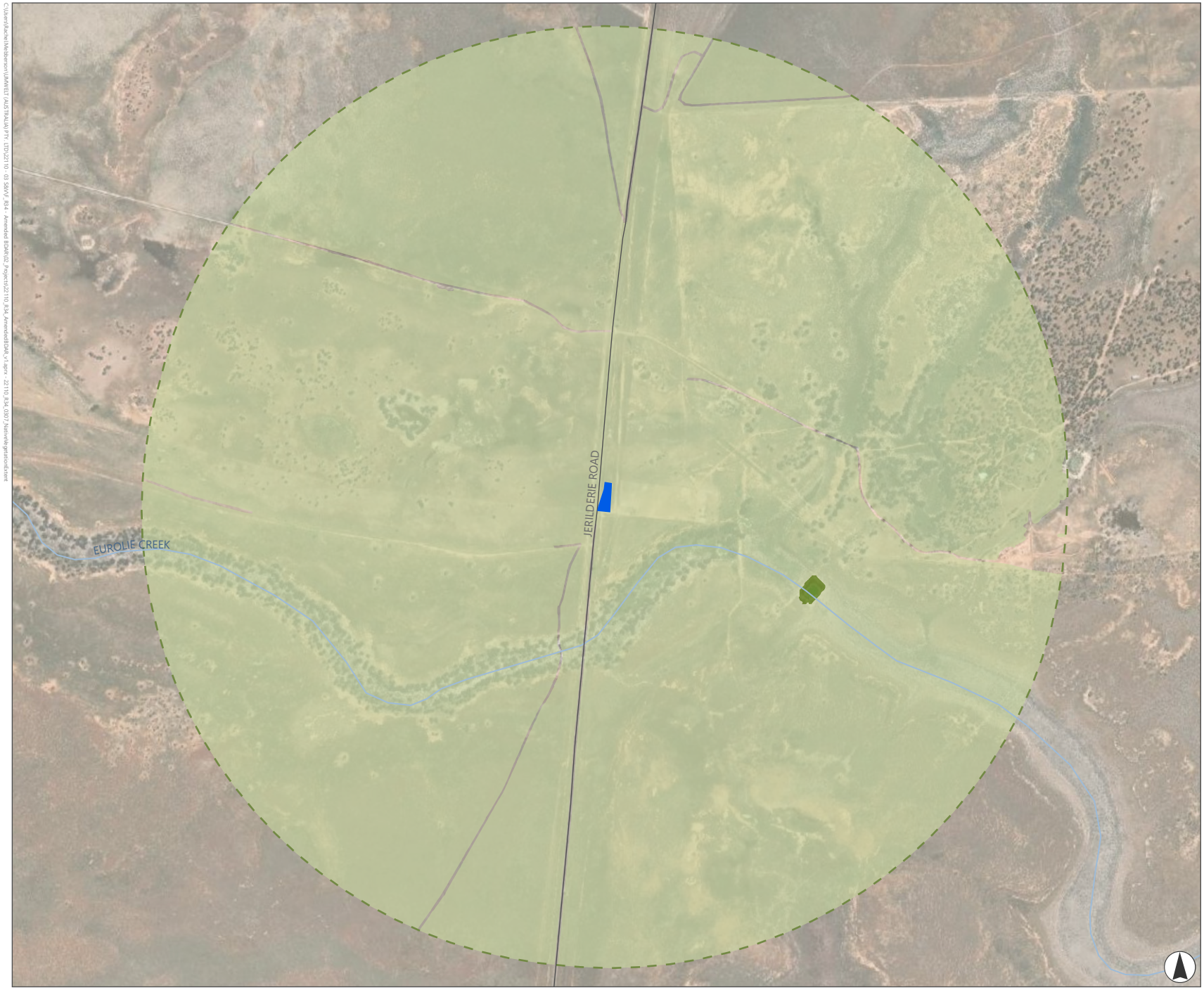
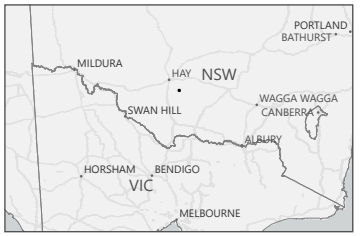


FIGURE 3.7.4

Native Vegetation Extent

Legend

- Stage 1 (South) Development Footprint
- Assessment Area
- Native Vegetation Extent
- Cleared Land
- Road
- Watercourse



0 210 420

Meters

Scale 1:17,500 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

4.0 Native Vegetation, Threatened Ecological Communities and Vegetation Integrity

4.1 Methodology

4.1.1 Background Research

Prior to commencing field surveys, a review of existing resources and databases was undertaken to identify the potential PCTs and TECs that could occur within the Subject Land.

The review included the following sources:

- BioNet Vegetation Classification (NSW DCCEEW, 2024).
- NSW State Vegetation Type Map (SVTM) – both current C2.0M2.0 (December 2023) release, and previous C1.1.M1.1 release.
- NSW State Vegetation Type Map (SVTM) – Riverina v1.1.0, VIS_ID 4469 (DPE 2019).
- NVMP Hay Vegetation Map. VIS_ID 4153 (DPE 2015).
- Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions – final determination under the BC Act (NSW Scientific Committee, 2011a).
- Commonwealth Listing Advice on Weeping Myall Woodlands (TSSC, 2009).
- Approved Conservation Advice for Weeping Myall Woodlands ecological community (DEWHA, 2008).
- Sandhill Pine Woodland in the Riverina, Murray-Darling Depression and NSW South Western Slopes bioregions – final determination under the BC Act (NSW Scientific Committee, 2011b).
- Commonwealth Listing Advice on Natural Grasslands of the Murray Valley Plains (TSSC, 2012).
- Approved Conservation Advice for Natural Grasslands of the Murray Valley Plains ecological community (DSEWPaC, 2012).
- Native Vegetation Guide for the Riverina – notes for land managers on its management and revegetation (Kent *et al*., 2002).
- Bureau of Meteorology Groundwater Dependent Ecosystems Atlas (BoM, 2024).

4.1.2 Vegetation Survey and Assessment

4.1.2.1 Identification of Native Vegetation Extent and Plant Community Types

Prior to field surveys, the descriptions of PCTs mapped within the Subject Land by the SVTM and held within BioNet Vegetation Classification were analysed and compared with other regional mapping namely, NSW State Vegetation Type Map (SVTM) – Riverina v1.1.0 (VIS_ID 4469) and NVMP Hay Vegetation Map.

(VIS_ID 4153). Where feasible, potential PCTs were reviewed against referenced published mapping methodologies for further descriptions relating to species abundance and potential diagnostic species.

Surveys of the vegetation, including vegetation mapping and collection of BAM vegetation integrity (BAM VI) plots, within the Subject Land were conducted from 22 December 2022 over a period of approximately six non-consecutive weeks, concluding on 9 May 2024. The first round of survey was conducted to obtain an overview of the nature and extent of vegetation not just within the field survey area but also within adjacent lands. Another objective of the first round of surveys was to map the extent of vegetation communities within the field survey area and establish the number of floristic plots required for the assessment. Once the likely PCTs were identified, full floristic plots and plot and transect surveys were conducted to verify the PCTs and collect vegetation integrity data from the identified vegetation zones.

The native vegetation extent within the Subject Land was determined during site surveys, through Geographic Information Systems (GIS) mapping and aerial photograph interpretation using recent aerial imagery. Native vegetation and PCT mapping were undertaken using best-practice techniques to delineate vegetation communities across the Subject Land. Vegetation within the Subject Land was mapped via the following method:

- Review of aerial imagery to assess vegetation distribution patterns as dictated by change in canopy texture, tone, and colour, as well as topography.
- Review of the modelled distribution of vegetation communities within broader scale regional based vegetation mapping.
- Transects and traverses using a hand-held tablet containing ESRI Field Maps to record boundaries of, and variation within stratification units not apparent from aerial imagery.
- Collection of data from rapid mapping points (RMP) to obtain information on vegetation community structure and distribution, to accurately assign stratification units to vegetation communities.
- Collection of vegetation integrity (VI) plot data in accordance with the BAM 2020.

The RMP collection method utilised across the Subject Land in order to capture species composition and abundance across potentially different vegetation communities in order to differentiate and delineate between communities and their boundaries. RMPs were also utilised to capture relevant contextual data across the Project Area to assist with the assessment of potential impacts to biodiversity values. Furthermore, the method to was used to assess areas of non-native vegetation such as paddocks and/or exotic grassland / pasture, including Category 1 – Exempt Land. RMPs were carried out across the entire survey period to capture the seasonable variability of species composition within the native vegetation. The location of RMPs is shown in **Figure 4.1**.

Vegetation communities were delineated through the identification of patterns of plant species assemblages in each of the identified strata. Slight variations in species composition are typical across the extent of a community and are often associated with microhabitats or ecotones with other plant communities. The native vegetation within the Subject Land was identified to a PCT as described in the BioNet Vegetation Classification System. Where an area of vegetation did not accurately correspond to a PCT described in the BioNet Vegetation Classification System, a 'best fit' PCT was selected based on IBRA sub-region, vegetation class, dominant canopy species, characteristic species of the PCT, the surrounding PCTs, and any supporting details contained within relevant reference regional mapping methodologies.

Native vegetation was also assessed for its potential to align with a TEC listed under the EPBC Act and/or BC Act as defined within their respective Final Determinations.

4.1.2.2 Vegetation Zones

The PCTs occurring within the Subject Land were stratified into areas represented by the locally-defined vegetation communities. The majority of the PCTs within the field survey area are of the same broad condition type, thus are provided for within their own single vegetation zone. However, two PCTs (PCT 26 and PCT 28) occur within the Subject Land area as two condition states. The condition states which were used to delineate vegetation zones are described in **Table 4.1**.

Table 4.1 Vegetation Zone Condition States

Condition State	Definition
Moderate-Good	Vegetation is structurally and floristically intact across all strata, moderate to high levels of native species diversity, which may be variable between species growth forms. Weed species present within the understorey and groundcover stratum are generally at a density of between 10–49 per cent projective foliage cover and can be seasonal in nature.
Derived Native Grassland (DNG)	Vegetation no longer retains a native canopy, or the canopy is present as scattered paddock trees. There is generally moderate to high diversity of native groundcover species, while understorey species may be present in low density. Exotic species, including perennial grasses, may be present but at a density of <50 per cent projective foliage cover.

4.1.2.3 Plot-Based Floristic and Vegetation Integrity Survey

Plot-based floristic vegetation surveys and vegetation integrity plots (BAM VI plot surveys) were conducted in accordance with Section 5.2 and 5.3 of the BAM. BAM plot surveys were carried out within all vegetation zones occurring within the Subject Land. The number of BAM plot surveys completed for each identified vegetation zone was conducted based on the area of each vegetation zone within the Subject Land (**Table 4.2**). The number of plots required for each vegetation zone was calculated in accordance with Table 4 of the BAM based on the total area of each vegetation zone across the entire Subject Land as a whole. Vegetation zones were not stratified by Project staging or associated assessment areas for the purposes of calculating BAM VI plot requirements.

Plot-based vegetation surveys were completed to assess vegetation composition, structure, function, enable calculation of the vegetation integrity scores for vegetation zones, sample areas of expected environmental variation and verify the results of previous mapping and available site information.
The locations of the BAM plot and transect surveys were determined by pacing a distance into the targeted vegetation zone on a random compass bearing, and then walking to that marked location. Plot locations were selected to ensure that they captured attributes relevant to each vegetation zone, to provide a representative assessment of the vegetation integrity of the vegetation zone, accounting for the level of variation in the broad condition state of the vegetation zone.

The following information was recorded for each plot:

- Unique plot reference.
- GPS coordinates (easting and northing).
- Date of the survey.
- Name of field surveyors.
- Bearing along a 50 m transect through the plot.
- Physiographic features that may assist in PCT identification such as slope, aspect and soil characteristics.
- Signs of disturbance.
- Photographs of the vegetation.

Floristic composition and structure data were collected from within a 400 m squared plot (standard 20 m x 20 m) and included:

- Species name: Scientific and common name.
- Status: Species status: native, exotic or high threat exotic.
- Growth form: Growth form classes: tree, shrub, grass, and grass like, forb, fern and other.
- Stratum (and layer) in which each species occurs.
- Cover: Per cent foliage cover across the plot for each species rooted in or overhanging the plot (Section 5.3.4.13 of the BAM).
- Abundance: For species with less than or equal to five per cent cover an estimate of the number of individuals or shoots of each species was recorded (Table 2 of the BAM).

Species naming, and classification was undertaken in accordance with the naming conventions and botanical keys provided by PlantNET (Royal Botanic Gardens and Domain Trust). Those plant species which could not be identified were sent to the NSW Herbarium at the Royal Botanic Gardens Sydney (RBGS) for verification.

Following field data collection, native plant species recorded within each plot were assigned to a growth form group (i.e., shrub, grass and grass like, forb, fern and other) according to the DCCEEW lookup table or the definitions set out in Table 15 of the BAM. Similarly, the species status (i.e., native, exotic or high threat exotic) was determined for each species based on the DCCEEW lookup table.

Floristic function data was collected from within a 1,000 m squared plot (standard 20 m x 50 m) and included:

- number of large trees: With reference to the appropriate large tree benchmark for each PCT
- tree regeneration: Presence or absence of living trees with < 5 cm diameter at breast height (DBH) over bark
- tree stem size class: 5–9, 10–19, 20–29, 30–49, 50–79 and > 80 cm DBH
- length of fallen logs: Total length in metres of all woody material >10 cm in diameter and > 50 cm in length
- trees with hollows: Count of the number of trees with hollows that are visible from the ground.

Litter coverage (as a percentage) was also measured from within five, 1 m^2 sub-plots located evenly along and either side of the 50 m plot midline. Litter was considered as plant material detached from a plant including leaves, seeds, twigs, branchlets and branches with a diameter of < 10 cm and in contact with the ground. The percentage litter cover from the five sub-plots was used to generate the average percentage litter cover for the entire plot.

A total of 78 BAM plots were sampled by Umwelt ecologists between 18 January 2023 and 9 May 2024, as detailed in **Table 4.2**.

Table 4.2 BAM Plots Completed Per Survey Period

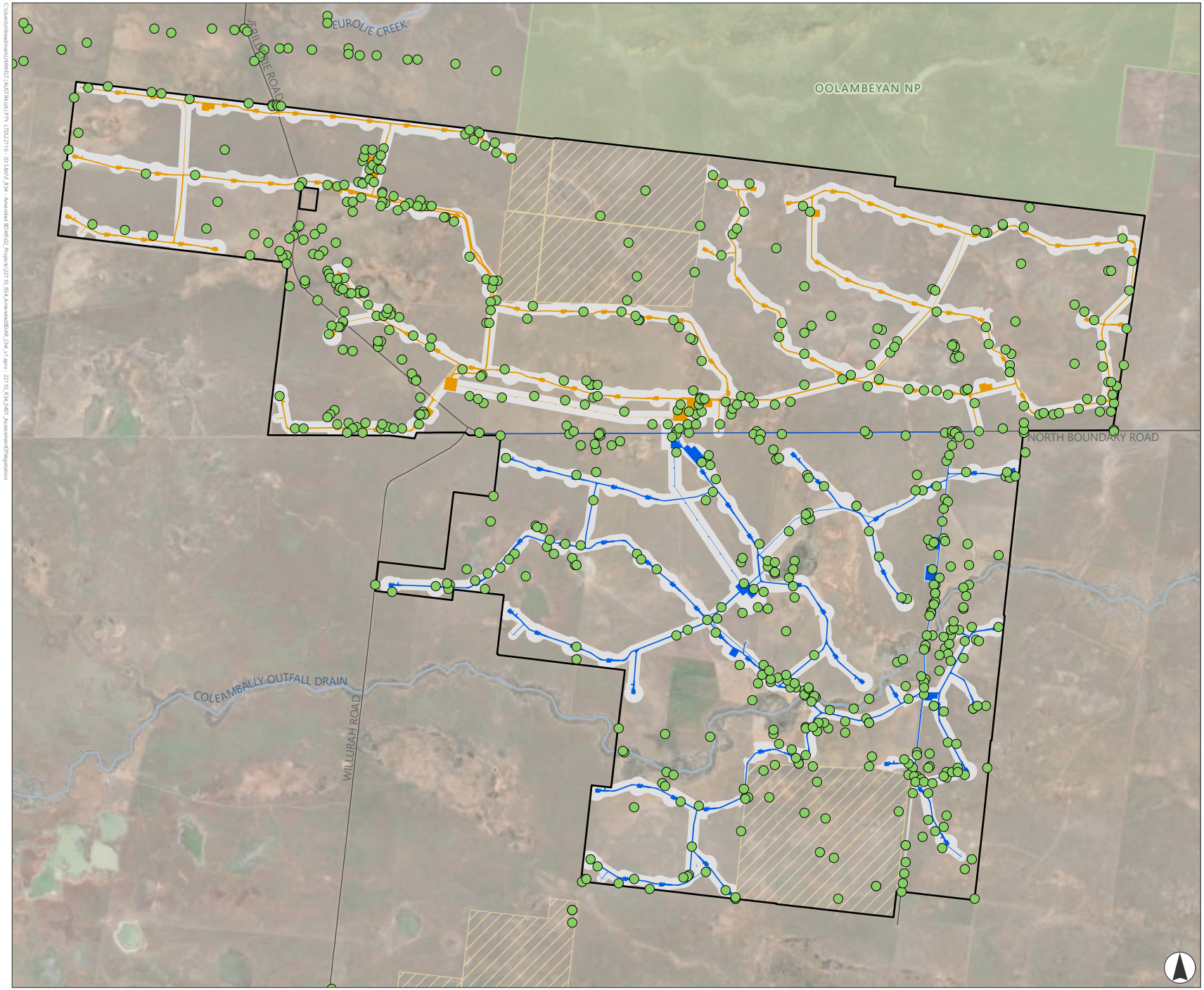
Survey periods	Total rainfall (mm) in preceding 12-month period*	Plots Surveyed (Plot ID Number)
18–24 January 2023	664.4	P68, P69, P70, P71, P72, P73, P74, P75, P76, P77
21–23 March 2023	733.8	P48, P49, P50, P51, P52, P53, P54, P55, P56, P57, P58, P59, P60, P61, P62, P63, P64, P65, P66, P67, P78
21 April 2023	744.2	P51
6–8 June 2023	661.0	P32, P33, P34, P35, P36, P37, P38, P39, P40, P41, P42, P43, P44, P45, P46, P47
7 July 2023	701.4	P79
17–22 August 2023	712.4	P1, P2, P3, P4, P5, P6, P7, P8, P9, P10, P11, P12, P13, P14
6–9 May 2024	376.6	P15, P16, P17, P18, P19, P20, P21, P22, P23, P24, P25, P26, P27, P28, P29, P30, P31

**Measured at Bedarbidgal (075173) weather station.*

Plot locations are shown in **Figure 4.2** and plot stratification details for each vegetation zone are provided in **Table 4.3**. BAM VI plots were carried across all both Stage 1 and Stage 2 of the Project, as well as within all assessment areas (Stage 1 – Linear, Stage 1 – Site based, Stage 2 – Linear). While it is noted that the assessment is one plot short the area of VZ3 within the Subject Land, the plots completed exceed the number required for the BAM-C (which is based on the area VZ3 within the Development Footprint), therefore, no additional plots (i.e. duplicate or benchmark plots) were required to complete the credit calculations.

FIGURE 4.1.1

Assessment of Vegetation



Legend

- Project Boundary
- Subject Land
- Stage 1 (South) Development Footprint
- Stage 2 (North) Development Footprint
- Conservation Agreement Area
- NPWS Reserves
- Road
- Watercourse
- Rapid Mapping Point

0 1,000 2,000

Meters

Scale 1:110,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

C:\Users\mbeadman\UMWELT (AUSTRALIA) PTY LTD\22110 - 03.SKKY..R34 - Amended IBAR\02. Projects\22110_R34_AmendedIBAR_CM_v1.aprx - 22110_R34_0401_AssessmentOfVegetation

FIGURE 4.1.2

Assessment of Vegetation

Legend

- Stage 1 (South) Development Footprint
- Road
- Rapid Mapping Point

0 60 120

Meters

Scale 1:5,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

C:\Users\mbeadman\UMWELT (AUSTRALIA) PTY LTD\2110 - 03.SAVY, R34 - Amended IBAR\02_Projects\2211\0_R34 Amended IBAR.CH4_v1.aprx - 22110_R34_0401_AssessmentOfVegetation

FIGURE 4.1.3

Assessment of Vegetation

Legend

- Stage 1 (South) Development Footprint
- Road

0 60 120

Meters

Scale 1:5,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

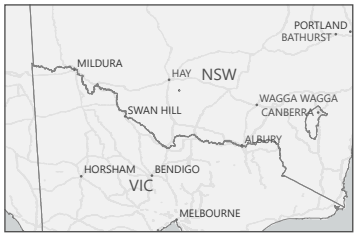
Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

FIGURE 4.1.4

Assessment of Vegetation

Legend

- Stage 1 (South) Development Footprint
- Road
- Watercourse
- Rapid Mapping Point



0 60 120

Meters

Scale 1:5,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

C:\Users\mbeadman\UMWELT (AUSTRALIA) PTY LTD\22110 - 03.SKVY..R34 - Amended BDAR\02. Projects\22110_R34_AmendedBDAR_CH4_v1.aprx - 22110_R34_0401_AssessmentOfVegetation

Table 4.3 Minimum Number of Plots Required and Completed per Vegetation Zone

VZ ID	PCT	Condition	BC Act	EPBC Act	Area within Subject Land (ha)	Area within Development Footprint (ha)	No. plots required	No. plots completed (plot IDs)
Zone 1	PCT 10: River Red Gum - Black Box woodland wetland of the semi-arid (warm) climatic zone (mainly Riverina Bioregion and Murray Darling Depression Bioregion)	Moderate-good	-	-	19.96	2.23	3	5+
Zone 2	PCT13: Black Box - Lignum woodland wetland of the inner floodplains in the semi-arid (warm) climate zone (mainly Riverina Bioregion and Murray Darling Depression Bioregion)	Moderate-good	-	-	2.45	0.08	2	4
Zone 3	PCT17: Lignum shrubland wetland of the semi-arid (warm) plains (mainly Riverina Bioregion and Murray Darling Depression Bioregion)	Moderate-good	-	-	20.20	2.05	4	3*
Zone 4	PCT24: Canegrass swamp tall grassland wetland of drainage depressions: lakes and pans of the inland plains	Moderate-good	-	-	10.02	1.97	3	3
Zone 5	PCT26: Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion	DNG	E	-	72.19	17.88	5	5
Zone 6		Moderate-good	E	E	42.56	4.92	4	4
Zone 7	PCT28: White Cypress Pine open woodland of sand plains, prior streams and dunes mainly of the semi-arid (warm) climate zone	DNG	E	-	486.69	59.70	7	9
Zone 8		Moderate-good	E	-	0.85	0.00	1	2
Zone 9	PCT44: Forb-rich Speargrass - Windmill Grass - White Top grassland of the Riverina Bioregion	Moderate-good	-	-	1,126.33	169.25	8	13
Zone 10	PCT46: Curly Windmill Grass - speargrass - wallaby grass grassland on alluvial clay and loam on the Hay Plain: Riverina Bioregion	Moderate-good	-	-	2,189.24	336.43	8	18
Zone 11	PCT160: Nitre Goosefoot shrubland wetland on clays of the inland floodplains	Moderate-good	-	-	16.43	2.55	3	3
Zone 12	PCT164: Cotton Bush open shrubland of the semi-arid (warm) zone	Moderate-good	-	-	296.40	40.95	7	9
Total					**4,283.32**	**638.01**	**55**	**78**

VZ ID	PCT	Condition	BC Act	EPBC Act	Area within Subject Land (ha)	Area within Development Footprint (ha)	No. plots required	No. plots completed (plot IDs)
Non-native vegetation		-			22.60	3.73	-	-
Dams/Waterbodies		-			0.45	0.06	-	-
Infrastructure		-			24.04	19.16	-	-

** The number of plots completed exceed the minimum number of plots required for the BAM-C credit calculations, which is based on the area of the Development Footprint.*

[+] Plot 23 has not been included BAMC calculations as it was sampled in 2024 when WET benchmark thresholds were not met. Please refer to Section 4.1.5 for details.

4.1.3 Approach to Confirming Land Categorisation Mapping

As detailed within **Section 1.3.3**, this assessment has adopted the draft NVR Map as published by NSW DCCEEW. Notwithstanding, as identified within the BAM Assessor Updates (No. 22 6 September 2019 and No. 3 6 August 2018), accredited assessors are responsible for responsible for Category 1 – Exempt Land for developments affecting rural land. For the purposes of this BDAR, land mapped as containing Category 2 Land (including Category 2 – Regulated, Category 2 – Vulnerable and Category 2 – Sensitive) has been accepted as correct and the BAM applied within these areas.

Land mapped as Category 1 - Exempt land was assessed to the presence of non-native and exotic vegetation through the methods described in **Section 4.1.2.1**, namely the collection of RMP capturing species composition and abundance across land mapped as Category 1 – Exempt Land. No BAM VI plots were collected within mapped Category 1 – Exempt land. In addition to field surveys, areas mapped as Category 1 - Exempt land were cross referenced against land use as mapped within NSW Landuse 2017 v1.5 (NSW DCCEEW, 2023).

Desktop found that areas mapped as Category 1 – Exempt Land was mapped as either grazing modified pastures, irrigated cropping, or cropping on NSW Landuse 2017 v1.5 (NSW DCCEEW, 2023), land uses consistent with Category 1 – Exempt Land. Field investigations found that approximately 50% of the land mapped as Category 1 – Exempt Land contained exotic vegetation, the remaining half contained native vegetation in moderate to good condition. Areas containing exotic vegetation was mapped as 'Non-native' (as described in **Section 4.7**), while areas containing native vegetation were assigned to a vegetation zone (as described in **Section 4.3**). The BAM was applied across the site accordingly.

A photo of land mapped as Category 1 – Exempt Land is show in **Section 4.7**.

4.1.4 Patch Size

The patch size for each vegetation zone located on the Subject Land was calculated for each of the vegetation zones in accordance with Section 4.3.2 of the BAM, using the following steps as detailed within the BAM Operational Manual – Stage 1 (DPE, 2022):

- Identify vegetation zones that will be included in the same patch (i.e. vegetation zones located within 100 m of one another for native woody vegetation and within 30 m of one another for native non-woody vegetation, including DNG).
- Identify the boundary of any adjoining native vegetation that extends beyond the limit of the Subject Land.
- Digitise each patch using separate polygons where multiple patches exist.
- Calculate the area of each patch in hectares.

Each vegetation zone was then allocated to a patch size class being <5 ha, 5–<25 ha, 25–<100 ha or ≥100 ha in accordance with Section 4.3.2 of the BAM.

Given the large native vegetation cover across the Subject Land, Project Area, and wider landscape, each vegetation zone was allocated to the largest patch size of ≥100 ha across all three BAM-C assessments.

4.1.5 Use of Benchmark Data

This assessment has utilised the Version 1.2 benchmarks published in the BAM-C on the 1 February 2023. Transitional arrangements related to Version 1.1 benchmarks do not apply to this assessment.

Section 1.4.2(2) of the BAM allows for the use of modified benchmark data in BioNet Vegetation Classification when extreme climatic variation is adversely affecting the composition and structure of growth form groups important to a PCT. Modified benchmarks include any benchmark data not contained within the BAM-C. Benchmarks available in the BAM-C are based on average environmental conditions (e.g. rainfall) and represent an average attribute state across seasons. Where prior climatic conditions are far from average the use of BAM-C benchmarks may result in a VI score that is not representative of vegetation condition during more average climatic conditions. The modified benchmark data in BioNet Vegetation Classification reflects seasonal or climatic variation in the benchmark values for a PCT as more appropriate local data (wet or dry benchmarks).

Guidance for assessors and decision-makers in applying modified benchmarks to assessments of vegetation integrity (DPIE 202d) provides guidance for assessors and decision-makers in using modified benchmarks to assess VI when applying the BAM. As detailed within the DPIE (2020d) practice note, modified benchmarks may be used when the rainfall total for 12 months prior to the assessment exceeds the vegetation class/IBRA bioregion rainfall threshold for a wet or dry rainfall year. The practice note also provides a decision process to apply wet or dry benchmarks to a BAM assessment.

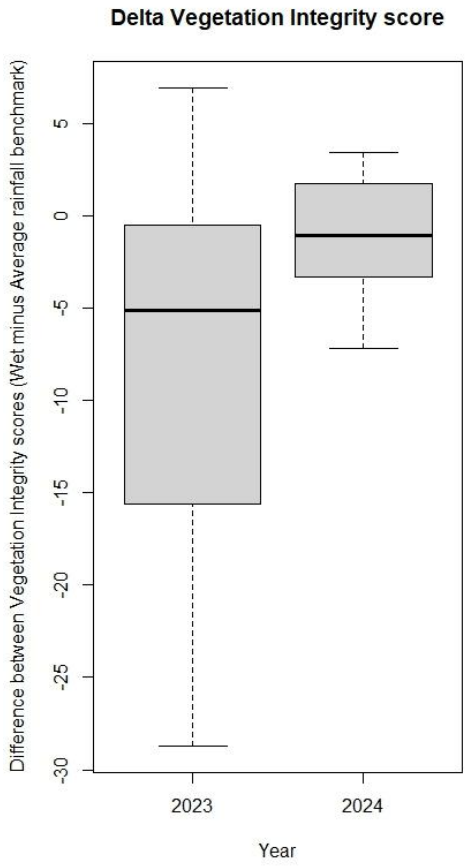
As detailed in **Section 4.1.6** below, the vegetation surveys were carried out during and immediately following a significant La Niña weather event between 2021 and late 2024, resulting in substantial and above average rainfall across the locality. As such, the Amended BDAR has opted to utilise the decision process detailed within the DPIE (2020d) practice note, with the modified WET benchmarks utilised for all PCTs within each BAM-C child case for all PCTs with exception of PCT 160. A detailed analysis of rainfall data for each survey period found that the total rainfall for the 12 months preceding plots carried out in May 2024 did not exceed the modified WET benchmark thresholds. As all plots within PCT 160 were carried out in May 2024, the assessment as adopted the default benchmark for this PCT across each BAM-C child case.

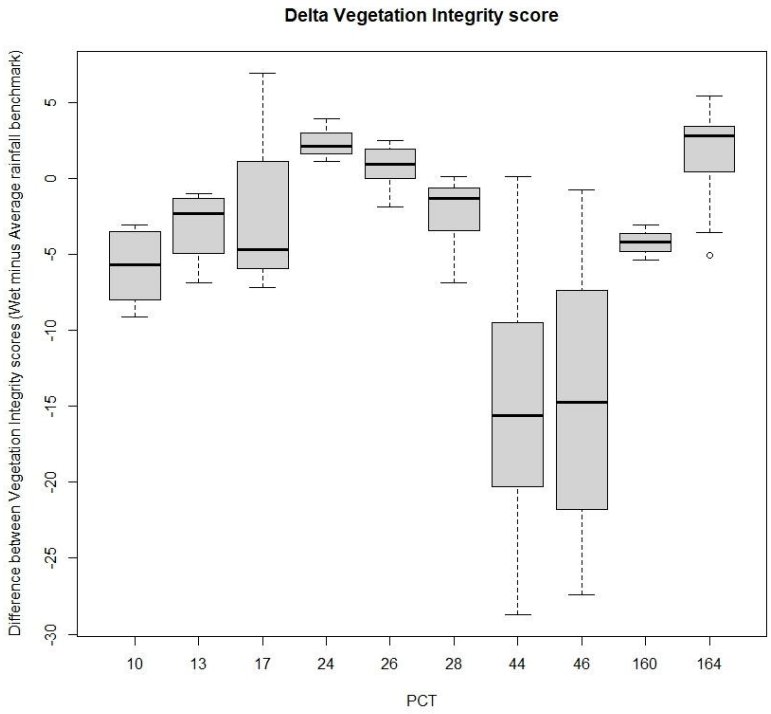
The process followed and justifications for the decisions make are detailed within **Table 4.4**.

Table 4.4 Assessment of Site Conditions Against Modified Benchmark Decision Process (DPIE, 2020d)

Decision Process Step	Justification
Has the Subject Area experienced higher or lower than average prior rainfall totals? 1. Calculate the cumulative rainfall for the previous 12 months to the survey using most recent data from the nearest BoM weather station 2. Compare the cumulative rainfall total to the WET and DRY rainfall threshold in BioNet Vegetation Classification 3. Classify the 12-month average rainfall period as WET, DRY or AVERAGE	The BAM VI plots surveys for the BDAR commenced on 18 January 2023 and were concluded 9 May 2024. According to the BoM, the cumulative rainfall data at the nearest weather station (Hay (Bedarbidgal)) for the 12 months preceding each plot survey period carried out in 2023 was between 664.4 mm and 744.4 mm of rainfall, with 376.6 mm of rainfall falling in the 12 months preceding the May 2024 survey period. The total rainfall values for the 12 months preceding each plot survey period are detailed in **Table 4.2**. The WET rainfall threshold within BioNet Vegetation Classification for each PCT recorded within the Subject Land and Riverina IBRA bioregion is as follows: a. PCT 10 = >458 mm b. PCT 13 = >415 mm c. PCT 17 = >402 mm d. PCT 24 = >402 mm e. PCT 26 = >471 mm f. PCT 28 = >452 mm g. PCT 44 = >455 mm h. PCT 46 = >455 mm i. PCT 160 = >402 mm j. PCT 164 = > 399 mm. The total rainfall values for the 12 months preceding the plots surveys carried out in 2023 exceed the WET rainfall thresholds for all PCTs within the Subject Land in the Riverina IBRA bioregion. The total rainfall values for the 12 months preceding the plot surveys carried out in May 2024 (376.6 mm) does not exceed the WET rainfall thresholds for all PCTs within the Subject Land in the Riverina IBRA bioregion. The 12-month average rainfall period for plots carried out in 2023 can be classified as WET. The 12-month average rainfall period for plots carried out in 2024 fall within the rainfall threshold ranges for an average rainfall year and therefore can be classified as AVERAGE.

Decision Process Step	Justification
WET or DRY rainfall period = YES for plots carried out in 2022 and 2023. Further justification is required to apply WET benchmarks to plots carried out in 2024.	
Are the WET or DRY benchmarks available on BioNet Vegetation Classification database or the Department's website or any other published resource? 1. Check BioNet Vegetation Classification for available dynamic benchmarks for the vegetation class/IBRA bioregion. 2. Other publications on the EES website or other peer-reviewed sources may have suitable WET/DRY benchmarks. 3. Assess the suitability of the benchmark attributes for the PCT and the confidence level assigned to the benchmark attributes.	Dynamic benchmarks for the PCTs recorded within the Subject Land are available in BioNet Vegetation Classification. No other publications of peer-reviewed sources have been reviewed for suitable benchmark data. To assess the suitability of the benchmark attributed for each vegetation zone, the impact of WET versus AVERAGE rainfall benchmarks on VI scores, both benchmark values were applied to plot data subdivided in different ways. For each plot, the VI scores were calculated using the with AVERAGE benchmarks and WET benchmarks. From these, a delta VI, the difference between VI scores with the WET benchmark and with the AVERAGE benchmark applied, was again calculated for each plot. The delta VI was calculated by subtracting the AVERAGE benchmark VI score from the WET benchmark VI score. Of particular interest was the influence on VI scores flowing from the application of the WET Benchmark to plot data collected in May 2024, at the end of a period of prolonged wet weather and at a time when the rainfall for the prior 365 days fell below the WET benchmark threshold for all PCTs sampled. It is possible that the incorrect application of the WET benchmark to these plots could reduce the VI score, thereby undervaluing the vegetation that may be impacted by the Project. The distributions of delta VI scores calculated for each plot were visually summarized by year of data collection and PCT sampled. Box plots illustrating the distribution of delta VI scores for the years 2023 and 2024 are presented in **Plate 4.1**. The delta VI scores for plots measured in 2023 are mostly negative, with a median of -5.0 units and a negative skew, meaning the VI scores with the WET benchmark applied were lower than those with the AVERAGE benchmark applied, with a quarter of the plot VI scores being more than 15 units lower with the WET benchmark than with the AVERAGE benchmark. By contrast, delta VI scores for plots measured in 2024 had a median of -1.0 unit and were more normally distributed, meaning VI scores for each plot with and without the WET benchmark applied were more similar.

Decision Process Step	Justification
	 **Plate 4.1 Box plots illustrating the distribution of delta VI scores for the years 2023 and 2024**

Decision Process Step	Justification
	Because WET benchmarks for each PCT are different, boxplots of delta VI scores were plotted for each PCT, these are presented in **Plate 4.2**, and highlight the variable influence of WET benchmark application on plot VI score across PCTs. In general, delta VI scores for PCTs are negative, all but three PCTs have median delta VI scores within six units of zero. For PCT 26 and PCT 164 the distribution of delta VI was centred close to zero, for PCT 24 all VI scores with the WET benchmark applied were slightly higher. For two PCTs, PCT44 and PCT46, delta VI scores were normally distributed but the whole distribution was within negative values, with median scores for both of around -16, and distributions extending to -31 units for PCT46, indicating the application of WET benchmarks had a strong influence on VI scores for each plot within these two PCTs.  **Plate 4.2 Boxplots of delta VI scores were plotted for each PCT**

Decision Process Step	Justification
	These exploratory boxplots suggested that the magnitude of any reduction in VI score stemming from the application of WET benchmark to plots measured in May 2024 will be a function of the PCTs in which those plots were placed. There were 17 plots measured in 2024, all between 6th and 9th May. These plots were located in five PCTs, PCT 28 (5 plots), PCT 160 (3 plots), PCT 17 (1 plot), PCT 26 (5 plots) and PCT 164 (1 plot). To quantify the realized magnitude of this reduction, arbitrary vegetation zones that accommodated PCT, vegetation condition, and year of measurement were defined for the purposes of VI score calculation, and for these calculated VI scores with and without WET benchmarks applied, these are presented in **Table 4.5**.

Table 4.5 Comparison of VI scores for vegetation zones utilising both WET and AVERAGE benchmarks

PCT ID	Zone	Year of Measurement	VI score – AVERAGE benchmark	VI score – WET benchmark
10	Moderate-good	2023	32.2	32.4
13	Moderate-good	2023	12.7	12.6
17	Moderate-good	2023	81.7	77
17	Moderate-good	2024	69.7	63.6
24	Moderate-good	2023	33.6	36.9
26	DNG	2024	45.3	44.2
26	Moderate-good	2023	30.9	31.8
28	DNG	2023	20.5	20.4
28	DNG	2024	24.8	24.4
28	Moderate-good	2023	51	50.2
28	Moderate-good	2024	43.6	42.5
44	Moderate-good	2023	92	78.3
46	Moderate-good	2023	71.6	56.2
160	Moderate-good	2024	70.9	68.8
164	Moderate-good	2023	41.9	42.2
164	Moderate-good	2024	67.9	68.5

Decision Process Step	Justification
	For zones based on plots measured in 2024, VI scores with WET and AVERAGE benchmarks were within 0.5 units of each other for zone PCT 164 moderate-good and PCT 28 DNG. For these two PCTs the VI scores calculated with and without the WET benchmark were essentially the same, which is consistent with the delta VI scores by PCT illustrated in **Plate 4.2** above. For PCT 28 moderate-good and PCT 26 DNG, VI scores with Wet Benchmark were 1.1 units lower than with AVERAGE benchmark. The greatest difference was for PCT17 moderate-good, where VI with the WET benchmark applied was 6.1 units lower than with the AVERAGE benchmark.
YES for plot carried out in 2023, and for a portion of the plots carried out in 2024.	
For plots carried out in 2023, the composition and structure scores within the BAM VI plots collected within the Subject Land exceeded the AVERAGE benchmark values within BioNet Vegetation Classification for the PCTs recorded within the Subject Land for the key structural components of each PCT (i.e. grass richness and cover) indicating that the significant and above average rainfall has resulted in an overestimation of vegetation condition values. The WET benchmark values better reflect the composition and structure scores of the BAM VI plots collected onsite, indicating that they are more representative of VI during the 2023 survey period. As such, WET benchmarks can be where available. Plots surveyed in 2024 have been treated in the following way: • The plot in PCT 17 Moderate-good that was surveyed in 2024 has not been included in the Project's BAM-C child cases, and the VI score calculated utilising WET benchmarks. The removal of this plot did not affect the minimum plot requirements for this vegetation zone required under the BAM. • AVERAGE benchmarks were applied to PCT 160 Moderate-good as all plots were carried out in 2024 when the total rainfall for the preceding 12-month period did not exceed the WET rainfall threshold for the PCT in question. • WET benchmarks were applied to all vegetation zones within PCT 26, PCT 28 and PCT 164 as the analysis demonstrated that the VI scores derived from both WET and AVERAGE benchmarks were essentially the same for the 2024 plots. For clarity, below is a summary of the final application of benchmarks for the Project in the three BAMC (Stage 1 – Linear, Stage 2 – Site Based and Stage 2 – Linear): • WET benchmarks: PCTs 10, 13, 17, 24, 26, 28, 44, 46 and 164 • AVERAGE benchmarks: PCT 160.	

4.1.6 Limitations

The native vegetation assessment was completed over a 17-month period between December 2022 and May 2024. The areas to be impacted are mostly composed of grazed areas of native grassland and shrubland which are subject to ongoing management for agricultural activities. Potential limitations associated with floristic and vegetation integrity plot surveys were mitigated by exceeding the minimum plots requirements of the BAM for most vegetation zones. Furthermore, surveys were carried out during and immediately following a significant La Niña weather event between 2021 and early 2024. As such, the conditions were optimal for maximising flora species diversity when drought sensitive species are present above ground.

4.2 Native Vegetation Extent

The extent of native vegetation across the Subject Land is shown in **Figure 3.7**. The mapped broad native vegetation extent visible on the aerial imagery utilised for this assessment was confirmed upon ground-truthing during surveys, with no significant changes to the presence or otherwise of native vegetation.
A small proportion of the Subject Land does not contain native vegetation. These areas include land around residential dwellings, access tracks, farm dams, and isolated paddocks where exotic grasses are sown, presumably for livestock feed.

4.3 Plant Community Types

4.3.1 Overview of Plant Community Types

Identification of the PCTs occurring with the Subject Land was guided by the results of the review of existing data (**Section 4.1.1**) and surveys of the Subject Land (**Section 4.1.2.1** and **Section 4.1.2.2**). The data collected during surveys of the Subject Land was analysed in conjunction with a review of the PCTs held within the BioNet Vegetation Classification Database and previously published regional vegetation mapping, namely the SVTM C2.0M2.0 (December 2023). Consideration was given to the following:

- Occurrence within the Riverina IBRA bioregion.
- Vegetation formation.
- Vegetation class.
- Dominant upper, mid and ground strata species.
- Landscape position, soil types and edaphics.

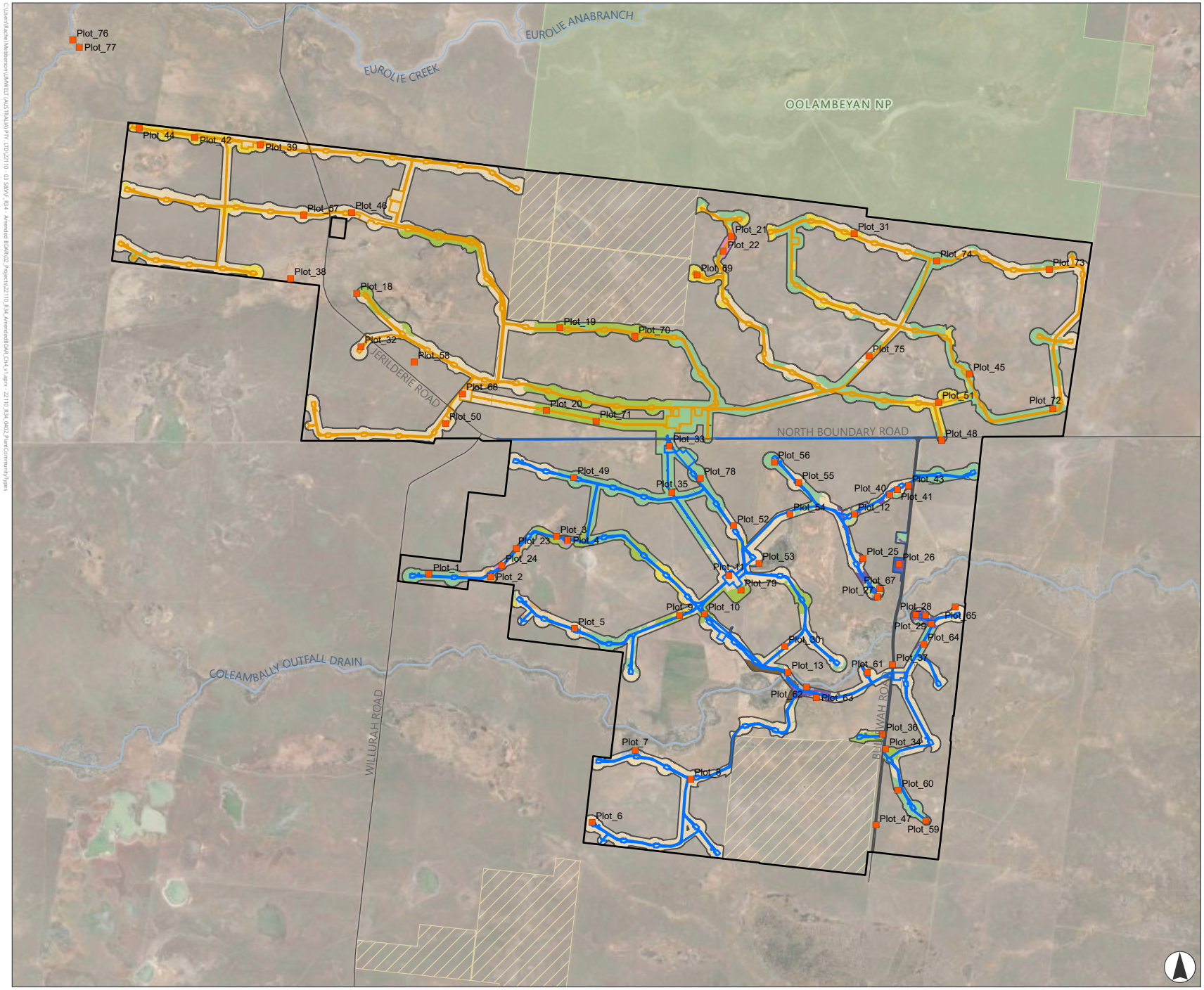
A total of 10 PCTs comprising 12 vegetation zones were recorded across the Subject Land as outlined in **Table 4.6** and **Figure 4.2**. A summary of these PCTs is provided in **Section 4.3.2** to **Section 4.3.11**.

Table 4.6 PCTs Identified Within the Subject Land

PCT ID	PCT Name	Vegetation Class	Vegetation Formation	BioNet Percentage Cleared Estimate	Condition	BC Act	EPBC Act	Area within Subject Land (ha)			Area within Development Footprint (ha)			Total Area within Subject Land (ha)	Total Area within Development Footprint (ha)
								Stage 1 – Linear	Stage 1 – Site based	Stage 2 – Linear	Stage 1 – Linear	Stage 1 – Site based	Stage 2 – Linear		
10	River Red Gum - Black Box woodland wetland of the semi-arid (warm) climatic zone (mainly Riverina Bioregion and Murray Darling Depression Bioregion)	Inland Riverine Forests	Forested Wetlands	43.00	Moderate-good	-	-	19.96	0.00	0.00	2.23	0.00	0.00	19.96	2.23
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)	Inland Floodplain Woodlands	Semi-arid Woodlands (Grassy sub-formation)	57.00	Moderate-good	-	-	2.45	0.00	0.00	0.08	0.00	0.00	2.45	0.08
17	Lignum shrubland wetland of the semi-arid (warm) plains (mainly Riverina Bioregion and Murray Darling Depression Bioregion)	Inland Floodplain Shrublands	Freshwater Wetlands	63.00	Moderate-good	-	-	20.20	0.00	0.00	2.05	0.00	0.00	20.20	2.05
24	Canegrass swamp tall grassland wetland of drainage depressions: lakes and pans of the inland plains	Inland Floodplain Shrublands	Freshwater Wetlands	20.00	Moderate-good	-	-	10.02	0.00	0.00	1.97	0.00	0.00	10.02	1.97
26	Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion	Riverine Plain Woodlands	Semi-arid Woodlands (Grassy sub-formation)	90.00	Moderate-good DNG	E	E -	114.74	0.00	0.00	22.80	0.00	0.00	114.74	22.80
28	White Cypress Pine open woodland of sand plains, prior streams and dunes mainly of the semi-arid (warm) climate zone	Riverine Sandhill Woodlands	Semi-arid Woodlands (Shrubby sub-formation)	73.00	Moderate-good DNG	E	-	151.25	0.53	335.76	20.44	0.53	38.74	487.54	59.70
44	Forb-rich Speargrass - Windmill Grass - White Top grassland of the Riverina Bioregion	Riverine Plain Grasslands	Grasslands	73.00	Moderate-good	-	-	525.83	0.00	600.96	76.46	0.00	92.79	1,126.33	169.25
46	Curly Windmill Grass - speargrass - wallaby grass grassland on alluvial clay and loam on the Hay Plain: Riverina Bioregion	Riverine Plain Grasslands	Grasslands	20.00	Moderate-good	-	-	931.16	0.00	1,258.09	138.83	0.00	197.59	2,189.24	336.43
160	Nitre Goosefoot shrubland wetland on clays of the inland floodplains	Inland Floodplain Shrublands	Freshwater Wetlands	28.00	Moderate-good	-	-	4.49	0.00	11.94	0.91	0.00	1.63	16.43	2.55
164	Cotton Bush open shrubland of the semi-arid (warm) zone	Riverine Chenopod Shrublands	Arid Shrublands (Chenopod sub-formation)	8.00	Moderate-good	-	-	40.76	0.38	255.26	3.91	0.38	36.65	296.40	40.95

FIGURE 4.2.1

Plant Community Types Present within the Subject Land

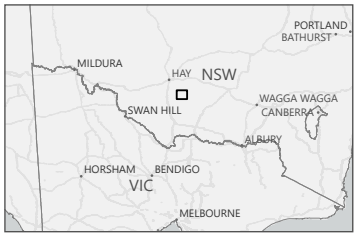


Legend

- Project Boundary
- Subject Land
- Stage 1 (South) Development Footprint
- Stage 2 (North) Development Footprint
- Conservation Agreement Area
- NPWS Reserves
- Road
- Watercourse
- BAM Plot

Plant Community Type

- PCT 10 Moderate-Good
- PCT 13 Moderate-Good
- PCT 17 Moderate-Good
- PCT 24 Moderate-Good
- PCT 26 Derived Native Grassland
- PCT 26 Moderate-Good
- PCT 28 Derived Native Grassland
- PCT 28 Moderate-Good
- PCT 44 Moderate-Good
- PCT 46 Moderate-Good
- PCT 160 Moderate-Good
- PCT 164 Moderate-Good
- Non-native vegetation
- Water
- Infrastructure



0 1,000 2,000

Meters

Scale 1:122,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

FIGURE 4.2.2

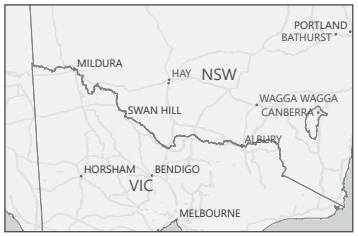
Plant Community Types Present within the Subject Land

Legend

- Stage 1 (South) Development Footprint
- Road
- BAM Plot

Plant Community Type

- PCT 164 Moderate-Good



0 20 40

Meters

Scale 1:2,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

C:\Users\RachelMeiberan\UMWELT (AUSTRALIA) PTY. LTD\22110 - 03 S6(V)F - R04 - Amended BDAR\02_Projects\22110_R34_AmendedBDAR_Ch4_v1.aprx - 22110_R34_0402_PlantCommunityTypes

FIGURE 4.2.3

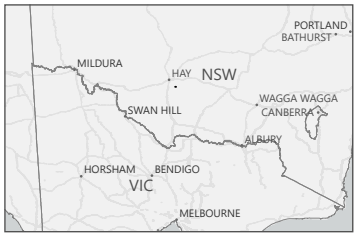
Plant Community Types Present within the Subject Land

Legend

- Stage 1 (South) Development Footprint
- Road
- BAM Plot

Plant Community Type

- PCT 28 Derived Native Grassland



0 20 40

Meters

Scale 1:2,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

C:\Users\RachelMeberson\UMWELT (AUSTRALIA) PTY. LTD\22110 - 03 S86VF R04 - Amended BDAR\02_Projects\22110_R34_AmendedBDAR_Ch4_v1.aprx - 22110_R34_04b02_PlantCommunityTypes

FIGURE 4.2.4

Plant Community Types Present within the Subject Land

Legend

- Stage 1 (South) Development Footprint
- Road
- Watercourse
- BAM Plot

Plant Community Type

- PCT 28 Derived Native Grassland

0 20 40

Meters

Scale 1:2,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

4.3.2 PCT 10: River Red Gum - Black Box woodland wetland of the semi-arid (warm) climatic zone (mainly Riverina Bioregion and Murray Darling Depression Bioregion)

4.3.2.1 PCT Description

PCT 10: River Red Gum - Black Box woodland wetland of the semi-arid (warm) climatic zone (mainly Riverina Bioregion and Murray Darling Depression Bioregion) is described in the BioNet Vegetation Classification as a tall to mid-high woodland comprised of *Eucalyptus camaldulensis* and *Eucalyptus largiflorens* occurring at the junction of River Red Gum and Black Box zones on the floodplains of major inland rivers. It is associated with a dense to very sparse midlayer dominated by *Duma florulenta* and *Acacia stenophylla* with the occasional *Exocarpos strictus* and a sparse grass dominated ground layer, usually displaying species such as *Paspalidium jubiflorum, Enteropogon acicularis, Cynodon dactylon, Rytidosperma caespitosum* and *Austrostipa nodosa*. Native forbs, such as *Sida corrugata, Oxalis perennans, Wahlenbergia fluminalis* and the sedge *Cyperus exaltatus* are also common. Dominant weeds associated within this PCT include *Hordeum* spp., *Lolium* spp. *Vulpia* spp., *Sonchus oleraceus*, *Medicago polymorpha* and *Phyla canescens* This PCT has been identified as occurring on grey to brown loam to medium clays in drainage depressions, swamps and backplains on alluvial plains and floodplains of the major inland rivers in the 450–250 mm annual rainfall zone in south-western NSW.

In the Subject Land this PCT is present as a medium height open woodland typically to 15 m tall.

This woodland is dominated by *Eucalyptus largiflorens* and *Eucalyptus camaldulensis* although they don't occur as mixed stands, with *Eucalyptus largiflorens* typically occupying larger areas away from the immediate channels, and *Eucalyptus camaldulensis* typically restricted to the immediate channels, with isolated small occurrences within isolated closed depressions.

There is a dense to open shrub layer to approximately 1.5 m tall, typically dominated by *Duma florulenta*, *Sclerolaena muricata* var. *muricata* and *Chenopodium nitrariaceum*. The groundlayer of grasses, forbs and dwarf shrubs is similarly variable in density and may include *Austrostipa nodosa, Sporobolus caroli*, *Lachnagrostis filiformis*, *Rytidosperma caespitosum*, *Paspalidium jubiflorum, Enteropogon acicularis*, *Atriplex semibaccata*, *Sida corrugata*, *Einadia nutans*, *Rhagodia spinescens* and *Oxalis perennans*.

This PCT is associated with grey-brown clays and red-brown clay loams principally in the south eastern parts of the Subject Land.

Table 4.7 Overview of PCT 10

PCT 10 River Red Gum - Black Box woodland wetland of the semi-arid (warm) climatic zone (mainly Riverina Bioregion and Murray Darling Depression Bioregion)	
Vegetation class	Inland Riverine Forests
Vegetation formation	Forested Wetlands
Estimate of per cent cleared	43.00
Area in Subject Land (ha)	19.96
Conservation status	No associated TEC
Vegetation zones (condition) and plots	Zone 1 – Moderate-good and 4 BAM VI plots

4.3.2.2 Justification of PCT Selection

The PCT in the Subject Land is a woodland of 15–20 m tall woodland dominated by *Eucalyptus camaldulensis* and *Eucalyptus largiflorens*, with typical shrubs being *Duma florulenta* and *Chenopodium nitrariaceum* and a low groundcover of sub-shrubs, forbs and grasses.

Using floristic data collected through BAM plots and rapid data points, the dominant and characteristic species along with the IBRA subregion (Murrumbidgee), formation (Forested Wetlands) and class (Inland Riverine Forests) were entered into the PCT filter tool and a single PCT (PCT 10) showed correlation with 11 associated species present. These species selected were *Eucalyptus largiflorens*, *Eucalyptus camaldulensis Duma florulenta*, *Einadia nutans, Chenopodium nitrariaceum*, *Sclerolaena muricata*, *Enteropogon acicularis*, *Austrostipa nodosa*, *Lachnagrostis filiformis*, *Paspalidium jubiflorum* and *Oxalis perennans.* It was noted that with just the formation, class and IBRA subregion selected, that only PCT 10 includes *Eucalyptus largiflorens*. Notwithstanding, the additional selected species is the best floristic match of any PCT irrespective of the class and IBRA subregion.

In the Subject Land and broad parts of the Project Area the SVTM also maps another Eucalypt woodland - the floristically similar 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). PCT 13 has been mapped by the current study in the Subject Land. Both PCTs areas as mapped by the current study have shared dominant species including *Eucalyptus largiflorens, Duma florulenta, Einadia nutans, Chenopodium nitrariaceum*, *Sclerolaena muricata* and *Enteropogon acicularis*. In the Subject Land PCT 10 supports both *Eucalyptus largiflorens* and *Eucalyptus camaldulensis*, although *Eucalyptus camaldulensis* is either restricted to the edge of the Coleambally Outfall Drain (in the lowest parts of the floodplain) or occurring as patches of drainage depressions with no *Eucalyptus largiflorens* present. Of both *Eucalyptus* species', PCT 13 is mapped by the current survey as only supporting *Eucalyptus largiflorens* and never the more inundation dependant *Eucalyptus camaldulensis*. Higher parts of the floodplain have been mapped as PCT 10 as the assigned formation of forested wetland; and areas mapped as PCT 13 as the assigned formation semi-arid (inland floodplain) woodland.

BioNet lists the relevant reference source for this PCT in this locality as a complex in Porteners (1993), evidently of map units 1 and 2, with map unit 1 Riverine Forest being the best match of floristics and landform for the Subject Land. The SVTM generally maps the PCT's extent in the locality well, with some modifications near the boundaries of PCT 13, or where isolated patches of *Eucalyptus camaldulensis* have been mapped erroneously by the SVTM as *Callitris* woodland.

The description of hydrology, soils and landscapes for PCT 10 in BioNet (and for the relevant part of map unit 1 in Porteners (1993)) matches well the areas mapped as PCT 10 by the current study, with the vegetation in the Subject Land being found on grey-brown clays and red-brown clay loams in the channels and adjacent flats and isolated closed depressions.

Table 4.8 Floristic and Structural Summary of PCT 10 Within the Subject Land

Growth Form	Details of PCT within Subject Land
IBRA subregion	Murrumbidgee subregion
Landscape position	Channels, adjacent flats and isolated closed depressions.
Soils and geology	Grey-brown clays and red-brown clay loams.
Floristic Description – Canopy stratum	*Eucalyptus largiflorens* and *Eucalyptus camaldulensis*

Growth Form	Details of PCT within Subject Land
Floristic Description – Mid stratum	*Duma florulenta* and *Chenopodium nitrariaceum*
Floristic Description – Ground stratum	*Einadia nutans, Sclerolaena muricata, Enteropogon acicularis, Austrostipa nodosa, Lachnagrostis filiformis, Paspalidium jubiflorum* and *Oxalis perennans.*

4.3.2.3 Condition States

PCT 10 occurs as one condition state within the Subject Land, PCT 10 Moderate-Good (VZ 1) which is a woodland vegetation zone.

Vegetation Zone 1 – PCT 10 Moderate-Good

PCT Name	PCT 10: River Red Gum - Black Box woodland wetland of the semi-arid (warm) climatic zone (mainly Riverina Bioregion and Murray Darling Depression Bioregion) – Moderate-Good	
Condition	Moderate-good	
Development Footprint (ha)		
Stage 1 – Linear	2.23	
Stage 1 – Site based	0.00	
Stage 2 -Linear	0.00	
Patch size	≥100 ha	
BAM VI plots	5 (P7, P14, P42, P49, P55)	
Description	Riverine woodland - structurally intact with canopy, shrub layer and ground layer present. May have naturally low density of shrub and ground layer. May include patchy occurrences of woody exotics.	
BC Act	No associated TEC	
EPBC Act	No associated TEC	

4.3.3 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)

4.3.3.1 PCT Description

The BioNet Vegetation Classification describes 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) as a woodland comprised of *Eucalyptus camaldulensis* and *Eucalyptus largiflorens* open forest or open woodland averaging about 15 m high, with a sparse to dense understorey of *Duma florulenta*, *Chenopodium nitrariaceum* and *Acacia stenophylla*. Low shrubs such as *Sclerolaena muricata* var. *muricata*, *Enchylaena tomentosa*, *Einadia nutans* ssp. *nutans* and *Atriplex* spp. are common. Forb species include *Solanum esuriale, Cotula australis, Oxalis perennans, Alternanthera denticulata* and *Pratia concolor*. Grass species include *Paspalidium jubiflorum*, *Enteropogon acicularis*, *Walwhalleya proluta* and *Rytidosperma* spp. Common Weed species include *Lycium ferocissimum*, the forbs *Cotula bipinnata, Erodium cicutarium* and *Sisymbrium irio* and the grasses *Hordeum leporinum* and *Lolium spp*. This PCT is known to occur on clay or clay-loam, often gilgaied, soils on inner floodplains and on alluvial plains mostly in depressions that are frequently flooded. It occurs in abundance around most river systems occurring within semi-arid (warm) climate zone of the Riverina and Murray Darling Depression and southern Cobar Peneplain Bioregions.

Table 4.9 Overview of PCT 13

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)	
Vegetation class	Inland Floodplain Woodlands
Vegetation formation	Semi-arid Woodlands (Grassy sub-formation)
Estimate of per cent cleared	57.00
Area in Subject Land	2.45
Conservation status	No associated TEC
Vegetation zones (condition) and plots	Zone 2 – Moderate-good and 4 BAM VI plots

4.3.3.2 Justification of PCT Selection

The PCT in the Subject Land is a woodland of 10–15 m tall woodland dominated by *Eucalyptus camaldulensis* and *Eucalyptus largiflorens*, with typical shrubs being *Duma florulenta* and *Chenopodium nitrariaceum* and a low groundcover of sub-shrubs, forbs and grasses.

Using floristic data collected through BAM plots and rapid data points, the dominant and characteristic species along with the IBRA subregion, (Murrumbidgee), formation (Semi-arid Woodlands) and class (Inland Floodplain Woodlands) were entered into the PCT filter tool and a single PCT (PCT 13) showed correlation with associated species present. These species selected were *Eucalyptus largiflorens, Duma florulenta, Einadia nutans, Chenopodium nitrariaceum, Enchylaena tomentosa, Atriplex semibaccata, Walwhalleya proluta, Sclerolaena muricata, Enteropogon acicularis, Rytidosperma caespitosum* and *Oxalis perennans*. It was noted that with just the formation, class and IBRA subregion selected, that only PCT 13 includes *Duma florulenta*. Notwithstanding, the additional selected species is the best floristic match of any PCT irrespective of the class and IBRA subregion.

BioNet lists the relevant reference source for this PCT in this locality as map unit 2: Black Box Woodland in Porteners (1993). The SVTM generally maps the PCT's extent in the locality well.

The description of hydrology, soils and landscapes for PCT 13 in BioNet (and for the relevant map unit 2 in Porteners (1993) matches well the areas mapped as PCT 13 by the current study, with the vegetation in the Subject Land being found on grey-brown clays and red-brown clay loams on terraces adjacent to channels and the higher parts of larger depressions.

In the Subject Land and broad parts of the Project Area the SVTM also maps another Eucalypt woodland - the floristically similar PCT 10: River Red Gum - Black Box woodland wetland of the semi-arid (warm) climatic zone (mainly Riverina Bioregion and Murray Darling Depression Bioregion). Discussion as to how these two floristically similar PCTs have been compared and mapped in the Subject land are presented in **Section 4.3.2.2**.

Table 4.10 Floristic and Structural Summary of PCT 13 Within the Subject Land

Growth Form	Details of PCT within Subject Land
IBRA subregion	Murrumbidgee subregion
Landscape position	Terraces and upper parts of larger depressions
Soils and geology	Grey-brown clays and red-brown clay loams
Floristic Description – Canopy stratum	*Eucalyptus largiflorens*
Floristic Description – Mid stratum	*Duma florulenta* and *Chenopodium nitrariaceum*
Floristic Description – Ground stratum	*Einadia nutans*, *Enchylaena tomentosa*, *Atriplex semibaccata*, *Walwhalleya proluta*, *Sclerolaena muricata* and *Enteropogon acicularis*.

4.3.3.3 Condition States

PCT 13 occurs as one condition state within the Subject Land, PCT 13 Moderate-Good (VZ 2) a woodland vegetation zone.

Vegetation Zone 2 – PCT 13 Moderate-Good

PCT Name	PCT 13 River Red Gum - Black Box woodland wetland of the semi-arid (warm) climatic zone (mainly Riverina Bioregion and Murray Darling Depression Bioregion) – Moderate-Good	
Condition	Moderate-good	
Development Footprint (ha)		
Stage 1 – Linear	0.08	
Stage 1 – Site based	0.00	
Stage 2 – Linear	0.00	
Patch size	≥100 ha	
BAM VI plots	2 (P33, P52)	
Description	Floodplain woodland – structurally intact with canopy, shrub layer and ground layer present. May have naturally low density of shrub and ground layer. May include patchy occurrences of woody exotics.	
BC Act	No associated TEC	
EPBC Act	No associated TEC	

4.3.4 PCT 17: Lignum shrubland wetland of the semi-arid (warm) plains (mainly Riverina Bioregion and Murray Darling Depression Bioregion)

4.3.4.1 PCT Description

PCT 17 Lignum shrubland wetland of the semi-arid (warm) plains (mainly Riverina Bioregion and Murray Darling Depression Bioregion) is described in the BioNet Vegetation Classification as an open shrubland to 2 m high, dominated by *Duma florulenta* often with *Chenopodium nitrariaceum*, low cover of *Eragrostis australasica* and occasionally scattered Black Box *Eucalyptus largiflorens*. *Acacia salicina* and *Acacia stenophylla* may be present as tall shrubs. The ground cover is commonly made up of small shrubs such as *Sclerolaena tricuspis*, *Sclerolaena muricata* var. *muricata*, *Atriplex lindleyi*, *Atriplex suberecta* and *Salsola tragus* ssp. *tragus*, the grasses *Walwhalleya proluata* and *Enteropogon ramosus*, the fern *Marsilea drummondii*, the rush *Juncus flavidus*, the forbs *Rumex tenax, Einadia nutans* ssp. *nutans, Bulbine bulbosa, Senecio glossanthus* and *Senecio cunninghamii*. Weed species include *Lolium spp., Hordeum leporinum* and *Rapistrum rugosum.* This PCT occurs widespread throughout 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. PCT 17 tends to have a consistent floristic composition throughout its wide range.

On the Subject Land this PCT is a shrubland with a moderate cover of a typically naturally low diversity of shrubs and a typically low cover and diversity of forbs. Non-native grass cover can be moderate to high in season.

The dominant plant is *Duma florulenta* to 2 m tall, often forming a dense canopy. Typically, *Chenopodium nitrariaceum and Eragrostis australasica* are present, along with occasional *Sclerolaena muricata*.
The groundlayer may be open to closed and of low native diversity, often dominated by *Einadia nutans*, *Salsola australis*, *Atriplex nummularia*, and in localised wetter drainage depressions *Eleocharis pallens* and *Eleocharis acuta.*

This PCT is associated with grey clays present as typically small patches associated with depressions of commonly less than 5 ha.

Table 4.11 Overview of PCT 17

PCT 17 Lignum shrubland wetland of the semi-arid (warm) plains (mainly Riverina Bioregion and Murray Darling Depression Bioregion)	
Vegetation class	Inland Floodplain Shrublands
Vegetation formation	Freshwater Wetlands
Estimate of per cent cleared	63.00
Area in Subject Land	20.20
Conservation status	No associated TEC
Vegetation zones (condition) and plots	Zone 3 – Moderate-good and 3 BAM VI plots

4.3.4.2 Justification of PCT Selection

The PCT in the Subject Land is a shrubland dominated by *Duma florulenta*, with occasional *Chenopodium nitrariaceum* and *Eragrostis australasica.*

Using floristic data collected through BAM plots and rapid data points, the dominant and characteristic species along with the IBRA subregion (Murrumbidgee), formation (freshwater wetlands) were entered into the PCT filter tool and a single PCT (PCT 17) showed correlation with associated species present. These nine species selected were *Duma florulenta, Chenopodium nitrariaceum, Eragrostis australasica, Sclerolaena muricata, Einadia nutans, Wahlwhalleya proluta, Enteropogon acicularis, Calotis scabiosifolia and Marsilia drumondii*. It was noted that if less than half of these species were entered into the PCT filter tool, PCT 17 is the only candidate PCT.

BioNet lists the relevant reference source for this PCT in this locality as part of map unit 18 Lignum and *Chenopodium nitrariaceum* in Porteners (1993). This part (*Duma* dominated versus *Chenopodium* dominated) of Porteners (1993) map unit 18 aligns well to both this PCT mapped on site by the current study and as described as PCT 160 in BioNet. The SVTM generally undermaps the PCT's extent in the locality, and the current study's ground truthing has reattributed many areas mapped as PCT 160 to PCT 17.

The description of hydrology, soils and landscapes for PCT 17 in BioNet (and for the relevant part of plant community 18 in Porteners (1993)), matches well the vegetation mapped as PCT 17 by the current study, with the vegetation in the Subject Land being found on grey clays (likely gleyed) in occasionally inundated depressions and floodplain and alluvial plains.

All dominant native species in patches mapped as PCT 17 are considered tolerant of periodic inundation or waterlogging, indicating that the formation is a wetland, however as part of the initial stratification and PCT investigation, consideration of other PCTs locally mapped in the Project area by SVTM that list *Duma florulenta* as a component species and are either classified as wetland formations (Forested Wetlands or Freshwater Wetlands) or include wetland within the PCT title were considered. This was particularly to consider whether these patches of *Duma*-dominated vegetation could be considered within other PCT extents. These other PCTs are:

- PCT 10: River Red Gum – Black Box woodland wetland of the semi-arid (warm) climatic zone (mainly Riverina Bioregion and Murray Darling Depression Bioregion).
- 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).
- PCT 24: Canegrass swamp tall grassland wetland of drainage depressions: lakes and pans of the inland plains.
- PCT 160: Nitre Goosefoot shrubland wetland on clays of the inland floodplains.
- PCT 10 and 13 are discussed in 4.3.2.2 and 4.3.3.2; both of these are Eucalypt dominated PCTs and while *Eucalyptus largiflorens* is noted as occurring in PCT 10, PCT 13 and PCT 17, it can be structurally dominant in PCT 10 and PCT 13 but never in PCT 17 which is described as a shrubland.
- PCT 24, while allocated to the class Inland Floodplain Shrublands, is described as a tall tussock grassland dominated by *Eragrostis australasica,* with *Duma florulenta* only as a potential component species. The nine species considered dominant or characteristic of patches mapped by the current study as PCT 17 that were entered into the PCT filter tool identified only 5 of the species as components of PCT 24.
- PCT 160, like PCT 17, is allocated to the class Inland Floodplain Shrublands in BioNet Vegetation Classification but is described as dominated by Nitre Goosefoot (*Chenopodium nitrariaceum*) often with Black Roly Poly (*Sclerolaena muricata*) with *Duma florulenta* only as a potential component species. Of the nine species considered dominant or characteristic of patches mapped by the current study as PCT 17 that were entered into the PCT filter tool identified only 5 of the species as components of PCT 160.

Table 4.12 Floristic and Structural Summary of PCT 17 Within the Subject Land

Growth Form	Details of PCT within Subject Land
IBRA subregion	Murrumbidgee subregion
Landscape position	Alluvial plain with occasional localised small depressions
Soils and geology	Grey cracking clays
Floristic Description – Canopy stratum	*Eucalyptus largiflorens* (rare)
Floristic Description – Mid stratum	*Duma florulenta* with occasional *Chenopodium nitrariaceum, Eragrostis australasica* and *Sclerolaena muricata*
Floristic Description – Ground stratum	*Einadia nutans, Wahlwhalleya proluta, Enteropogon acicularis, Calotis scabiosifolia* and *Marsilia drumondii*

4.3.4.3 Condition States

PCT 17 occurs as one condition state within the Subject Land, PCT 17 Moderate-Good (Zone 3) a shrubland vegetation zone.

Vegetation Zone 3 – PCT 17 Moderate-Good

PCT Name	PCT 17 Lignum shrubland wetland of the semi-arid (warm) plains (mainly Riverina Bioregion and Murray Darling Depression Bioregion)	
Condition	Moderate-good	
Development Footprint (ha)		
Stage 1 – Linear	2.05	
Stage 1 – Site based	0.00	
Stage 2 – Linear	0.00	
Patch size	≥100 ha	
BAM VI plots	3 (P2, P24, P45)	
Description	Floodplain shrubland – structurally intact with shrub layer and ground layer present. May have naturally low density of shrub and ground layer. May include patchy occurrences of exotic forbs and grasses.	
BC Act	No associated TEC	
EPBC Act	No associated TEC	

4.3.5 PCT 24: Canegrass swamp tall grassland wetland of drainage depressions: lakes and pans of the inland plains

4.3.5.1 PCT Description

BioNet Vegetation Classification describes PCT 24 Canegrass swamp tall grassland wetland of drainage depressions, lakes and pans of the inland plains as a tall tussock grassland dominated by *Eragrostis australasica* growing to over 2 m high ranging in cover from dense to isolated plants. This PCT is widespread, and there is considerable floristic variation across its range. The PCT requires periodic inundation during floods to stimulate germination of a range of plant species, thus the ground cover varies depending on time since and duration of inundation. The sub-formations could be divided into a number of communities, but several dominant species tend to be consistently present. Species sometimes associated across its range include *Sclerostegia tenuis* or *Halosarcia pergranulata*. *Eragrostis australasica* dies off during drought leaving persistent culms. Associated grass species vary depending on the area of NSW it is occurring in, sometimes including *Chloris truncata*, *Lachnagrostis filiformis*, *Austrostipa aristiglumis*, *Eragrostis setifolia* and *Eragrostis parviflora.* A variety of low shrubs are associated, including *Sclerolaena* spp., *Atriplex* spp. and *Teucrium racemosum.* Sedges and rushes, such as *Eleocharis acuta, Eleocharis pusilla* and *Eleocharis pallens* are often common. The aquatic *Marsilea drummondii*, *M. costulifera*, *Azolla filiculoides* and *Myriophyllum* spp. may be ephemerally present. Highly salt tolerant plant species are more common in western-most areas and include *Disphyma crassifolium* ssp. *clavellatum*, *Frankenia serpyllifolia* and *Osteocarpum acropterum*. 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.

On the Subject Land this PCT is a shrubland with a moderate cover of a typically naturally low diversity of shrubs and a typically low cover and diversity of forbs. Non-native grass cover can be moderate in season.

The dominant plant is *Eragrostis australasica* to 2 m tall, often forming a dense canopy. Typically, *Chenopodium nitrariaceum* is present but at lower densities than *Eragrostis australasica. Duma florulenta* and *Sclerolaena muricata* may be occasionally present. The groundlayer may be open to closed and of low native diversity, often dominated by *Marsilea drummondii*, *Einadia nutans*, *Atriplex semibaccata*, *Austrostipa aristiglumis*, and in localised wetter parts of depressions *Eleocharis pallens* and *Eleocharis acuta.* Groundlayer above ground cover varies seasonally.

This PCT is associated with grey clays present as typically small patches associated with depressions of commonly less than 5 ha.

Table 4.13 Overview of PCT 24

PCT 24 Canegrass swamp tall grassland wetland of drainage depressions: lakes and pans of the inland plains	
Vegetation class	Inland Floodplain Shrublands
Vegetation formation	Freshwater Wetlands
Estimate of per cent cleared	20.00
Area in Subject Land	10.02

PCT 24 Canegrass swamp tall grassland wetland of drainage depressions: lakes and pans of the inland plains	
Conservation status	This PCT is associated with one TEC listed under the BC Act, Artesian Springs Ecological Community in the Great Artesian Basin, but the Subject Land is outside of the particular area of the TEC (The Great Artesian Basin) and therefore does not occur on the Subject Land.
Vegetation zones (condition) and plots	Zone 4 – Moderate-good and 3 BAM VI plots

4.3.5.2 Justification of PCT Selection

The PCT in the Subject Land is a shrubland-grassland dominated by *Eragrostis australasica* with occasional *Chenopodium nitrariaceum*, *Duma florulenta* and *Sclerolaena muricata*.

The vegetation community on site is floristically and structurally distinctive and with a sharp boundary from other communities. Using floristic data collected through BAM plots and rapid data points, the dominant and characteristic species along with the IBRA subregion (Murrumbidgee), formation (freshwater wetlands), and community structure (Inland Floodplain Shrublands) were entered into the PCT filter tool and a candidate list of PCTs was generated from those PCTs showing highest correlation of associated species present. These ten species selected were *Eragrostis australasica, Duma florulenta, Chenopodium nitrariaceum, Sclerolaena muricata, Marsilia drumondii, Atrilex semibaccata, Maireana aphylla, Austrostipa aristiglumis, Eleocharis pallens* and *Eleocharis acuta.* Of these PCTs that the tool includes with the dominant species *Eragrostis australasica* and the occasionally present *Duma florulenta* and *Chenopodium nitrariaceum*, there are two PCTs: PCT 17 and PCT 24. While the tool identifies these three wetland species in both these PCTs, BioNet Vegetation Classification describes *Eragrostis australasica* as the dominant species in PCT 24 and of low cover in PCT 17, with *Duma florulenta* being dominant in PCT 17 and Chenopodium nitrariaceum in PCT 160.

BioNet lists the relevant reference source for this PCT in this locality as part of map unit 18 Lignum and Chenopodium nitrariaceum in Porteners (1993). This part (*Duma* dominated versus *Chenopodium* dominated) of Porteners (1993) map unit 18 aligns well to both this PCT mapped on site by the current study and as described in BioNet Vegetation Classification as PCT 24. The SVTM generally maps the PCT's extent in the locality similarly to the current study.

The description of hydrology, soils and landscapes for PCT 24 in BioNet (and for the relevant part of plant community 18 in Porteners (1993) matches well the vegetation mapped as PCT 24 by the current study, with the vegetation in the Subject Land being found on cracking grey clays (likely gleyed) in occasionally inundated depressions and floodplain and alluvial plains.

Most of the dominant native species in patches mapped as PCT 24 are considered tolerant of periodic inundation or waterlogging, indicating that the formation is a wetland. However as part of the initial stratification and PCT investigation, consideration of other PCTs locally mapped in the Project area by SVTM that list *Eragrostis australasica* as a component species, and are either classified as wetland formations (Forested Wetlands or Freshwater Wetlands) or include wetland within the PCT title, were considered. This was particularly to consider whether these patches of *Eragrostis* -dominated vegetation could be considered within other PCT extents.

These other PCTs are:

- PCT 17: Lignum shrubland wetland of the semi-arid (warm) plains (mainly Riverina Bioregion and Murray Darling Depression Bioregion)
- PCT 160: Nitre Goosefoot shrubland wetland on clays of the inland floodplains.

PCT 17 and 160 are discussed in 4.3.4.2 and 4.3.10.2. Both of these PCTs, like PCT 24, are assigned to the class Inland Floodplain Shrublands and while *Eragrostis australasica* is listed as occurring in PCT 17 and PCT 160, it isn't described as ever being dominant in these shrubland but is described as the dominant species in PCT 24.

While PCT 17 is described as an open shrubland, and it is allocated to the class Inland Floodplain Shrublands. It is described as dominated by *Duma florulenta* often with *Chenopodium nitrariaceum* and low cover of *Eragrostis australasica*. The ten species considered dominant or characteristic of patches mapped by the current study as PCT 24 that were entered into the PCT filter tool identified six of the species as components of PCT 17.

PCT 160, like PCT 17 and PCT 24, is allocated to the class Inland Floodplain Shrublands in BioNet Vegetation Classification. It is described as dominated by *Chenopodium nitrariaceum* often with *Sclerolaena muricata* with *Duma florulenta* only as a potential component species. Of the ten species considered dominant or characteristic of patches mapped by the current study as PCT 24 that were entered into the PCT filter tool identified only 4 of the species are components of PCT 24.

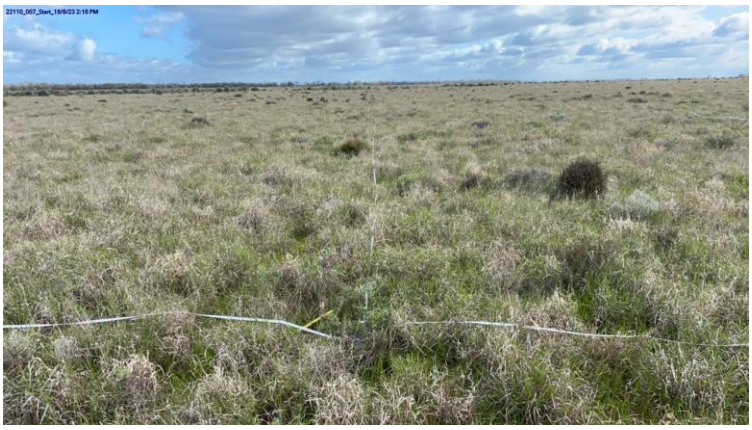
Table 4.14 Floristic and Structural Summary of PCT 24 Within the Subject Land

Growth Form	Details of PCT within Subject Land
IBRA subregion	Murrumbidgee subregion
Landscape position	Depressions on floodplain
Soils and geology	Grey clays
Floristic Description – Canopy stratum	No canopy present
Floristic Description – Mid stratum	*Eragrostis australasica* dominated with *Chenopodium nitrariaceum* occasional and lower densities of *Duma florulenta*
Floristic Description – Ground stratum	Dominated by *Marsilea drummondii and Einadia nutans*

4.3.5.3 Condition States

PCT 17 occurs as one condition state within the Subject Land, PCT 24 Moderate-Good (Zone 3) a shrubland-tall grassland vegetation zone.

Vegetation Zone 4 – PCT 24 Moderate-Good

PCT Name	PCT 24 Canegrass swamp tall grassland wetland of drainage depressions: lakes and pans of the inland plains	
Condition	Moderate-good	
Area Development Footprint (ha)		
Stage 1 – Linear	1.97	
Stage 1 – Site based	0.00	
Stage 2 – Linear	0.00	
Patch size	≥100 ha	
BAM VI plots	3 (P3, P4, P34)	
Description	Floodplain shrubland-tall grassland– structurally intact with shrub and tall grass layer and ground layer present. May have naturally low density ground layer. Dense patches of exotic grasses may seasonally occur.	
BC Act	While BioNet Vegetation Classification lists on TEC listed under the BC Act, Artesian Springs Ecological Community in the Great Artesian Basin (critically endangered) as associated with PCT24, the Subject Land is outside of the particular area of the TEC (The Great Artesian Basin) and therefore does not occur on the Subject Land.	
EPBC Act	No associated TEC	

4.3.6 PCT 26: Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion

4.3.6.1 PCT Description

PCT 26 Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion is described in the BioNet Vegetation Classification as a mid-high open woodland to 8 m high, dominated by *Acacia pendula*. *Casuarina cristata* also often occurs, with *Eucalyptus largiflorens* and *Eucalyptus camaldulensis* sometimes occurring in depressions. If chenopod shrubs do occur, species often include *Rhagodia spinescens, Maireana decalvans, Atriplex nummularia, Chenopodium nitrariaceum, Hakea leucoptera, Santalum lanceolatum, Exocarpos aphyllus* and *Maireana aphylla.* Ground dover density is variable and dependant on rainfall. It is grass dominated, often displaying species such as *Rytidosperma caespitosum, Rytidosperma setaceum, Austrostipa aristiglumis, Austrostipa scabra, Austrostipa nodosa* and *Sporobolus caroli.* Other groundcovers include the saltbush species such as *Atriplex spinibractea, Atriplex leptocarpa* and *Atriplex semibaccata* and forb species such as *Alternanthera denticulata, Myriocephalus rhizocephalus, Centipeda cunninghamii, Rhodanthe corymbiflora* and *Vittadinia cuneata* var. *cuneata*. PCT 26 is found on brown clays or loam soils on alluvial plains mainly in the Riverina and NSW South-western Slopes Bioregions of south-western NSW.

The woodland vegetation zone is dominated by *Acacia pendula* with *Eucalyptus largiflorens* occurring very rarely as isolated trees near adjoining PCTs. There is a patchy shrub layer to approximately 1 m, typically dominated by chenopods, including species such as *Maireana aphylla*, *Sclerolaena muricata* var. *semiglabra, Sclerolaena muricata* var. *muricata*, *Sida corrugata*, and *Salsola australis*. The groundlayer of grasses, forbs and dwarf shrubs is well-developed and commonly includes *Austrostipa scabra*, *Rytidosperma caespitosa*, *Sporobolus caroli*, *Atriplex semibaccata*, *Einadia nutans*, *Chenopodium desertorum*, *Goodenia fascicularis*, *Maireana pentagona*, *Enteropogon acicularis*, *Calotis scabiosifolia* and *Vittadinia cuneata*. The mistletoe *Amyema quandang* is commonly growing on with *Acacia pendula* trees.

This PCT is associated with grey-brown clays and red-brown clay loams in the south eastern parts of the Subject Land.

Table 4.15 Overview of PCT 26

PCT 26 Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion	
Vegetation class	Riverine Plain Woodlands
Vegetation formation	Semi-arid Woodlands (Grassy sub-formation)
Estimate of per cent cleared	20.00
Area in Subject Land (ha)	114.74
Conservation status	PCT is associated with two TECs. • Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions, listed as endangered under BC Act. • Weeping Myall Woodlands, listed as endangered under EPBC Act.
Vegetation zones (condition) and plots	Zone 5 - DNG and 5 BAM VI plots
	Zone 6 - Moderate-good and 4 BAM VI plots

4.3.6.2 Justification of PCT Selection

The PCT in the Subject Land is dominated by *Acacia pendula* as an open woodland over a grassy groundlayer with patchy low shrubs, or as a largely treeless DNG with scattered *Acacia pendula* present as low suckers. The associated assemblage of patchy low shrubs and groundlayer along with correlation of landform, location and soils as discussed above supports stratification of these two related plant communities as map units of the PCT in two condition state.

The BioNet Vegetation Classification PCT Filter Tool was used to determine the vegetation formation and class as Semi-arid Woodlands (grassy sub-formation) – Riverine Plain Woodlands. Using floristic data collected through BAM plots and rapid data points, the dominant and characteristic species in each layer, along with the IBRA subregion, were entered into the tool and a candidate list of PCTs was generated. These seven species selected for input into the BioNet Vegetation Classification PCT Filter Tool were *Acacia pendula, Maireana aphylla, Rytidosperma caespitosa, Austrostipa scabra, Maireana pentagona, Atriplex semibaccata* and *Einadia nutans.* PCT 26 was the only semi-arid woodland PCT described as occurring in the IBRA region with *Acacia pendula* as a dominant species rather than an understorey species within *Eucalyptus* or *Casuarina* dominated woodland.

Of these PCTs that BioNet Vegetation Classification PCT Filter Tool includes with Acacia pendula as a component species that are mapped in the locality by the SVTM, is only PCT 15, which is dominated by Eucalyptus largiflorens as discussed in 4.3.3. Of the seven species considered dominant or characteristic of patches mapped by the current study as PCT 26 that were entered into the PCT filter tool identified only 3 of the species are components of PCT 26.

BioNet lists the relevant reference source for this PCT in this locality as Porteners (1993), which has a map unit 25 *Acacia pendula* Woodland that aligns well to both this PCT mapped on site by the current study and as described as PCT 26 in BioNet. The SVTM maps the PCT's extent closely to that mapped by the current study.

The description of associated soils and landscapes for PCT 26 in BioNet matches well with the areas mapped as PCT 26 by the current study, with the vegetation in the Subject Land being found on alluvial clays and loams on riverine plains.

Table 4.16 Floristic and Structural Summary of PCT 26 Within the Subject Land

Growth Form	Details of PCT within Subject Land
IBRA subregion	Murrumbidgee subregion
Landscape position	Level riverine plains
Soils and geology	Grey-brown clays to red-brown clay loams
Floristic Description – Canopy stratum	Open woodland of *Acacia pendula* or as treeless DNG with occasional suckering individuals.
Floristic Description – Mid stratum	Patchy low shrubs most commonly *Maireana aphylla* and *Sclerolaena muricata* varieties.
Floristic Description – Ground stratum	Well-developed in season of grasses including *Austrostipa scabra*, *Rytidosperma caespitosum,* and low shrubs and forbs including *Atriplex semibaccata Maireana decalvans*, and *Vittadinia cuneata* var. *cuneata.*

4.3.6.3 Condition States

Within the Subject Land this PCT is present as two condition states

- largely treeless form of a DNG, derived native grassland with only rare isolated mature *Acacia pendula* present and/or low juvenile or suckering *Acacia pendula* plants
- intact open grassy woodland structure with *Acacia pendula* present as both mature and recruiting trees.

Vegetation Zone 5 – PCT 26 Derived Native Grassland

PCT Name	PCT 26 Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion - Derived Native Grassland	
Condition	DNG	
Development Footprint (ha)		
Stage 1 – Linear	17.88	
Stage 1 – Site based	0.00	
Stage 2 – Linear	0.00	
Patch size	≥100 ha	
BAM VI plots	5 (P26, P27, P28, P29, P30)	
Description	This condition state includes a derived native grassland to very open woodland, with patchy low shrubs and uncommon small trees of *Acacia pendula* and occasional small recruiting or suckering plants of *Acacia pendula*. This vegetation zone is concentrated in the south eastern quarter of the Subject Land, often adjacent to or surrounding areas of Zone 6.	
BC Act	Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions (endangered).	
EPBC Act	VZ 5 does not meet the condition class requirements for the Weeping Myall Woodlands EEC because of structural and floristic limitations.	

Vegetation Zone 6 – PCT 26 Moderate-Good

PCT Name	PCT 26 Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion - Moderate-Good	
Condition	Moderate-good	
Development Footprint (ha)		
Stage 1 – Linear	4.92	
Stage 1 – Site based	0.00	
Stage 2 – Linear	0.00	
Patch size	≥100 ha	
BAM VI plots	4 (P12, P43, P46, P47)	

PCT Name	PCT 26 Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion - Moderate-Good
Description	This condition state includes a woodland with mature *Acacia pendula* trees present associated with recruiting or suckering smaller plants. There is a patchy shrub layer dominated by chenopods and diverse sub-shrubs, forbs and grasses. This vegetation zone is concentrated in the south eastern quarter of the Subject Land, often adjacent to or surrounded by areas of Zone 5.
BC Act	Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions (endangered).
EPBC Act	Weeping Myall Woodlands (endangered).

4.3.7 PCT 28: White Cypress Pine open woodland of sand plains, prior streams and dunes mainly of the semi-arid (warm) climate zone

4.3.7.1 PCT Description

The BioNet Vegetation Classification describes PCT28: White Cypress Pine open woodland of sand plains, prior streams and dunes mainly of the semi-arid (warm) climate zone as a *Callitris glaucophylla* dominated open woodland or a derived grassland with scattered trees up to 15 m high. Associated small tree and tall shrub species include *Allocasuarina luehmannii*, *Hakea leucoptera*, *Hakea tephrosperma*, *Myoporum platycarpum*, *Pittosporum angustifolium*, *Alectryon oleifolius* ssp. *canescens*, *Eremophila longifolia* and *Geijera parviflora*. Common chenopod shrub species include *Maireana pyramidata*, *Maireana enchylaenoides* and *Rhagodia spinescens*. Copperburr low shrubs include *Sclerolaena diacantha* and *Sclerolaena obliquicuspis*. Forb species include *Tetragonia tetragonioides, Calandrinia eremaea, Calotis hispidula, Tribulus terrestris* and *Zygophyllum ammophilum*. Many stands contain a very sparse shrub understorey that has been grazed out with the ground being dominated by native and exotic grasses and forbs. Native grass species include *Austrostipa scabra* ssp. *scabra, Rytidosperma caespitosum, Aristida behriana, Enneapogon nigricans* and *Paspalidium constrictum*. Exotic species include *Schismus barbatus, Brassica tournefortii* and *Medicago polymorpha*. Occurs on sandy loam soils on prior streams, source bordering sand dunes and sand plains in south-western NSW. Often present in a mosaic with Belah - Western Rosewood, *Acacia* or *Eucalyptus* communities.

On the Subject Land this PCT is present as two vegetation zones: one with an intact open woodland structure with trees to approximately 8 m tall (Zone 8 - Moderate-good), and one as a largely treeless form of a derived native grassland, in which there may be uncommon, scattered trees (Zone 7 - Derived native grassland).

The woodland vegetation of Zone 8 - Moderate-good is dominated by Callitris glaucophylla, Alectryon oleifolius, Geijera parviflora, Eremophila longifolia, Pittosporum angustifolium, Hakea tephrosperma, Acacia pendula and A. oswaldii. There is a patchy shrub layer to approximately 1 m, typically dominated by chenopods, including species such as Maireana aphylla, Chenopodium curvispicatum, Sclerolaena muricata var. semiglabra, Sclerolaena muricata var. muricata, Solanum esuriale, Roepera glauca and Salsola australis. The groundlayer of grasses, forbs and dwarf shrubs is variable with areas protected from sheep, cattle grazing and rabbit browsing being well-developed although many areas have low vegetation cover. Groundlayer commonly includes Enteropogon acicularis, Austrostipa scabra, Rytidosperma caespitosum, Atriplex semibaccata, Boerhavia domini, Sida corrugata, Crassula sp., Sclerolaena brachyptera and Tetragonia moorei.

The derived native grassland of Zone 7 has uncommon or scattered trees of *Callitris glaucophylla*, *Hakea tephrosperma*, *Acacia pendula* or *A. oswaldii*. The mid and ground layers are typically similar to Zone 8, with a patchy shrub-layer sometimes present dominated by *Maireana aphylla*, *Solanum esuriale* and *Salsola australis*. Grasses are dominated by *Enteropogon acicularis*, *Austrostipa scabra* and *Rytidosperma caespitosum*.

This PCT is associated with red-brown clay loams with localised shallow surface sand, in the north-east, central and south-eastern parts of the Subject Land.

Table 4.17 Overview of PCT 28

PCT 28 - White Cypress Pine open woodland of sand plains, prior streams and dunes mainly of the semi-arid (warm) climate zone	
Vegetation class	Riverine Plain Woodlands
Vegetation formation	Semi-arid Woodlands (Grassy sub-formation)
Estimate of per cent cleared	20.00
Area in Subject Land	487.54
Conservation status	Sandhill Pine Woodland in the Riverina, Murray-Darling Depression and NSW South Western Slopes bioregions in the Subject Land – listed as endangered under the BC Act.
Vegetation zones (condition) and plots	Zone 7 - Derived native grassland and 9 BAM VI plots
	Zone 8 - Moderate-good and two BAM VI plots

4.3.7.2 Justification of PCT Selection

The PCT in the Subject Land as an open woodland is dominated by *Callitris glaucophylla*, *Alectryon oleifolius* and *Geijera parviflora* over a shrubby groundlayer, or as a largely treeless derived native grassland with scattered *Callitris* trees. The correlation of these assemblages with associated landform, location and soils as discussed above supports stratification of these two related plant communities as map units of the PCT in two condition state. The presence of *Callitris glaucophylla* is considered by the current survey to be a diagnostic species for this PCT in the Subject Land, noting that there is evidence of widespread logging of trees in the locality, resulting in derived native grasslands of this PCT. In addition to the floristic and abiotic features discussed above, these stumps or fallen logs of the relatively decay-resistant *Callitris glaucophylla* have assisted in the mapping of this PCT.

Using floristic data collected through BAM plots and rapid data points, the dominant and characteristic species in each layer, along with the IBRA subregion, was entered into the PCT Filter Tool and a candidate list of PCTs was generated. Of these, PCT 28 was the best floristic fit of a *Callitris* and associated woody species in a semi-arid woodland in the IBRA sub-region. Only one other PCT: 57 Belah/Black Oak-Western Rosewood-Wilga woodland of Central NSW including the Cobar Peneplain Bioregion, had all dominant associated trees on site, but it was noted that PCT 57 also has a suite of other trees including *Eucalyptus* species and *Casuarina* species not found in the areas of PCT 28. BioNet lists the relevant reference source for this PCT in this locality as Porteners (1993), with the relevant map units being 16 *Callitris* Mixed Woodland and 27 Prior Stream Remnant Woodland. The descriptions and species recorded by Porteners (1993) in that study's map unit map units aligns well with PCT 28 mapped by the current study on the Subject Land.

The description of associated soils and landscapes for PCT 28 in BioNet correlates well with the areas mapped by the current study, with the vegetation in the Subject Land being found on generally raised red-brown clay loams with localised shallow surface sand.

Table 4.18 Floristic and Structural Summary of PCT 28 Within the Subject Land

Growth Form	Details of PCT within Subject Land
IBRA subregion	Murrumbidgee subregion
Landscape position	Raised red-brown clay loams with localised shallow surface sand.
Soils and geology	Red-brown clay loams with localised shallow surface sand
Floristic Description – Canopy stratum	*Callitris glaucophylla, Alectryon oleifolius and Geijera parviflora*
Floristic Description – Mid stratum	*Eremophila longifolia, Pittosporum angustifolium, Hakea tephrosperma, Acacia pendula* and *A. oswaldii.*
Floristic Description – Ground stratum	*Enteropogon acicularis, Austrostipa scabra, Rytidosperma caespitosum, Atriplex semibaccata, Boerhavia domini, Sida corrugata, Crassula sp., Sclerolaena brachyptera* and *Tetragonia moorei*.

4.3.7.3 Condition States

Within the Subject Land this PCT is present as two condition states:

- intact open woodland structure with trees of *Callitris glaucophylla*, *Alectryon oleifolius* and *Geijera parviflora* to 6 m tall
- a largely treeless form of a DNG, which may have rare, scattered trees or shrubs.

Vegetation Zone 7 – PCT 28 Derived Native Grassland

PCT Name	PCT 28: White Cypress Pine open woodland of sand plains, prior streams and dunes mainly of the semi-arid (warm) climate zone – DNG	
Condition	DNG	
Development Footprint (ha)		
Stage 1 – Linear	20.44	
Stage 1 – Site based	0.53	
Stage 2 – Linear	38.74	
Patch size	≥100 ha	
BAM VI plots	9 (P10, P17, P18, P20, P21, P51, P70, P71, P79)	
Description	This condition state includes a derived native grassland with very rare and patchy trees and shrubs present. Trees where present may include *Callitris glaucophylla*, *Alectryon oleifolius* and *Geijera parviflora* and shrubs *Eremophila longifolia, Pittosporum angustifolium, Hakea tephrosperma, Acacia pendula* and *A. oswaldii.* The vegetation zone may have patchy shrubs and most vegetation cover is a variably dense ground layer of subshrubs, forbs and grasses. The vegetation zone may be affected by rabbit grazing and warrens, as well as areas dominated by seasonal exotic grasses. Evidence of cut stumps of dead *Callitris* is often common.	
BA Act	Sandhill Pine Woodland in the Riverina, Murray-Darling Depression and NSW South Western Slopes bioregions – endangered.	
EPBC Act	Currently on finalised priority assessment list: Sandhill pine woodlands in the Riverina, Murray-Darling Depression and NSW South Western Slopes bioregions.	

Vegetation Zone 8 – PCT 28 Moderate-Good

PCT Name	PCT 28: White Cypress Pine open woodland of sand plains, prior streams and dunes mainly of the semi-arid (warm) climate zone	
Condition	Moderate-good	
Area Development Footprint (ha)		
Stage 1 – Linear	0.00*	
Stage 1 – Site based	0.00*	
Stage 2 – Linear	0.00*	
Patch size	≥100 ha	
BAM VI plots	2 (P19, P53)	

PCT Name	PCT 28: White Cypress Pine open woodland of sand plains, prior streams and dunes mainly of the semi-arid (warm) climate zone
Description	Riverine woodland - structurally intact with canopy, shrub layer and ground layer present. May have naturally low density of shrub and ground layer. May include patchy occurrences of exotics forbs and grasses.
BA Act	Sandhill Pine Woodland in the Riverina, Murray-Darling Depression and NSW South Western Slopes bioregions – endangered.
EPBC Act	Currently on finalised priority assessment list: Sandhill pine woodlands in the Riverina, Murray-Darling Depression and NSW South Western Slopes bioregions.

** PCT 28 Moderate-Good occurs within the Subject Land but has been avoided by the Development Footprint.*

4.3.8 PCT 44: Forb-rich Speargrass - Windmill Grass - White Top grassland of the Riverina Bioregion

4.3.8.1 PCT Description

PCT 44 Forb-rich Speargrass - Windmill Grass - White Top grassland of the Riverina Bioregion is described in the BioNet Vegetation Classification as a diverse open to closed grasslands of usually 0.3 m, composed of *Austrostipa nodosa*, *Chloris truncata* and *Rytidosperma caespitosum*. A range of forbs associated include daisies such as *Leucochrysum molle* and *Calotis scabiosifolia* and legumes such as *Swainsona* spp. Scattered bluebush species such as *Maireana pentagona* and *M. excavata* are common. Occurs on grey-cracking clays and red-brown clays often including scalds on the plains of the southern part of the Riverine Plain Bioregion from Urana in the east to Deniliquin in the west and to the north. This PCT is associated with a number of threatened flora species, such as *Swainsona plagiotropis*, *Leptorhynchos scaber*, *Sclerolaena napiformis* and *Lepidium monoplocoides*. This PCT is known to be diverse, with up to 100 native and 40 exotic species being recorded. Species composition alters with the seasons and from year to year depending on rainfall, with annual exotics such as *Lolium* spp. and *Avena* spp. sometimes dominating over spring. PCT 44 is likely derived from a chenopod shrubland prior to European settlement where grassland probably formed a mosaic with shrubland.

On the Subject Land this PCT is a grassland with a diverse cover of low shrubs and forbs in season. Medium shrubs are typically patchy or absent. Vegetation cover can be sparse or during seasonal dying back, but diversity in season is typically high.

The groundlayer on the Subject Land is dominated by grasses including *Rytidosperma caespitosum, Austrostipa nodosa* and *Austrostipa scabra*, with low densities, if present, of *Enteropogon acicularis, Walwhalleya proluta* and *Sporobolus caroli*. Forbs and subshrubs commonly include *Leiocarpa panaetioides*, *Maireana pentagona, Calotis scabiosifolia*, *Sida corrugata*, *Sida trichopoda*, *Chrysocephalum apiculatum*, *Goodenia fascicularis, Swainsona murrayana, Swainsona procumbens, Ptilotus exaltatus,* and *Pycnosorus globosus*. Medium-sized shrubs when present include *Maireana aphylla* and *Sclerolaena muricata* varieties.

This PCT is associated with red-brown clay loams to grey-brown clays in central and north eastern parts of the Subject Land.

Table 4.19 Overview of PCT 44

PCT 44 Forb-rich Speargrass - Windmill Grass - White Top grassland of the Riverina Bioregion	
Vegetation class	Riverine Plain Grasslands
Vegetation formation	Grasslands
Estimate of per cent cleared	73.00
Area in Subject Land	1,126.33
Conservation status	PCT 44 is associated with one TEC, Natural Grasslands of the Murray Valley Plains, listed and critically endangered under the EPBC Act. This TEC was not found to be present within the Subject Land (**Section 4.5**).
Vegetation zones (condition) and plots	Zone 9 - Moderate-Good and 13 BAM VI plots.

4.3.8.2 Justification of PCT Selection

The PCT in the Subject Land is dominated by *Rytidosperma caespitosum, Austrostipa nodosa* and *Austrostipa scabra* as an open to moderately dense tussock grassland with a diverse forb component and rare to patchy low (<1 m tall) chenopod shrub component.

The PCT Filter Tool was used to determine the vegetation formation as Grasslands - Riverine Plain Grasslands. Using floristic data collected through BAM plots and rapid data points, the dominant and characteristic species in each layer, along with the IBRA subregion and Keith class, was entered into the tool and a candidate list of PCTs was generated from those PCTs showing highest correlation of associated species. Of these, two PCTs (PCT 44 and PCT 46) showed high floristic fidelity based on occurrence of species.

This output of the tool is based on presence of dominant or distinctive species (species richness) without any consideration of species diversity such as relative abundance or cover. While many forb species are shared between PCT 44 and PCT 46, the description of PCT 44 in BioNet Vegetation Classification supports a higher cover and abundance of these forb species than those shared with PCT 46, which aligns with the current study's mapping of these two PCTs.

BioNet notes that PCT 44 is a combination of the plant communities 1a and 1b in Benson et al. (1997). The vegetation mapped as PCT 44 by the current study matches very well both these plant communities of Benson (1997) and is easily distinguished from plant community 4 of Benson et al. (1997) which is described by BioNet as equivalent to PCT 46. Mapping relevant areas on the Subject Land as PCT 44, rather than PCT 46 is supported by the relevant dominance of the plant species on site and the dominant and indicator species for the communities discussed in Benson et al. (1997), noting that the PCT filter tool is not supported by relevant abundance or cover data for these two PCTs. PCT 44 is also described in BioNet Vegetation Classification as also occurring on loams and clays, typical of the current study's mapped occurrence on the Subject Land, whereas PCT is described as associated with clays only, with the current study mapping PCT 46 as restricted to clays.

The description of associated soils and landscapes for PCT 44 in BioNet (and for the plant communities 1a and 1b in Benson et al. (1997)) matches well the vegetation mapped as PCT 44 by the current study, with the vegetation in the Subject Land being found alluvial grey-brown clays and red-brown loams on riverine plains. By comparison, the associated soils supporting PCT 46 on site tend to be self-mulching grey clays, as described by BioNet and the equivalent plant community 4 of Benson et al. (1997)

Table 4.20 Floristic and Structural Summary of PCT 44 Within the Subject Land

Growth Form	Details of PCT within Subject Land
IBRA subregion	Murrumbidgee subregion
Landscape position	Riverine plains
Soils and geology	Grey-brown clays to red-brown clay loams
Floristic Description – Canopy stratum	Absent
Floristic Description – Mid stratum	Patchy to absent. *Maireana aphylla* and *Sclerolaena muricata* varieties if present.
Floristic Description – Ground stratum	May be patchy but diverse. Dominated by grasses including *Rytidosperma caespitosum, Austrostipa nodosa and Austrostipa scabra* with only lower densities if present of *Enteropogon acicularis Walwhalleya proluta* and *Sporobolus caroli*. Forbs abundant in season commonly *Leiocarpa panaetioides, Calotis scabiosifolia, Sida* spp, *Maireana pentagona, Chrysocephalum apiculatum*, *Goodenia fascicularis* and *Swainsona* species. Shrubs rare to patchy and if present include *Maireana aphylla* and *Sclerolaena muricata* varieties.

4.3.8.3 Condition States

PCT 44 occurs as one condition state within the Subject Land, PCT 44: Moderate-good (VZ 9) a natural grassland vegetation zone.

Vegetation Zone 9 – PCT 44 Moderate-Good

PCT Name	PCT 44 Forb-rich Speargrass - Windmill Grass - White Top grassland of the Riverina Bioregion	
Condition	Moderate-good	
Development Footprint (ha)		
Stage 1 – Linear	76.46	
Stage 1 – Site based	0.00	
Stage 2 – Linear	92.79	
Patch size	≥100 ha	
BAM VI plots	13 (P1, P36, P39, P40, P44, P48, P50, P60, P63, P64, P72, P74, P78)	

PCT Name	PCT 44 Forb-rich Speargrass - Windmill Grass - White Top grassland of the Riverina Bioregion
Description	Riverine plain natural grassland – structurally intact with cover of shrubs and dominated by tussock grasses with scattered low shrubs, and diverse subshrubs and forbs. Exotic grasses of low diversity.
BC Act	No associated TEC.
EPBC Act	While listed as associated TEC under the EPBC Act, Natural Grasslands of the Murray Valley Plains (critically endangered), the TEC is not identified on site due to floristics, location and landform (**Section 4.5**).

4.3.9 PCT 46: Curly Windmill Grass - speargrass - wallaby grass grassland on alluvial clay and loam on the Hay Plain: Riverina Bioregion

4.3.9.1 PCT Description

PCT 46: Curly Windmill Grass - speargrass - wallaby grass grassland on alluvial clay and loam on the Hay Plain - Riverina Bioregion is described by the BioNet Vegetation Classification as an open to closed tussock grassland of around 3 m dominated by *Enteropogon ramosus*, *Austrostipa nodosa* and/or *Austrostipa scabra* and a number of *Rytidosperma* spp. A very sparse shrub layer is sometimes present including *Sclerolaena stelligera*, *Maireana excavata* and *Maireana aphylla*. The dominant grasses are mixed 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*. Annual exotics such as *Lolium spp.* and *Avena spp.* may dominate during the Spring growing period. This PCT 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.

On the Subject Land this PCT is a grassland with a moderate to dense cover of a typically low diversity of tussock grasses and a typically low cover and diversity of forbs, and a very low or often absent low shrub cover. Non-native grass cover can be moderate to high in season.

The groundlayer on the Subject Land is dominated by grasses including *Enteropogon acicularis*, *Walwhalleya proluta*, *Sporobolus caroli*, *Rytidosperma caespitosum*, *Austrostipa scabra and Eragrostis australasica*. Forbs and subshrubs are typically low in diversity and cover and include *Marsilea drummondii*, *Leiocarpa panaetioides*, *Calotis scabiosifolia*, *Oxalis perennans*, *Sida corrugata*, *Sida trichopoda*, *Goodenia fascicularis*, *Goodenia pusilliflora*. Medium-sized shrubs when present include *Maireana aphylla* and *Sclerolaena muricata* varieties.

This PCT is associated with grey clays and grey-brown clays, often cracking, particularly in the north-west, south and central-east of the Subject Land.

Table 4.21 Overview of PCT 46

PCT 46 Curly Windmill Grass - speargrass - wallaby grass grassland on alluvial clay and loam on the Hay Plain: Riverina Bioregion	
Vegetation class	Riverine Plain Grasslands
Vegetation formation	Grasslands
Estimate of per cent cleared	20.00
Area in Subject Land	2,189.24
Conservation status	PCT is associated with TEC listed under the EPBC Act, Natural Grasslands of the Murray Valley Plains (critically endangered), however this TEC was not found to occur within the Subject Land (**Section 4.5**).
Vegetation zones (condition) and plots	Zone 10 - Moderate-good and 18 BAM VI plots.

4.3.9.2 Justification of PCT Selection

The PCT in the Subject Land is dominated by *Enteropogon acicularis*, *Walwhalleya proluta*, *Sporobolus caroli*, *Rytidosperma caespitosum* and *Austrostipa scabra* as a typically moderately dense to dense tussock grassland with a low to moderate forb diversity and rare to patchy low (<1 m tall) chenopod shrub component.

The PCT Filter Tool was used to determine the vegetation formation as Grasslands - Riverine Plain Grasslands. Using floristic data collected through BAM plots and rapid data points, the dominant and characteristic species in each layer, along with the IBRA subregion and Keith class, was entered into the tool and a candidate list of PCTs was generated from those PCTs showing highest correlation of associated species. Of these, three PCTs (PCT 44, PCT 45 and PCT 46) showed similar shared dominant species. This output of the tool is based on presence of dominant or distinctive species (species richness) without any consideration of species diversity such as relative abundance or cover.

While PCT 46 is described as sharing many forb species with both PCT 44 and PCT 45, the relative cover and abundance of those species distinguishes them from each other, along with associated landforms and soils.

As described in **Section 4.3.8.1**, the description of PCT 44 in BioNet Vegetation Classification supports a higher cover and abundance of forb species than those shared with PCT 46.

Compared to PCT 46, the description of PCT 45 in BioNet Vegetation Classification indicates an association of that PCT with a higher water table and drainage depressions supporting an associated higher cover and abundance of species associated with these wetter conditions such as *Eleocharis* spp, *Asperula conferta*, *Marsilea drummondii*, *Goodenia fascicularis* and *Duma florulenta*. While these species occur within PCT 46 in the Subject Land, they occur as low density, localised or patchy small occurrences, typically in localised small depressions.

BioNet notes that PCT 46 is equivalent to the plant community 4 in Benson et al. (1997). The vegetation mapped as PCT 46 by the current study matches reasonably well both the species diversity and landscape associations of this plant community of Benson (1997).

Table 4.22 Floristic and Structural Summary of PCT 46 Within the Subject Land

Growth Form	Details of PCT within Subject Land
IBRA subregion	Murrumbidgee subregion
Landscape position	Alluvial plain with occasional localised small depressions
Soils and geology	Typically grey clays to grey-brown clays
Floristic Description – Canopy stratum	Absent.
Floristic Description – Mid stratum	Patchy or localised *Maireana aphylla* and *Sclerolaena muricata.*
Floristic Description – Ground stratum	Typically dense grassland dominated by *Enteropogon acicularis*, *Walwhalleya proluta*, *Sporobolus caroli*, *Rytidosperma caespitosum* and *Austrostipa scabra* with poorly developed forb cover.

4.3.9.3 Condition States

PCT 46 occurs as one condition state within the Subject Land, PCT 46: Moderate-Good (Zone 10) a natural grassland vegetation zone.

Vegetation Zone 10 – PCT 46 Moderate-Good

PCT Name	PCT 46 Curly Windmill Grass - speargrass - wallaby grass grassland on alluvial clay and loam on the Hay Plain: Riverina Bioregion	
Condition	Moderate-good	
Development Footprint (ha)		
Stage 1 – Linear	138.83	
Stage 1 – Site based	0.00	
Stage 2 – Linear	197.59	
Patch size	≥100 ha	
BAM VI plots	18 (P5, P6, P8, P11, P13, P32, P35, P37, P38, P41, P56, P58, P61, P65, P67, P68, P73, P75)	
Description	Riverine plain natural grassland – structurally intact with low cover of shrubs and dominated by tussock grasses with subshrubs and low-moderate forb cover. Exotic groundlayer of low-moderate cover in season.	
BC Act	No associated TEC.	
EPBC Act	While listed as associated TEC under the EPBC Act, Natural Grasslands of the Murray Valley Plains (critically endangered), the TEC is not identified on site due to floristics, location and landform (**Section 4.5**).	

4.3.10 PCT 160: Nitre Goosefoot shrubland wetland on clays of the inland floodplains

4.3.10.1 PCT Description

The BioNet Vegetation Classification describes PCT 160: Nitre Goosefoot shrubland wetland on clays of the inland floodplains as a tall shrubland to 2 m high, dominated by *Chenopodium nitrariaceum* often with *Sclerolaena muricata*. *Acacia salicina* and *Acacia stenophylla* shrubs may be present. Low shrubs which may occur include *Sclerolaena stelligera*, *Malacocera tricornis* and *Atriplex semibaccata,* alongside forb species including *Omphalolappula concava, Harmsiodoxa blennodioides and Oxalis perennans.* Exotics may be common in this PCT with the grasses *Hordeum leporinum, Hordeum marinum, Lolium sp.* and *Avena sp.* and the forbs *Brassica tournefortii, Cirsium vulgare, Echium plantagineum, Erodium cicutarium, Hedypnois rhagadioloides* ssp. *cretica* and *Medicago polymorpha* often occurring. Occurs across arid and semi-arid zones of far western NSW on cracking clay or sandy clay soils in lake beds, low lying plains, drainage depressions and alluvial plains subject to flooding. This PCT is widespread but is predominantly found in discrete stands.

On the Subject Land this PCT is a shrubland with a moderate to dense cover of a typically low diversity of shrubs and a typically low cover and diversity of forbs. Non-native grass cover can be moderate to high in season.

The dominant plant of all layers is *Chenopodium nitrariaceum* to 2 m tall, often forming a dense canopy. Away from *Chenopodium nitrariaceum*, *Sclerolaena muricata* may be common. *Duma florulenta* and *Eragrostis australasica* are typically uncommon or absent. The groundlayer may be open to closed and of low native diversity, often dominated by *Einadia nutans* or *Atriplex nummularia*.

This PCT is associated with grey clays often cracking, present as typically small patches associated with depressions of commonly less than 5 ha.

Table 4.23 Overview of PCT 160

PCT 160 Nitre Goosefoot shrubland wetland on clays of the inland floodplains	
Vegetation class	Inland Floodplain Shrublands
Vegetation formation	Freshwater Wetlands
Estimate of per cent cleared	28.00
Area in Subject Land	16.43
Conservation status	This PCT is associated with one TEC listed under the BC Act, Artesian Springs Ecological Community in the Great Artesian Basin, but the Subject Land is outside of the particular area of the TEC (The Great Artesian Basin) and therefore does not occur on the Subject Land.
Vegetation zones (condition) and plots	Zone 11 - Moderate-good and 3 BAM VI plots.

4.3.10.2 Justification of PCT Selection

The PCT in the Subject Land is a shrubland dominated by *Chenopodium nitrariaceum*, with occasional *Sclerolaena muricata.*

The vegetation community on site is floristically and structurally distinctive and with a sharp boundary from other communities. Using floristic data collected through BAM plots and rapid data points, the dominant and characteristic species along with the IBRA subregion, (Murrumbidgee), formation (freshwater wetlands), and community structure (chenopod shrubland) were entered into the PCT filter tool and a candidate list of PCTs was generated from those PCTs showing highest correlation of associated species present. Of these, the PCTs that the tool includes with the dominant species *Chenopodium nitrariaceum* and the usually present sub-dominant *Sclerolaena muricata and Einadia nutans,* are two PCTs: PCT 17 and PCT 160. The tool also identifies two wetland species *Duma florulenta* and *Eragrostis australasica* in both these PCTs, and while occasionally present in the PCT 160 on site, the BioNet Vegetation Classification describes *Duma florulenta* as the dominant species in PCT 17 and not necessarily abundant in PCT 160.

Six dominant or characteristic species were entered into the PCT filter tool: Chenopodium nitrariaceum, Sclerolaena muricata, Einadia nutans, Atriplex semibaccata, Eragrostis australasica, and Duma florulenta.

Most of the dominant native species in patches mapped as PCT 160 are considered tolerant of periodic inundation or waterlogging, indicating that the formation is a wetland. However as part of the initial stratification and PCT investigation, consideration of other PCTs locally mapped in the Project area by SVTM that list *Chenopodium nitrariaceum* as a component species, and are either classified as wetland formations (Forested Wetlands or Freshwater Wetlands) or include wetland within the PCT title, were considered. This was particularly to consider whether these patches of Chenopodium-dominated vegetation could be considered within other PCT extents. These other PCTs are:

- 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.

While PCT 17 is described as an open shrubland, and it is allocated to the class Inland Floodplain Shrublands. It is described as dominated by *Duma florulenta* often with *Chenopodium nitrariaceum* and low cover of *Eragrostis australasica*. The six species considered dominant or characteristic of patches mapped by the current study as PCT 160 that were entered into the PCT filter tool, five of the species as components of PCT 17.

PCT 24, like PCT 17 and PCT 160, is allocated to the class Inland Floodplain Shrublands in BioNet Vegetation Classification. It is described as dominated by *Chenopodium nitrariaceum* often with *Sclerolaena muricata* with *Duma florulenta* only as a potential component species. Of the six species considered dominant or characteristic of patches mapped by the current study as PCT 160 that were entered into the PCT filter tool, 5 of the species are components of PCT 24.

BioNet lists the relevant reference source for this PCT in this locality as part of map unit 18 Lignum and *Chenopodium nitrariaceum* in Porteners (1993). This part (*Chenopodium* dominated versus *Duma* dominated) of Porteners (1993) map unit 18 aligns well to both this PCT mapped on site by the current study and as described as PCT 160 in BioNet. The SVTM generally overmaps the PCT's extent in the locality, and the current study's ground truthing has reattributed many areas mapped as PCT 160 to PCT 17.

The description of hydrology, soils and landscapes for PCT 160 in BioNet (and for the relevant part of plant community 18 in Porteners (1993) matches well the vegetation mapped as PCT 160 by the current study, with the vegetation in the Subject Land being found on cracking grey clays (likely gleyed) in occasionally inundated depressions and floodplain and alluvial plains.

Table 4.24 Floristic and Structural Summary of PCT 160 Within the Subject Land

Growth Form	Details of PCT within Subject Land
IBRA subregion	Murrumbidgee subregion
Landscape position	Occasionally inundated depressions, floodplains and alluvial plains.
Soils and geology	Cracking clays, often heavy and gleyed
Floristic Description – Canopy stratum	Shrublayer, often closed, of *Chenopodium nitrariaceum.*
Floristic Description – Mid stratum	Lower shrublayer in gaps and edges of *Sclerolaena muricata*. Uncommon *Eragrostis australasica* and *Duma florulenta.*
Floristic Description – Ground stratum	*Einadia nutans* and *Atriplex semibaccata.*

4.3.10.3 Condition States

PCT 160 occurs as one condition state within the Subject Land, PCT 160 Moderate-good (Zone 11) a shrubland vegetation zone.

Vegetation Zone 11 – PCT 160 Moderate-Good

PCT Name	PCT 160 Nitre Goosefoot shrubland wetland on clays of the inland floodplains	
Condition	Moderate-good	
Area Development Footprint (ha)		
Stage 1 – Linear	0.91	
Stage 1 – Site based	0.00	
Stage 2 – Linear	1.63	
Patch size	≥100 ha	
BAM VI plots	3 (P22, P23, P25)	
Description	Floodplain shrubland – structurally intact with shrub layer and ground layer present. May have naturally low density of ground layer. May include patchy occurrences of exotic forbs and grasses particularly on edges.	
BC Act	No associated TEC	
EPBC Act	No associated TEC	

4.3.11 PCT 164: Cotton Bush open shrubland of the semi-arid (warm) zone

4.3.11.1 PCT Description

The BioNet Vegetation Classification describes PCT 164: Cotton Bush open shrubland of the semi-arid (warm) zone as a low to mid-high sparse to mid-dense shrubland usually about 0.8 m high dominated by *Maireana aphylla* with occasional remnant shrubs of *Atriplex vesicaria s.l.*. Smaller shrubs include copperburrs (*Sclerolaena muricata, Sclerolaena tricuspis* and *Sclerolaena bicornis*) and annual saltbushes (*Atriplex lindleyi, Atriplex leptocarpa*). The ground cover is sparse, often exhibiting a range of native forbs paper daisies (*Rhodanthe* spp.), *Minuria cunninghamii*, and *Calotis scabiosifolia* var. *scabiosifolia* and grasses such as *Rytidosperma caespitosum*. Exotic ground cover is often very high, usually containing *Hordeum* spp., *Bromus* spp., *Vulpia* spp., *Medicago* spp., *Avena sp.* and *Lolium sp*. 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, often in very disturbed areas.

On the Subject Land this PCT is a shrubland with the dominant shrubs the chenopod species *Maireana aphylla*, with occasional *Sclerolaena muricata* var. *muricata*, *Sclerolaena muricata* var. *semiglabra* and occasionally *Chenopodium nitrariaceum*. A moderate to dense cover of sub-shrubs, forbs and grasses includes *Calotis scabiosifolia, Rytidosperma caespitosum, Maireana pentagona*, *Leiocarpa panaetioides*, *Sporobolus caroli*, *Enteropogon acicularis*, *Walwhalleya proluta* and *Convolvulus clementii*. Isolated clumps of *Eragrostis australasica* and *Duma florulenta* can occur but are overall at low densities. While the tussock grasses *Sporobolus caroli*, *Enteropogon acicularis* and *Walwhalleya proluta* can have moderate cover, this PCT is dominated by shrubs rather than grasses.

This PCT is associated with grey to red-brown clays across many general areas of the survey corridor away from the main drainage channels.

Table 4.25 Overview of PCT 164

PCT 164 Cotton Bush open shrubland of the semi-arid (warm) zone	
Vegetation class	Riverine Chenopod Shrublands
Vegetation formation	Arid Shrublands (Chenopod sub-formation)
Estimate of per cent cleared	8.00
Area in Subject Land	296.40
Conservation status	No associated TEC
Vegetation zones (condition) and plots	Zone 12 - Moderate-good and 9 BAM VI plots

4.3.11.2 Justification of PCT Selection

The PCT in the Subject Land is a shrubland dominated by the chenopod shrubs *Maireana aphylla*, with occasional *Sclerolaena muricata* var. *muricata*, *Sclerolaena muricata* var. *semiglabra*. While grasses may be abundant in the groundlayer, the PCT is dominated by these shrubs.

The vegetation community on site has many species commonly present in a variety of other PCTs in the Subject Land, including woodlands and grasslands, but is structurally a shrubland. Other shrublands on the Subject Land are in the vegetation formation Freshwater Wetlands, rather than the formation Arid Shrublands to which PCT 164 belong.

Using floristic data collected through BAM plots and rapid data points, the dominant and characteristic species along with the IBRA subregion, (Murrumbidgee), formation (Arid Shrublands (Chenopod sub-formation)), and class (Riverine Chenopod Shrubland), along with a single species – the dominant *Maireana aphylla* - were entered into the PCT filter tool. Two PCTs were generated from these selections: PCT 164 and also PCT 163: Dillon Bush (Nitre Bush) shrubland of the semi-arid and arid zones. PCT 163 is dominated by *Nitraria billardierei* (Dillon Bush/Nitre Bush) which is a species that is very rare in the Subject Land. Separate to this, the input of the other species noted above with the local IBRA subregion and *Maireana aphylla* as positive filters generates PCT 164 as the best floristic match in the tool.

In order to consider broader floristic components of the areas mapped by the current study as PCT 164, eight of the most dominant or distinctive species were added into the PCT filter tool: *Maireana aphylla, Sclerolaena muricata, Eragrostis australasica, Maireana pentagona, Chenopodium nitrariaceum, Rytidosperma caespitosa, Leiocarpa panaetioides* and *Calotis scabiosifolia.* Of the PCTs mapped by SVTM in the locality, only PCT 46 (a grassland) and PCT 26 (a woodland), had shared associated species shown in the filter tool. PCT 46 had five of the eight species in the PCT filter tool, and is classed as a grassland and isn't dominated by *Maireana aphylla* although it can be an occasional component. PCT 26 had four of the eight species in the PCT filter tool and is classed as a woodland.

BioNet lists the relevant reference source for this PCT in this locality as part of map unit 21 Cotton Bush in Porteners (1993). Map unit 21 of Porteners (1993) aligns well to both this PCT mapped on site by the current study and as described as PCT 164 in BioNet. The SVTM generally overmaps the PCT's extent in the locality, and the current study's ground truthing has reattributed many areas mapped as PCT 164 to PCTs 44 and 46 in particular. While areas mapped by the current study as PCT 164 are structurally a low shrubland, dominated by shrubs, there can be a significant grass component in the groundlayer which is not described as that significant in both BioNet description or Porteners (1993). It should also be noted during the site preliminary visits, prior to current flora surveys on, that many plants of the two varieties of *Sclerolaena muricata* that are common in this community have shown much death and, as so-called 'roly-polies', have blown away from their previous localities after death, reducing the shrub extent of these two taxa within extensive areas, however these areas are still mapped as a shrubland (PCT 164).

The description of hydrology, soils and landscapes for PCT 164 in BioNet, and of plant community 21 in Porteners (1993) matches well the vegetation mapped as PCT 164 by the current study, with the vegetation in the Subject Land being found on grey to red-brown clays on floodplains and alluvial plains.

Table 4.26 Floristic and Structural Summary of PCT 164 Within the Subject Land

Growth form	Details of PCT within Subject Land
IBRA subregion	Murrumbidgee subregion
Landscape position	Alluvial plains
Soils and geology	Grey to red-brown clays
Floristic Description – Canopy stratum	No tree canopy present.
Floristic Description – Mid stratum	Dominated by *Maireana aphylla*, with sub-dominant *Sclerolaena muricata* var. *muricata*, *Sclerolaena muricata* var. *semiglabra* and occasional *Chenopodium nitrariaceum.*
Floristic Description – Ground stratum	*Calotis scabiosifolia*, *Rytidosperma caespitosum*, *Maireana pentagona* and *Leiocarpa panaetioides.*

4.3.11.3 Condition States

PCT 164 occurs as one condition state within the Subject Land, PCT164: Cotton Bush open shrubland of the semi-arid (warm) zone – a shrubland vegetation zone.

Vegetation Zone 12 – PCT 164 Moderate-Good

PCT Name	PCT164: Cotton Bush open shrubland of the semi-arid (warm) zone	
Condition	Moderate-good	
Area Subject Land (ha)		
Stage 1 – Linear	3.91	
Stage 1 – Site based	0.38	
Stage 2 – Linear	36.65	
Patch size	≥100 ha	
BAM VI plots	9 (P9, P15, P31, P54, P57, P59, P62, P66, P69)	
Description	Riverine chenopod shrubland – structurally intact with dominant shrub layer and ground layer present. May include patchy occurrences of exotic forbs and grasses.	
BC Act	No associated TEC	
EPBC Act	No associated TEC	

4.4 Vegetation Zones and Vegetation Integrity Score

Details on the number of BAM VI plots required and completed for each vegetation condition zone, in accordance with Table 3 of the BAM, are provided in **Table 4.27**. The vegetation integrity plot survey locations are shown in **Figure 4.2**.

The vegetation integrity condition scores for the BAM Plots completed are provided in **Table 4.27**. This table represents the combined scores from all plots completed for each vegetation condition zone, including the vegetation integrity score and the presence of hollow bearing trees. The BAM VI plot data has been provided to CPHR in an excel spreadsheet along with the spatial data.

Table 4.27 Vegetation Zones and Vegetation Integrity Scores

VZ ID	PCT	Condition State	Patch Size Class	Total Area within Subject Land (ha)	Total Area within Development Footprint (ha)	Plots completed	TEC (Y/N)?	Composition condition score	Structure condition score	Function condition score	VI Score	Hollow Bearing Trees present (Y/N)?
1	PCT 10	Moderate-good	☐ <5 ha ☐ 5–24 ha ☐ 25–100 ha ☒ >100 ha	19.69	Stage 1 Linear: 2.23 Stage 1 Site-based: 0.00 Stage 2 Linear: 0.00 Total: 2.23	5	N	37.0	20.4	56.0	34.9	Y
2	PCT 13	Moderate-good	☐ <5 ha ☐ 5–24 ha ☐ 25–100 ha ☒ >100 ha	2.45	Stage 1 Linear: 0.08 Stage 1 Site-based: 0.00 Stage 2 Linear: 0.00 Total: 0.08	4	N	63.7	60.9	75.3	66.4	Y
3	PCT 17	Moderate-good	☐ <5 ha ☐ 5–24 ha ☐ 25–100 ha ☒ >100 ha	20.20	Stage 1 Linear: 2.05 Stage 1 Site-based: 0.00 Stage 2 Linear: 0.00 Total: 2.05	3	N	88.5	82.4	Not applicable to wetland PCTs (OEH 2018a)	85.4	N
4	PCT 24	Moderate-good	☐ <5 ha ☐ 5–24 ha ☐ 25–100 ha ☒ >100 ha	10.02	Stage 1 Linear: 1.97 Stage 1 Site-based: 0.00 Stage 2 Linear: 0.00 Total: 1.97	3	N	35.0	39.6	Not applicable to wetland PCTs (OEH 2018a)	37.2	N
5	PCT 26	DNG	☐ <5 ha ☐ 5–24 ha ☐ 25–100 ha ☒ >100 ha	72.19	Stage 1 Linear: 17.88 Stage 1 Site-based: 0.00 Stage 2 Linear: 0.00 Total: 17.88	5	Y	56.2	48.5	14.9	34.3	N
6	PCT 26	Moderate-good	☐ <5 ha ☐ 5–24 ha ☐ 25–100 ha ☒ >100 ha	42.56	Stage 1 Linear: 4.92 Stage 1 Site-based: 0.00 Stage 2 Linear: 0.00 Total: 4.92	4	Y	90.3	53.5	33.9	54.7	N
7	PCT 28	DNG	☐ <5 ha ☐ 5–24 ha ☐ 25–100 ha ☒ >100 ha	486.69	Stage 1 Linear: 20.44 Stage 1 Site-based: 0.53 Stage 2 Linear: 38.74 Total: 59.70	9	Y	93.5	84.1	15.2	49.2	N
8	PCT 28	Moderate-good	☐ <5 ha ☐ 5–24 ha ☐ 25–100 ha ☒ >100 ha	0.85	Stage 1 Linear: 0.00 Stage 1 Site-based: 0.00 Stage 2 Linear: 0.00 Total: 0.00	2	Y	-	-	-	-	N
9	PCT 44	Moderate-good	☐ <5 ha ☐ 5–24 ha ☐ 25–100 ha ☒ >100 ha	1,126.33	Stage 1 Linear: 76.46 Stage 1 Site-based: 0.00 Stage 2 Linear: 92.79 Total: 169.25	13	N	61.3	37.9	Not applicable to grassland PCTs (OEH 2018a)	48.2	N
10	PCT 46	Moderate-good	☐ <5 ha ☐ 5–24 ha ☐ 25–100 ha ☒ >100 ha	2,189.24	Stage 1 Linear: 138.83 Stage 1 Site-based: 0.00 Stage 2 Linear: 197.59 Total: 336.43	18	N	70.3	66.6	Not applicable to grassland PCTs (OEH 2018a)	68.4	N

VZ ID	PCT	Condition State	Patch Size Class	Total Area within Subject Land (ha)	Total Area within Development Footprint (ha)	Plots completed	TEC (Y/N)?	Composition condition score	Structure condition score	Function condition score	VI Score	Hollow Bearing Trees present (Y/N)?
11	PCT 160	Moderate-good	☐ <5 ha ☐ 5–24 ha ☐ 25–100 ha ☒ >100 ha	16.43	Stage 1 Linear: 0.91 Stage 1 Site-based: 0.00 Stage 2 Linear: 1.63 Total: 2.55	3	N	52.0	65.5	Not applicable to wetland PCTs (OEH 2018a)	58.4	N
12	PCT 164	Moderate-good	☐ <5 ha ☐ 5–24 ha ☐ 25–100 ha ☒ >100 ha	296.40	Stage 1 Linear: 3.91 Stage 1 Site-based: 0.38 Stage 2 Linear: 36.65 Total: 40.95	9	N	67.4	35.1	Not applicable to arid shrubland PCTs (OEH 2018a)	48.6	N

4.5 Threatened Ecological Communities

4.5.1 Overview

PCTs and TECs are different classification systems that have been developed independently of each other. In the BioNet Vegetation Classification database, the relationship between PCTs and TECs are summarised in terms of their potential equivalence to each other where each PCT includes a description of its relationship and degree of fit to both State and Commonwealth listed TECs. However, the PCT-TEC relationships outlined within the BioNet Vegetation Classification database may not necessarily be correct, and therefore vegetation on site must be assessed against the respective Final Determination or Listing Advice for the TEC under each Act.

The assemblage of species, area of occupancy, and supplementary descriptors outlined within the NSW Scientific Committee's Scientific Determination under the BC Act for each of the potential TECs were compared against each associated PCT present within the Subject Land. The same activity was also carried out against the listing advice for the TEC under the EPBC Act. Two PCTs occurring in the Subject Land were assessed as conforming to three TECs listed under the BC Act and EPBC Act (**Figure 4.3** and **Figure 4.4**).

A summary of the equivalencies between PCTs and TECs occurring in the Subject Land is provided in **Table 4.28**.

Within BioNet Vegetation Classification, PCT 44 and PCT 46 are associated with Natural Grasslands of the Murray Valley Plains, a TEC listed as critically endangered under the EPBC Act. Although both PCTs were recorded within the Subject Land, this TEC was not found to be present.

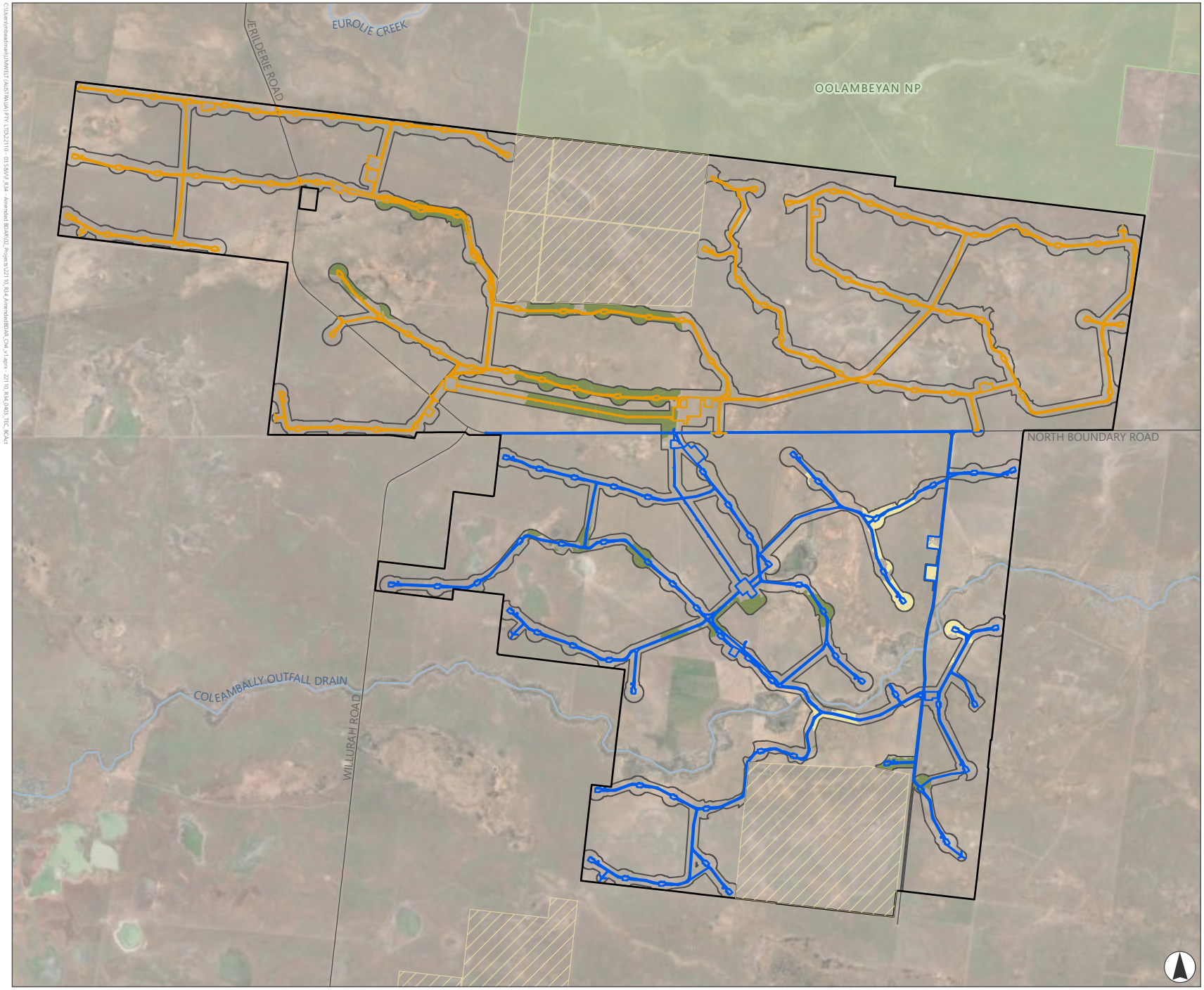
An assessment of these PCTs against the Listing Advice for this TEC is provided in **Section 4.5.5**.

Table 4.28 Threatened Ecological Communities Present Within the Subject Land

TEC	Associated PCT that TEC may be present as.	Condition State that TEC is present as.	BC Act	EPBC Act	SAII	Area within Subject Land (ha)			Area within Development Footprint (ha)			Total Area within Subject Land (ha)	Total Area within Development Footprint (ha)
						Stage 1 – Linear	Stage 1 – Site based	Stage 2 – Linear	Stage 1 – Linear	Stage 1 – Site based	Stage 2 – Linear		
Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions	PCT 26: Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion	DNG	E	-	No	72.19	0.00	0.00	17.88	0.00	0.00	72.19	17.88
		Moderate-Good				42.56	0.00	0.00	4.92	0.00	0.00	42.56	4.92
Weeping Myall Woodlands	PCT 26: Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion	Moderate-Good	-	E	No	42.56	0.00	0.00	4.92	0.00	0.00	42.56	4.92
Sandhill Pine Woodland in the Riverina, Murray-Darling Depression and NSW South Western Slopes bioregion	PCT 28: White Cypress Pine open woodland of sand plains, prior streams and dunes mainly of the semi-arid (warm) climate zone	DNG	E	-	No	151.25	0.53	334.91	20.44	0.53	38.74	486.69	59.70
		Moderate-Good				0.00	0.00	0.85	0.00	0.00	0.00	0.85	0.00

FIGURE 4.3.1

Distribution of Threatened Ecological Communities listed under BC Act across the Subject Land



Legend

- Project Boundary
- Subject Land
- Stage 1 (South) Development Footprint
- Stage 2 (North) Development Footprint
- Conservation Agreement Area
- NPWS Reserves
- Road
- Watercourse

Threatened Ecological Communities - BC Act

- Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions
- Sandhill Pine Woodland in the Riverina, Murray-Darling Depression and NSW South Western Slopes bioregion

0 1,000 2,000

Meters

Scale 1:110,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

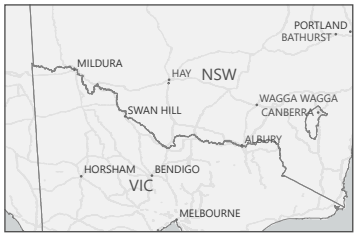
Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

FIGURE 4.3.2

Distribution of Threatened Ecological Communities listed under BC Act across the Subject Land

Legend

- Stage 1 (South) Development Footprint
- Road



0 60 120

Meters

Scale 1:5,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

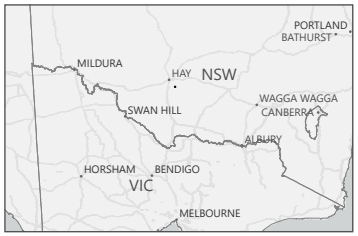
C:\Users\mbeadman\UMWELT (AUSTRALIA) PTY LTD\2110 - 03.SKKY..R34 - Amended BDAR\02. Projects\22110_R34 Amended BDAR_CH4_v1.aprx - 22110_R34_0403_TEC_BCAct

FIGURE 4.3.3

Distribution of Threatened Ecological Communities listed under BC Act across the Subject Land

Legend

- Stage 1 (South) Development Footprint
- Road



0 60 120

Meters

Scale 1:5,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

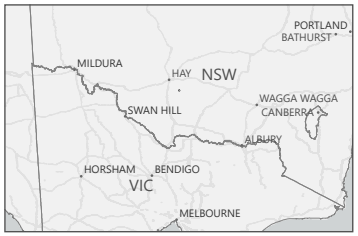
Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

FIGURE 4.3.4

Distribution of Threatened Ecological Communities listed under BC Act across the Subject Land

Legend

- Stage 1 (South) Development Footprint
- Road
- Watercourse



0 60 120

Meters

Scale 1:5,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

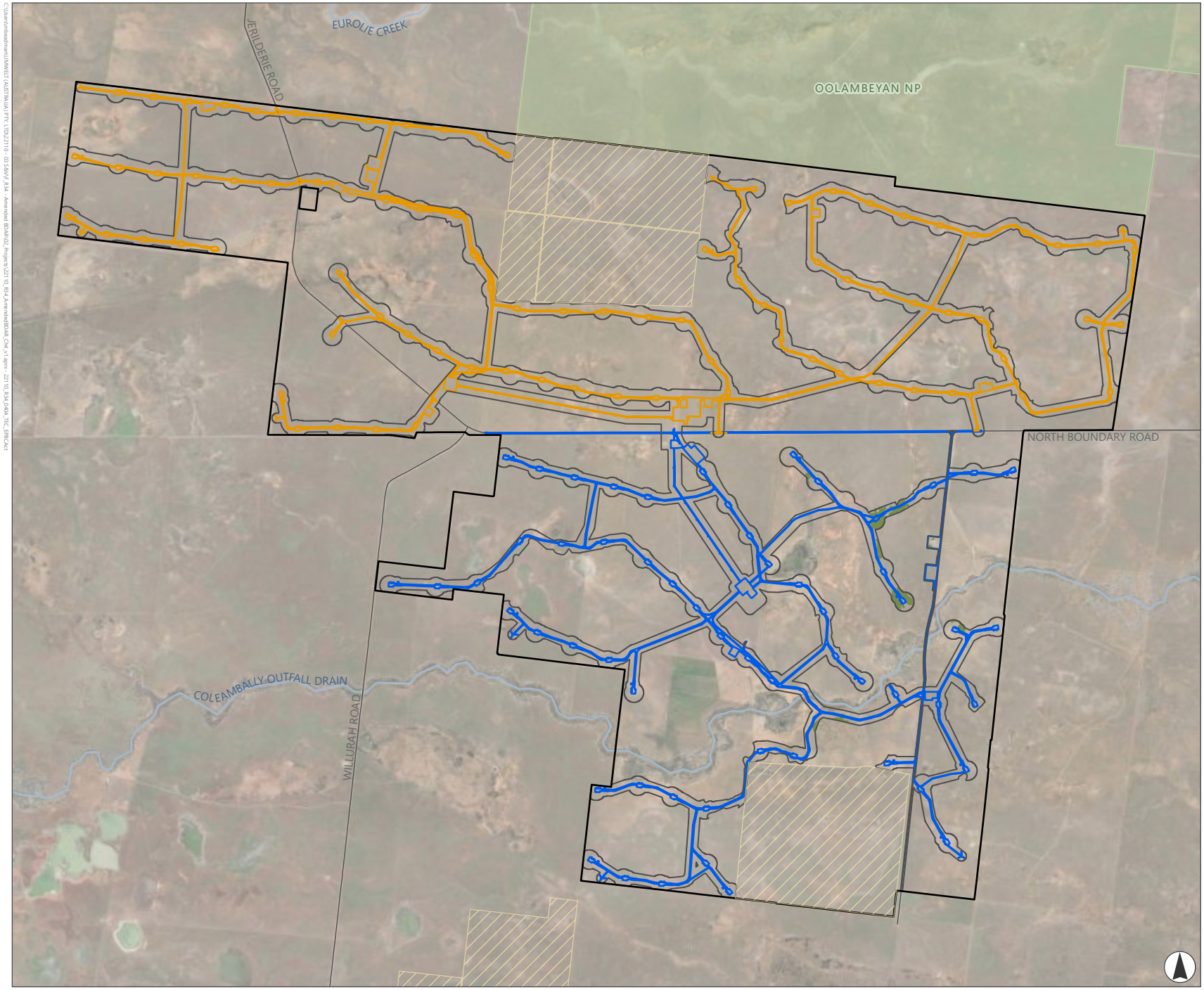


FIGURE 4.4.1

Distribution of Threatened Ecological Communities listed under EPBC Act across the Subject Land

Legend

- Project Boundary
- Subject Land
- Stage 1 (South) Development Footprint
- Stage 2 (North) Development Footprint
- Conservation Agreement Area
- NPWS Reserves
- Road
- Watercourse

Threatened Ecological Communities - EPBC Act

- Weeping Myall Woodland

0 1,000 2,000

Meters

Scale 1:110,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

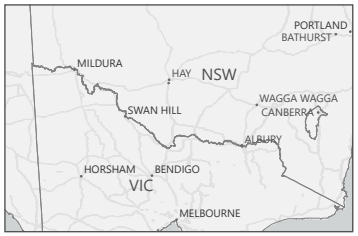
Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

FIGURE 4.4.2

Distribution of Threatened Ecological Communities listed under EPBC Act across the Subject Land

Legend

- Stage 1 (South) Development Footprint
- Road



0 90 180

Meters

Scale 1:5,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

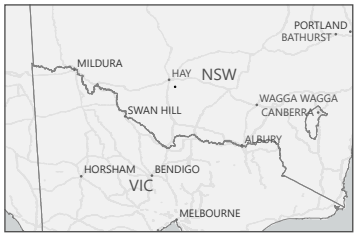
C:\Users\mbeadman\UMWELT (AUSTRALIA) PTY LTD\22110 - 03.SAVY, R34 - Amended BDAR\02. Projects\22110_R34 Amended BDAR_CH4_v1.aprx - 22110_R34_0404_TEC_EPBCAct

FIGURE 4.4.3

Distribution of Threatened Ecological Communities listed under EPBC Act across the Subject Land

Legend

- Stage 1 (South) Development Footprint
- Road



0 90 180

Meters

Scale 1:5,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

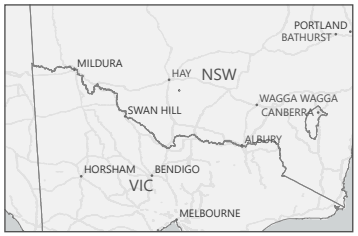
C:\Users\mbeadman\UMWELT (AUSTRALIA) PTY LTD\22110 - 03.SKKY..R34 - Amended IBDAR\02. Projects\22110_R34_AmendedIBDAR_CH4_v1.aprx - 22110_R34_0404_TEC_EPBCAct

FIGURE 4.4.4

Distribution of Threatened Ecological Communities listed under EPBC Act across the Subject Land

Legend

- Stage 1 (South) Development Footprint
- Road
- Watercourse



0 90 180

Meters

Scale 1:5,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

4.5.2 Sandhill Pine Woodland in the Riverina, Murray-Darling Depression and NSW South Western Slopes bioregions

Sandhill Pine Woodland in the Riverina, Murray-Darling Depression and NSW South Western Slopes bioregions (hereby referred to as Sandhill Pine Woodland) is an endangered ecological community (EEC) listed under the BC Act.

Sandhill Pine Woodland is an open woodland, or a derived grassland with no or scattered trees, which is dominated by *Callitris glaucophylla*. The structure of the TEC varies depending on past and current disturbances, particularly clearing, logging/silvicultural practices, grazing and soil erosion, as well as variability in rainfall over time. Sandhill Pine Woodland typically occupies red-brown loamy sands with alkaline sub-soils on prior streams, rises, source-bordering dunes, sandhills and lunettes of the alluvial plain of the Murray River and its tributaries, and on parts of the sandplain in south-western NSW. It is distributed from the Urana – Narrandera district in the east, into the southern part of the Murray–Darling Depression Bioregion, as far west as the South Australian border, and is known occur within the Balranald, Berrigan, Carrathool, Central Darling, Conargo, Corowa, Deniliquin, Hay, Murray, Narrandera, Urana, Wakool and Wentworth LGAs.

Sandhill Pine Woodland is comprised of an open tree canopy up to 15 m high, although it may be less tall or even absent in sites where there has been past clearing or thinning. The TEC is dominated by *Callitris glauophylla*, either as pure stands or alongside other less abundant species such as *Acacia melvillei*, *Acacia oswaldii*, *Allocasuarina luehmannii*, *Callitris gracilis* subsp. *murrayensis*, *Allocasuarina verticillata*, and *Hakea leucoptera* at lower abundance. Where present, the open shrub layer contains *Dodonaea viscosa* subsp. *angustifolia*, *Enchylaena tomentosa*, *Sclerolaena muricata*, *Maireana enchylaenoides*, *Marieana pyramidata*, and *Rhagodia spinescens*. The groundcover is highly variable in structure and composition depending on the prevailing climatic conditions as well as historical and ongoing disturbance regimes. The groundcover may include species such as *Rytidosperma caespitosum*, *Rytidosperma setaceum*, *Austrostipa scabra*, *Enteropogon acicularis*, *Panicum effusum*, *Atriplex semibaccata*, *Einadia nutans*, *Oxalis perennans*, and *Sida corrugata*.

One PCT within the Subject Land, PCT 28: White Cypress Pine open woodland of sand plains, prior streams and dunes mainly of the semi-arid (warm) climate zone, is associated with Sandhill Pine Woodland in the Riverina, Murray-Darling Depression and NSW South Western Slopes bioregions within BioNet Vegetation Classification. The TEC is listed as endangered under the BC Act.

An assessment against the Final Determination found that all areas of PCT 28 in the Subject Land conform with Sandhill Pine Woodland in the Riverina, Murray-Darling Depression and NSW South Western Slopes bioregions as listed under the BC Act. Both vegetation zones of PCT 28, VZ7 and VZ 8, conform to the TEC Sandhill Pine Woodland in the Riverina, Murray-Darling Depression and NSW South Western Slopes bioregions. **Table 4.29** compares the characteristic attributes of each community.

Table 4.29 Justification of the presence of Sandhill Pine Woodland in the Riverina, Murray-Darling Depression and NSW South Western Slopes bioregions in the Subject Land

TEC attribute as per the Final Determination	TEC attribute relative to VZ 7 - PCT 28: White Cypress Pine open woodland of sand plains, prior streams and dunes mainly of the semi-arid (warm) climate zone_Derived Native Grassland	TEC attribute relative to VZ 8 - PCT 28: White Cypress Pine open woodland of sand plains, prior streams and dunes mainly of the semi-arid (warm) climate zone_Moderate-Good
Geographic	The Subject Land falls within the Riverina IBRA bioregion, which is one of the bioregions defined as the particular area that the TEC occupies. The TEC is known from the Hay and Conargo LGAs. The Subject Land falls within the Hay and Conargo LGAs. Attribute across all patches of VZ 7 conform with TEC.	The Subject Land falls within the Riverina IBRA bioregion which is one of the bioregions defined as the particular area that the TEC occupies. The TEC is known from the Hay and Conargo LGAs. The Subject Land falls within the Hay and Conargo LGAs. Attribute across all patches of VZ 8 conform with TEC.
Landscape position	The Subject Land occurs on the alluvial plain of the Murray River and its tributaries, and on parts of the sandplain in south-western NSW, which the Final Determination describes as a typical area of occupation Attribute across all patches of VZ 7 conform with TEC.	The Subject Land occurs on the alluvial plain of the Murray River and its tributaries, and on parts of the sandplain in south-western NSW, which the Final Determination describes as a typical area of occupation. Attribute across all patches of VZ 8 conform with TEC.
Edaphic	Within the Subject Land, the VZ 7 is associated with raised red-brown clay loams with localised shallow surface sand. The Final Determination describes the TEC as typically on red-brown loamy sand. Attribute across all patches of VZ 7 conform with TEC.	Within the Subject Land, the VZ 7 is associated with raised red-brown clay loams with localised shallow surface sand. The Final Determination describes the TEC as typically on red-brown loamy sand. Attribute across all patches of VZ 8 conform with TEC.
Structural	VZ 7 consists of a derived native grassland with very rare and isolated small trees and shrubs. A groundlayer of grasses, sub-shrubs and forbs. In some locations, there is evidence of prior occupation of *Callitris* as dead stumps of fallen timber. The Final Determination describes Sandhill Pine Woodland as characterised by an open tree stratum, which may be reduced to isolated individuals or may be absent as a result of past clearing. Attribute across all patches of VZ 7 conform with TEC.	VZ 8 consists of an open woodland of small trees with a patchy shrub layer, and groundlayer of grasses, sub-shrubs and forbs. The Final Determination describes Sandhill Pine Woodland as characterised by an open tree stratum, which may be reduced to isolated individuals or may be absent as a result of past clearing. Attribute across all patches of VZ 8 conform with TEC.

TEC attribute as per the Final Determination	TEC attribute relative to VZ 7 - PCT 28: White Cypress Pine open woodland of sand plains, prior streams and dunes mainly of the semi-arid (warm) climate zone_Derived Native Grassland	TEC attribute relative to VZ 8 - PCT 28: White Cypress Pine open woodland of sand plains, prior streams and dunes mainly of the semi-arid (warm) climate zone_Moderate-Good
Characteristic assemblage of species	**Recorded upper stratum:** Very rare and isolated *Callitris glaucophylla.* **Recorded middle stratum:** Very rare and isolated *Hakea tephrosperma* and *Acacia oswaldii* **Recorded ground stratum:** *Austrostipa scabra, Enteropogon acicularis, Rytidosperma caespitosum Atriplex semibaccata, Boerhavia domini, Sida corrugata.* All these species are characteristic species as per the Final Determination. Attribute across all patches of VZ 7 conform with TEC.	Conforming with TEC. **Recorded upper stratum:** *Callitris glaucophylla, Geijera parviflora, Pittosporum angustifolium, Eremophila longifolia, Alectryon oleifolius.* **Recorded middle stratum:** *Hakea tephrosperma, Acacia oswaldii* **Recorded ground stratum:** *Austrostipa scabra, Enteropogon acicularis, Rytidosperma caespitosum, Atriplex semibaccata, Boerhavia domini, Sida corrugata* and *Einadia nutans.* All these species are characteristic species as per the Final Determination. Attribute across all patches of VZ 8 conform with TEC.
Summary of TEC attributes of vegetation zone relative to the Final Determination	All patches of the vegetation zone conform to the TEC.	All patches of the vegetation zone conform to the TEC.

4.5.3 Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions

Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions (hereby referred to as Myall Woodland) is an EEC listed under the BC Act.

Myall Woodland EEC is a community of variable structure, occurring as a low woodland and low open woodland to low sparse woodland or open shrubland, depending on site quality and disturbance history depending on the site. In some locations, the canopy and midstrata may have been reduced or eliminated such that the community exists as a derived native grassland. Myall Woodland typically occurs on red-brown earths and heavy textured grey and brown alluvial soils within a climatic belt receiving between 375 and 500 mm mean annual rainfall. The EEC occurs across the eastern parts of the alluvial plains of the Murray-Darling river system, and is known from the Berrigan, Bland, Bogan, Carrathool, Conargo, Coolamon, Coonamble, Corowa, Forbes, Gilgandra, Griffith, Gwydir, Inverell, Jerilderie, Lachlan, Leeton, Lockhart, Moree Plains, Murray, Murrumbidgee, Narrabri, Narrandera, Narromine, Parkes, Urana, Wagga Wagga and Warren LGAs.

The woodland vegetation zone is dominated by *Acacia pendula* with *Eucalyptus largiflorens* occurring very rarely as isolated trees near adjoining PCTs. There is a patchy shrub layer to approximately 1 m, typically dominated by chenopods, including species such as *Maireana aphylla*, *Sclerolaena muricata* var. *semiglabra, Sclerolaena muricata* var. *muricata*, *Sida corrugata*, and *Salsola australis*. The groundlayer of grasses, forbs and dwarf shrubs is well-developed and commonly includes *Austrostipa scabra*, *Rytidosperma caespitosum*, *Sporobolus caroli*, *Atriplex semibaccata*, *Chenopodium desertorum*, *Goodenia fascicularis*, *Maireana pentagona*, *Enteropogon acicularis*, *Calotis scabiosifolia* and *Vittadinia cuneata*.

One PCT within the Subject Land, PCT 26: Weeping Myall open woodland of semi-arid woodlands (Grassy sub-formation) associated with the Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression Riverina Bioregion and NSW South Western Slopes Bioregions within the BioNet Vegetation Classification. The TEC is listed as endangered under the BC Act.

An assessment against the Final Determination found that PCT 26 conforms with Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression Riverina Bioregion and NSW South Western Slopes bioregions as listed under the BC Act. **Table 4.30** compares the characteristic attributes of each community.

Table 4.30 Justification of the presence of the Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions in the Subject Land

TEC attribute as per the Final Determination	TEC attribute relative to VZ 5 – PCT 26: Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion – Derived Native Grassland	TEC attribute relative to VZ 6 – PCT26: Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion - Moderate -Good
Geographic location	The Subject Land falls within one of the described localities in the Final Determination: the Riverina IBRA bioregion. The Final Determination describes the TEC as known from the Hay and Conargo LGAs. The Subject Land falls within the Hay and Conargo LGAs. Attribute across all patches of VZ 5 conform with TEC.	The Subject Land falls within one of the described localities in the Final Determination: the Riverina IBRA bioregion The Final Determination describes the TEC as known from the Hay and Conargo LGAs. The Subject Land falls within the Hay and Conargo LGAs. Attribute across all patches of VZ 6 conform with TEC.
Landscape position	The Subject Land occurs on the alluvial plain of the Murray River and its tributaries which the Final Determination describes as a typical area of occupation. Attribute across all patches of VZ 5 conform with TEC.	The Subject Land occurs on the alluvial plain of the Murray River and its tributaries which the Final Determination describes as a typical occupation. Attribute across all patches of VZ 6 conform with TEC.
Edaphic	Within the Subject Land, the VZ 5 is associated with grey-brown clays and red-brown clay loams in the south eastern parts of the subject area. The Final Determination describes the TEC as typically occurring on red-brown earths and heavy textured grey and brown alluvial soils. Attribute across all patches of VZ 5 conform with TEC.	Within the Subject Land, the VZ 6 is associated with grey-brown clays and red-brown clay loams in the south eastern parts of the subject area. The Final Determination describes the TEC as typically occurring on red-brown earths and heavy textured grey and brown alluvial soils. Attribute across all patches of VZ 6 conform with TEC.
Structural	VZ5 consists of a largely treeless form of a derived native grassland, which may have scattered small plants of *Acacia pendula* or very rare and isolated adult individuals. The Final Determination describes the structure of the community as including low sparse woodland or open shrubland. Attribute across all patches of VZ 5 conform with TEC.	VZ6 consists of an intact open woodland structure with trees to 6 m tall. Dominated by *Acacia pendula* with *Eucalyptus largiflorens* occurring very rarely as isolated trees near adjoining PCTs. The Final Determination describes the structure of the community as including low woodland and low open woodland. Attribute across all patches of VZ 6 conform with TEC.

TEC attribute as per the Final Determination	TEC attribute relative to VZ 5 – PCT 26: Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion – Derived Native Grassland	TEC attribute relative to VZ 6 – PCT26: Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion - Moderate -Good
Characteristic assemblage of species	**Recorded upper stratum**: Rare and isolated adult trees of *Acacia pendula,* with occasional to common suckering small plants of *Acacia pendula.* **Recorded middle stratum**: *Maireana aphylla* and *Sclerolaena muricata, Maireana aphylla.* **Recorded ground stratum**: *Asperula conferta, Atriplex semibaccata, Rytidosperma caespitosa, Austrostipa aristiglumis, Austrostipa scabra, Alternanthera denticulata, Boerhavia domini, Calocephalus sonderi, Calotis scabiosifolia, Convolvulus erubescens (as Convolvulus clementii), Einadia nutans, Enchylaena tomentosa, Enteropogon acicularis, Marsilea drummondii, Rhodanthe pygmaea, Salsola kali (*as *S. australis), Sclerolaena brachyptera, Sclerolaena muricata, Sclerolaena stelligera, Sporobolus caroli, Sida corrugata, Sida trichopoda, Solanum esuriale, Swainsona procumbens, Vittadinia cuneata*. The Final Determination describes these as some of the characteristic species. Attribute across all patches of VZ 5 conform with TEC.	Conforming with TEC. **Recorded upper stratum:** *Acacia pendula* with rare *Eucalyptus largiflorens.* **Recorded middle stratum**: *Maireana aphylla* and *Sclerolaena muricata, Maireana aphylla.* **Recorded ground stratum**: *Atriplex semibaccata, Rytidosperma caespitosa, Austrostipa aristiglumis, Austrostipa scabra, Alternanthera denticulata, Boerhavia domini, Calocephalus sonderi, Calotis scabiosifolia, Convolvulus erubescens (as Convolvulus clementii), Einadia nutans, Enchylaena tomentosa, Enteropogon acicularis, Marsilea drummondii, Rhodanthe pygmaea, Salsola kali (*as *S. australis), Sclerolaena brachyptera, Sclerolaena stelligera, Sporobolus caroli, Sida corrugata, Sida trichopoda, Solanum esuriale, Swainsona procumbens, Vittadinia cuneata.* The Final Determination describes these as some of the characteristic species. Attribute across all patches of VZ 6 conform with TEC.
Summary of TEC attributes of vegetation zone relative to the Final Determination	All patches of the vegetation zone conform to the TEC.	All patches of the vegetation zone conform to the TEC.

4.5.4 Weeping Myall Woodlands

Weeping Myall Woodlands is listed as endangered under the EPBC Act.

Weeping Myall Woodlands range from open woodlands to woodlands, generally 4 to 12 m high. The overstorey is dominated by weeping myall (*Acacia pendula*) trees and in some cases this species may be the only tree canopy species. Other woodland species may also form part of the overstorey of the ecological community. These include: *Alectryon oleifolius* subsp*. elongatus*. *Eucalyptus populnea*, or *Eucalyptus largiflorens*. *Amyema quandang* commonly occurs on the branches of weeping myall trees throughout the ecological community's range.

Weeping Myall Woodlands EEC can naturally occur either as a grassy or a shrubby woodland. The understorey often includes an open layer of shrubs over a ground layer which includes a diversity of grasses and forbs. The ground layers can vary in species composition and cover depending on past and current grazing regimes, and the occurrence of recent rain.

The EEC has a number of diagnostic features that a patch must meet as condition thresholds to be the EEC:

- the tree canopy is dominated (at least 50% of trees present) by living, dead or defoliated Weeping Myall trees; and
- the overstorey must have at least 5% tree canopy cover or at least 25 dead or defoliated mature Weeping Myall trees/ha; and
- the area is at least 0.5 ha in size; and
- the patch has either:
    - more than two layers of regeneration of Weeping Myall present; or
    - the tallest layer of living, dead or defoliated Weeping Myall trees is at least 4 m tall and of the vegetative cover present, 50% is comprised of native species.

An assessment of the Conservation Advice, Listing Advice and Policy Statement has found that all nine patches of the Vegetation Zone 6 of PCT 26 intersecting the Subject Land conform with Weeping Myall Woodlands, while all patches of Vegetation Zone 5 do not. **Table 4.31** compares the characteristic attributes of patches of both vegetation zones against Weeping Myall Woodlands EEC.

Table 4.31 Justification of the absence of Weeping Myall Woodlands in the Subject Land

Key diagnostic characteristics as per the Conservation Advice, Listing Advice and Policy Statement	Key diagnostic characteristics relative to patches of VZ 5 – PCT 26: Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion - Derived Native Grassland		Key diagnostic characteristics relative to patches of VZ 6 – PCT26: Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion - Moderate -Good	
Geographic	The Subject Land falls within the Riverina IBRA bioregion, which is one of the bioregions defined as the particular area that the TEC occupies in the Approved Conservation Advice. Attribute across all patches of VZ 5 conforms with TEC.		The Subject Land falls within the Riverina IBRA bioregion, which is one of the bioregions defined as the particular area that the TEC occupies in the Approved Conservation Advice. Attribute across all patches of VZ 6 conforms with TEC.	
Landscape position	As per the listing advice, VZ 5 occurs in flat areas, shallow depressions. These areas are not associated with active drainage channels, and are rarely if ever flooded. Attribute across all patches of VZ 5 conforms with TEC.		As per the listing advice, VZ 6 occurs in Flat areas, shallow depressions. These areas are not associated with active drainage channels, and are rarely if ever flooded. Attribute across all patches of VZ 6 conforms with TEC.	
Edaphic	As per the listing advice, VZ 5 occurs on black, brown, red-brown or grey clay or clay loam soils. Attribute across all patches of VZ 5 conforms with TEC.		As per the listing advice, VZ 6 occurs on black, brown, red-brown or grey clay or clay loam soils. Attribute across all patches of VZ 6 conform with TEC.	
Structural	VZ 5 occurs as grassland with rare trees which does not conform to structural descriptions of the condition threshold (inadequate tree canopy cover/trees per hectare). Details of structural condition class criteria required by Conservation Advice, Listing Advice and Policy Statement are given below.		VZ 6 occurs as an open woodland with intact understorey including regenerating suckers of *Acacia pendula.* Details of structural condition class criteria required by Conservation Advice, Listing Advice and Policy Statements are given below.	
	• Structural condition class criteria required by Conservation Advice, Listing Advice and Policy Statement:	Structural condition class criteria details on site:	• Structural condition class criteria required by Conservation Advice, Listing Advice and Policy Statement:	Structural condition class criteria details on site:
	• A tree canopy is dominated (at least 50% of trees present) by living, dead or defoliated Weeping Myall trees.	Tree cover across patches of VZ 5, while typically *Acacia pendula*, is <0.1% cover across all patches. **Attribute across all patches of VZ 5 does not conform with TEC.**	• A tree canopy is dominated (at least 50% of trees present) by living, dead or defoliated Weeping Myall trees; and	A tree canopy dominated by Acacia pendula occurs across all patches of VZ 6.

Key diagnostic characteristics as per the Conservation Advice, Listing Advice and Policy Statement	Key diagnostic characteristics relative to patches of VZ 5 – PCT 26: Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion - Derived Native Grassland		Key diagnostic characteristics relative to patches of VZ 6 – PCT26: Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion - Moderate -Good	
	• An overstorey of at least 5% tree canopy cover or at least 25 dead or defoliated mature Weeping Myall trees/ha	Tree cover is <0.1 % across all patches of VZ 5 **Attribute across all patches of VZ 5 does not conform with TEC.**	• The overstorey must have at least 5% tree canopy cover or at least 25 dead or defoliated mature Weeping Myall trees/ha.	Tree cover is greater than 5% across all patches of VZ 6 Attribute across all patches of VZ 6 conforms with TEC.
	• An area (patch) is at least 0.5 ha in size	All patches within the subject land are over 0.5 ha in size. Attribute across all patches of VZ 5 conforms with TEC.	• The area is at least 0.5 ha in size.	All patches within the subject land are over 0.5 ha in size. Attribute across all patches of VZ 6 conforms with TEC.
	• The patch has either:		The patch has either:	
	More than two layers of regeneration of Weeping Myall present; or	Most larger patches have two layers of regenerating *Acacia pendula* present as very rare adults and rare low-growing grazed suckers. Attribute across most patches of VZ 5 marginally conforms with TEC.	More than two layers of regeneration of Weeping Myall present; or	All patches have two layers of regenerating *Acacia pendula* present as dominant adults and common low-growing grazed suckers. Attribute across all patches of VZ 6 conforms with TEC.
	The tallest layer of living, dead or defoliated Weeping Myall trees is at least 4 m tall and of the vegetative cover present, 50% is comprised of native species.	*Acacia pendula* present as very rare individuals. More than 50% of vegetation cover present - in most months where growth favours native species - is comprised of native species. Attribute across most patches of VZ 5 marginally conforms with TEC.	The tallest layer of living, dead or defoliated Weeping Myall trees is at least 4 m tall and of the vegetative cover present, 50% is comprised of native species.	All patches have living, dead or defoliated *Acacia pendula* trees of at least 4 m tall. More than 50% of vegetation cover present in most months where growth favours native species, is comprised of native species. Attribute across most patches of VZ 6 conforms with TEC.

Key diagnostic characteristics as per the Conservation Advice, Listing Advice and Policy Statement	Key diagnostic characteristics relative to patches of VZ 5 – PCT 26: Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion - Derived Native Grassland	Key diagnostic characteristics relative to patches of VZ 6 – PCT26: Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion - Moderate -Good
Characteristic assemblage of species	The Listing Advice does not give detail as to the assemblage of plant species that make up the TEC, but as the Listing Advice notes that the community is listed in NSW, it is assumed that a similar assemblage would locally describe the TEC. Recorded upper stratum: Very rare and isolated adult trees of *Acacia pendula*, with rare suckering small plants of *Acacia pendula*. Recorded middle stratum: *Maireana aphylla* and *Sclerolaena muricata, Maireana aphylla.* Recorded ground stratum*: Atriplex semibaccata, Rytidosperma caespitosa, Austrostipa aristiglumis, Alternanthera denticulata, Calotis scabiosifolia, Convolvulus clementii, Einadia nutans, Enchylaena tomentosa, Enteropogon acicularis, Sclerolaena brachyptera, Sporobolus caroli, Sida corrugata, Solanum esuriale, Vittadinia cuneata*. This attribute across all patches of VZ 5 broadly conforms with TEC, although noting the relative rarity of *Acacia pendula* as adult trees.	The Listing Advice does not give detail as to the assemblage of plant species that make up the TEC, but as the Listing Advice notes that the community is listed in NSW, it is assumed that a similar assemblage would locally describe the TEC. Recorded upper stratum: Acacia pendula common and from low suckers to adults, with Eucalyptus largiflorens as a rare component. Recorded middle stratum: Maireana aphylla and Sclerolaena muricata, Maireana aphylla. Recorded ground stratum: *Atriplex semibaccata, Rytidosperma caespitosa, Austrostipa aristiglumis, Alternanthera denticulata, Calotis scabiosifolia, Convolvulus clementii, Einadia nutans, Enchylaena tomentosa, Enteropogon acicularis, Sclerolaena brachyptera, Sporobolus caroli, Sida corrugata, Solanum esuriale, Vittadinia cuneata*. This attribute across all patches of VZ 6 conforms with TEC.
Summary of TEC attributes of vegetation zone/patches relative to the Listing Advice and Conservation Advice	No patches of the vegetation zone conform to all the required condition class criteria for the TEC.	All patches of the vegetation zone conform to all the required condition class criteria for the TEC.

4.5.5 Natural Grasslands of the Murray Valley Plains

The Natural Grasslands of the Murray Valley Plains are listed as a critically endangered ecological community under the EPBC Act.

Two PCTs within the Subject Land, PCT 44 Forb-rich Speargrass - Windmill Grass - White Top grassland of the Riverina Bioregion and PCT 46: Curly Windmill Grass - speargrass - wallaby grass grassland on alluvial clay and loam on the Hay Plain - Riverina Bioregion are listed in BioNet Vegetation Classification as associated with the Natural Grasslands of the Murray Valley Plains. Both these PCTs are classified by BioNet in the vegetation class Riverine Plain Grasslands.

The CEEC is described in the Approved Conservation Advice as dominated by grasses such as: *Rytidosperma* spp, *Austrostipa* spp, *Chloris* spp and *Enteropogon* spp. Forbs and herbs commonly present include: *Arthropodium spp, Bulbine spp, Calotis spp*, *Chrysocephalum* spp, *Leptorhynchos* spp, *Minnuria* spp, *Ptilotus* spp, *Rhodanthe* spp, *Sida* spp, and *Swainsona* spp.. Small shrubs may include occasional saltbushes and bluebushes *Atriplex* spp. and Maireana spp.

The Listing Advice describes the assemblage in more detail with characteristic species that may be present in this part of the Riverina. These are described growth form below.

Trees and large shrubs are generally absent to sparse, amounting to less than 10% projective foliage cover for emergent trees or shrubs. Tree and large shrub species include:

- *Eucalyptus* spp
- *Acacia oswaldii*
- *Nitraria billardierei*
- *Acacia pendula.*

The ecological community is usually dominated by a range of species, typically perennial grasses, forbs or small shrubs (generally <1 m tall).

- *Rytidosperma*
- *Austrostipa*
- *Chloris*
- *Enteropogon*
- *Arthropodium* spp
- *Bulbine* spp
- *Calocephalus sonderi*
- *Chrysocephalum apiculatum*
- *Leptorhynchos squamatus*
- *Minuria leptophylla*
- *Oxalis perennans*
- *Ptilotus nobilis*
- *Rhodanthe corymbiflora*
- *Sida corrugata.*

Perennial herbs that are less widespread but are characteristic of the community include

- *Calotis scabiosifolia*
- *Convolvulus angustissimus*
- *Plantago gaudichaudii*
- *Swainsona plagiotropis*
- *Wurmbea latifolia.*

Other important groups of native species in the ecological community include small annual forbs and small shrubs. The most common annuals are:

- *Eriochlamys behrii*
- *Goodenia pusilliflora*
- *Isoetopsis graminifolia*
- *Levenhookia dubia*
- *Triptilodiscus pygmaeus.*

The most common small shrubs present are chenopods. Chenopods that characteristically occur in the ecological community include:

- *Atriplex semibaccata*
- *M. enchylaenoides*
- *M. humillima*
- *Maireana decalvans*
- *M. excavata*
- *M. pentagona.*

The CEEC typically occurs on a landscape of flat alluvial lowland plains with heavy-textured grey, brown and red clays.

The Natural Grasslands of the Murray Valley Plains is limited to a particular kind of grassland that is naturally treeless or almost so, with sparse tree cover. Such grasslands do not naturally occur in many areas. The policy statement for the CEEC, for example, notes that the extensive grasslands on the Hay Plains are not part of the listed grassland community, as they are not natural grasslands, but are derived from clearing past saltbush or woodland vegetation. BioNet Vegetation Classification classifies the vegetation class for both PCT 44 and PCT 46 as Riverina Plain Grasslands. It notes that it is likely that over 1000000 ha of grassland of various types occurs on the Riverina Plain and are derived largely from Myall woodland and Saltbush shrubland since European settlement. The BioNet profile for Riverine Plain Grasslands notes that the Riverine Grasslands were apparently derived from Riverine Plains Woodlands, which were eliminated by heavy grazing. Porteners MJ (1993) states that the shrubland and grassland communities on the Hay Plain may be regarded as various stages in a succession after grazing disturbance, indicating that the grasslands of Hay are not natural grasslands but disclimax communities with various degrees of degeneration.

In the northern part of the distribution of the ecological community, the Listing Advice details a method to help distinguish the listed natural grasslands from grasslands derived from clearing past saltbush or woodland vegetation. This method looks at native plant species characteristic of grassland ecological communities in south-western NSW. Species more frequent in the Natural Grasslands of the Murray Valley Plains ecological community and species more frequent in grassland vegetation not considered to be the ecological community are listed in the method. A comparison was made for both PCT 44 and PCT 46 between the species in the Listing Advice noted as common in the CEEC and species noted as common in grasslands that are not the CEEC. It was found, for both PCT 44 and PCT 46 on site, that there are approximately twice as many species that listed as common in grasslands derived from former *Acacia pendula* woodlands or chenopod shrublands, compared to species listed as common in natural grasslands of the CEEC.

The Listing Advice defines a patch for this CEEC as a discrete and continuous area of the ecological community. However, a patch may include small-scale disturbances, such as tracks or breaks (including exposed soil, leaf and other plant litter, cryptogams) or small-scale variations in vegetation that do not significantly alter its overall functionality (for instance the movement of wildlife or dispersal of plant propagules).

The Listing Advice states that the ecological community is limited to patches that meet the following key diagnostic characteristics and condition thresholds.

Key Diagnostic Characteristics

The key diagnostic characteristics of this ecological community are:

- Distribution is primarily in the Riverina Bioregion and the Wimmera plains of the Murray Darling Depression Bioregion. Other outlying occurrences are also in the Murray Darling Depression Bioregion and the NSW South Western Slopes Bioregion.
- The approximate northern limit of the ecological community is in the Murrumbidgee subregion (IBRA RIV2), approximately near the northern boundary of the Murray Catchment Management Authority (CMA) in NSW.
- It typically occurs on a landscape of flat alluvial lowland plains with heavy-textured grey, brown and red clays.
- The ecological community is typically dominated by a range of perennial grasses and/or forbs or co-dominated by small shrubs. Sites are not necessarily dominated by any particular plant species. Characteristic genera present typically include:
    - for grasses – Rytidosperma, Austrostipa, Chloris and Enteropogon.
    - for forbs – Arthropodium, Bulbine, Calotis, Chrysocephalum, Leptorhynchos, Minuria, Ptilotus, Rhodanthe, Sida and Swainsona.
    - for small shrubs – *Atriplex* and *Maireana*.
- Trees and large shrubs (>1 m tall) are generally absent to sparse, amounting to less than 10% projective foliage cover for emergent trees or shrubs. Where tree and large shrub species are present, they may often include *Acacia oswaldii* (umbrella wattle), *A. pendula* (weeping myall, boree), *Allocasuarina luehmannii* (buloke) and *Eucalyptus* spp. from intergrading communities. Where woodlands overlap or adjoin with the ecological community, they are not included as part of the Natural Grasslands of the Murray Valley Plains. The outer boundary for these adjacent ecological communities should be defined as two times the canopy width of the dominant tree species.
- In addition to the vegetation and other characteristics, above, presence of the ecological community may also be indicated by the presence or past records of 'diagnostic' indicator fauna species in the patch, such as the plains-wanderer, striped legless lizard, hooded scaly-foot or curl snake.

Condition Thresholds

In addition to the diagnostic characteristics above, the following condition thresholds for the community apply:

- For all patches of the ecological community:
    - The percentage cover of native vascular plants (annual and perennial) in the patch is greater than the percentage cover of perennial exotic species, and
    - Either category A or category B thresholds are met as below:

- Category A. For patches with high diversity or that are relatively undisturbed:
    - 15 or more native vascular plant species are present in the patch, and
    - The patch contains one or more indicator species in Table 2 of the Listing Advice, characteristic of sites that are relatively undisturbed (e.g. have little to no history of cultivation), and
    - The size of the grassland patch is at least 0.04 ha or more in size
- Category B. For larger patches that have good ground layer diversity:
    - 10 or more native vascular plant species are present in the patch, and
    - The size of the grassland patch is at least 1 ha or more in size.

For the current report, PCT and vegetation zone ground truthing was limited to the Subject Land, but the majority of the Project Boundary was broadly assessed through extensive rapid data points and aerial photograph interpretation (API). This vegetation mapping in those parts of the Project Area outside the Subject Land gives a high confidence for mapping of vegetation formation (grasslands), a high confidence for vegetation class (Riverine Plain Grasslands), and a moderate confidence to PCT. Across the Project Area the extent of grassland occurs as Riverine Plain Grasslands (PCT 44 – VZ 9, and PCT 46 – VZ 10) in spatial extent to form two principal patches divided by the wooded vegetation along the Coleambally Outfall Drain. Within the Project Boundary are eight further relatively small and tenuously patches of grassland which occur within the wooded vegetation along Coleambally Outfall drain. Two of these smaller patches occur within the Survey Corridor, one each of VZ 9 - PCT 44 (total patch size 0.18 ha.), and VZ 10 - PCT 46 (total patch size 0.07 ha.).

Vegetations surveys for the BWF were carried out across a two-year period and consisted of the collection of detailed data as part of BAM VI plots, and RMPs. Data was captured across all four seasons in order to capture the seasonal variation of native vegetation composition. Furthermore, data was collected following durations of good rainfall and not during time of drought. An assessment against the Conservation Advice found that patches of PCT 44 and PCT 46, both as patches of each vegetation zone (PCT) and as patches of the vegetation class Riverine Plain Grasslands, do not conform with Natural Grasslands of the Murray Valley Plains CEEC. **Table 4.27** compares the characteristic attributes of vegetation zone (PCT) patches and Riverine Plain Grasslands patches in the Subject Land.

Table 4.32 Justification of the absence of Natural Grasslands of the Murray Valley Plains in the Subject Land

Key diagnostic characteristics and condition thresholds as per the Conservation Advice, Listing Advice and Policy Advice	Key diagnostic characteristics relative to VZ – 9. PCT44: Forb-rich Speargrass - Windmill Grass - White Top grassland of the Riverina Bioregion	Key diagnostic characteristics relative to VZ – 10. PCT46: Curly Windmill Grass - speargrass - wallaby grass grassland on alluvial clay and loam on the Hay Plain: Riverina Bioregion	Key diagnostic characteristics relative to all patches of Riverine Plain Grasslands (contiguous patches of VZ – 9 PCT44 and VZ – 10 PCT46.
Diagnostic characteristic: Distribution	While as per the Listing Advice, the Subject Land is in the Riverina Bioregion, as per the policy advice, the Subject Land lies generally north of those parts of the Murray Valley Plains supporting the CEEC, specifically the Hay Plain which are not considered natural grasslands. **Attribute across all patches of PCT 44 (VZ 9) in the subject land does not conform to the CEEC.**	While as per the Listing Advice, the Subject Land is in the Riverina Bioregion, as per the policy advice, the Subject Land lies generally north of those parts of the Murray Valley Plains supporting the CEEC, specifically the Hay Plain which are not considered natural grasslands. **Attribute across all patches of PCT 46 (VZ 10) in the subject land does not conform to the CEEC.**	While as per the Listing Advice, the Subject Land is in the Riverina Bioregion, as s per the policy advice, the Subject Land lies generally north of those parts of the Murray Valley **Attribute across all grassland patches in the subject land doesn't conform to the CEEC.**
Diagnostic characteristic: Landscape position	The Subject Land occurs on the alluvial plain of the Murray River and its tributaries. Attribute across all patches of PCT 44 (VZ 9) in the subject land conforms with the CEEC.	The Subject Land occurs on the alluvial plain of the Murray River and its tributaries. Attribute across all patches of PCT 46 (VZ 10) in the subject land conforms with the CEEC.	The Subject Land occurs on the alluvial plain of the Murray River and its tributaries. Attribute across all patches of Riverine Plain Grasslands in the subject land conforms with the CEEC.
Diagnostic characteristic: Edaphic	The Listing Advice notes that the CEEC typically occurs on a landscape of flat alluvial lowland plains with heavy-textured grey, brown and red clays. All patches of PCT 44 (VZ 9) in the subject land occur on red-brown clay loams.	The Listing Advice notes that the CEEC typically occurs on a landscape of flat alluvial lowland plains with heavy-textured grey, brown and red clays. All patches of PCT 46 (VZ 10) in the subject land occur on grey to red-brown clay loams.	The Listing Advice notes that the CEEC typically occurs on a landscape of flat alluvial lowland plains with heavy-textured grey, brown and red clays. All patches of Riverine Plain Grasslands in the subject land occur on grey to red-brown clay loams. Attribute across all patches of Riverine Plain Grasslands in the subject land conforms with the CEEC.

Key diagnostic characteristics and condition thresholds as per the Conservation Advice, Listing Advice and Policy Advice	Key diagnostic characteristics relative to VZ – 9. PCT44: Forb-rich Speargrass - Windmill Grass - White Top grassland of the Riverina Bioregion	Key diagnostic characteristics relative to VZ – 10. PCT46: Curly Windmill Grass - speargrass - wallaby grass grassland on alluvial clay and loam on the Hay Plain: Riverina Bioregion	Key diagnostic characteristics relative to all patches of Riverine Plain Grasslands (contiguous patches of VZ – 9 PCT44 and VZ – 10 PCT46.
	Attribute across all patches of PCT 44 (VZ 9) in the subject land conforms with the CEEC.	Attribute across all patches of PCT 46 (VZ 10) in the subject land conforms with the CEEC.	
Diagnostic characteristic: Natural grassland structure	All patches of PCT 44 (VZ 9) are a grassland derived from clearing past saltbush or *Acacia* woodland, rather than the CEEC's requirement to be a natural grassland. **Attribute across all patches of PCT 44 (VZ 9) in the subject land doesn't conform to the CEEC. As this attribute of the grassland being natural is determinative, then the failure of this attribute to conform to the CEEC means the CEEC does not exist in the Subject Land, irrespective of the status of other attributes.**	All patches of PCT 46 (VZ 10) are a grassland derived from clearing past saltbush or Acacia woodland, rather than the CEEC's requirement to be a natural grassland. **Attribute across all patches of PCT 46 (VZ 10) in the subject land doesn't conform to the CEEC. As this attribute of the grassland being natural is determinative, then the failure of this attribute to conform to the CEEC means the CEEC does not exist in the Subject Land, irrespective of the status of other attributes.**	All patches of riparian grasslands are a grassland derived from clearing past saltbush or Acacia woodland, rather than the CEEC's requirement to be a natural grassland. **Attribute across all patches of Riverine Plain Grasslands in the subject land doesn't conform to the CEEC. As this attribute of the grassland being natural is determinative, then the failure of this attribute to conform to the CEEC means the CEEC does not exist in the Subject Land, irrespective of the status of other attributes.**
Diagnostic characteristic: Characteristic vascular plant species present	14 of the 29 characteristic species identified in Appendix A of the listing advice occur across all patches of PCT 44 (VZ 9). Attribute across all patches of PCT 44 (VZ 9) in the subject land moderately conforms with the CEEC.	9 of the 29 number of characteristic species identified in Appendix A of the listing advice occur across all patches of PCT 44 (VZ 9). Attribute across all patches of PCT 46 (VZ 10) in the subject land poorly conforms with the CEEC.	14 of the 29 characteristic species identified in Appendix A of the listing advice occur across both largest patches of Riverine Plain Grasslands. Attribute across all patches of Riverine Plain Grasslands in the subject land moderately conforms with the CEEC.

Key diagnostic characteristics and condition thresholds as per the Conservation Advice, Listing Advice and Policy Advice	Key diagnostic characteristics relative to VZ – 9. PCT44: Forb-rich Speargrass - Windmill Grass - White Top grassland of the Riverina Bioregion	Key diagnostic characteristics relative to VZ – 10. PCT46: Curly Windmill Grass - speargrass - wallaby grass grassland on alluvial clay and loam on the Hay Plain: Riverina Bioregion	Key diagnostic characteristics relative to all patches of Riverine Plain Grasslands (contiguous patches of VZ – 9 PCT44 and VZ – 10 PCT46.
Diagnostic characteristic: Indicator fauna species	The Listing Advice notes that the CEEC may also be indicated by the presence or past records of 'diagnostic' indicator fauna species in the patch, such as the plains-wanderer, striped legless lizard, hooded scaly-foot or curl snake. Plains-Wanderer was observed by the current survey in PCT 44 (V9). The Listing Advice does not define a ''diagnostic' indicator' species, but it is noted that Plains Wanderer is not listed as associated only with PCTs listed as also associated with the CEEC. PCT 44 and PCT 46 are the only two PCTs noted as occurring within the Murrumbidgee IBRA sub-region listed as also associated with Plains Wanderer, however as described above, the Grasslands on the Subject Land are not natural and as such are not the CEEC.	The Listing Advice notes that the CEEC may also be indicated by the presence or past records of 'diagnostic' indicator fauna species in the patch, such as the plains-wanderer, striped legless lizard, hooded scaly-foot or curl snake. Plains-Wanderer was observed by the current survey in PCT 46 (V10). The Listing Advice does not define a ''diagnostic' indicator' species, but it is noted that Plains Wanderer is not listed as associated only with PCTs listed as also associated with the CEEC. PCT 44 and PCT 46 are the only two PCTs noted as occurring within the Murrumbidgee IBRA sub-region listed as also associated with Plains Wanderer, however as described above, the Grasslands on the Subject Land are not natural and as such are not the CEEC.	The Listing Advice notes that the CEEC may also be indicated by the presence or past records of 'diagnostic' indicator fauna species in the patch, such as the plains-wanderer, striped legless lizard, hooded scaly-foot or curl snake. Plains-Wanderer was observed by the current survey in both large patches of Riverine Plain Grassland. The Listing Advice does not define a ''diagnostic' indicator' species, but it is noted that Plains Wanderer is not listed as associated only with PCTs listed as also associated with the CEEC. PCT 44 and PCT 46 are the only two PCTs noted as occurring within the Murrumbidgee IBRA sub-region listed as also associated with Plains Wanderer, however as described above, the Grasslands on the Subject Land are not natural and as such are not the CEEC.

Key diagnostic characteristics and condition thresholds as per the Conservation Advice, Listing Advice and Policy Advice	Key diagnostic characteristics relative to VZ – 9. PCT44: Forb-rich Speargrass - Windmill Grass - White Top grassland of the Riverina Bioregion	Key diagnostic characteristics relative to VZ – 10. PCT46: Curly Windmill Grass - speargrass - wallaby grass grassland on alluvial clay and loam on the Hay Plain: Riverina Bioregion	Key diagnostic characteristics relative to all patches of Riverine Plain Grasslands (contiguous patches of VZ – 9 PCT44 and VZ – 10 PCT46.
Condition threshold: **Percentage cover of native vascular plants is greater than the percentage cover of perennial exotic species.**	Of the exotic species across the Subject Land's grasslands, three annual grasses are by far dominant: *Lolium rigidum*, *Avena fatua*, and *Hordeum leporinum*. The principal perennial exotic in PCT is *Lycium ferocissimum* which is present at very low densities of <0.01% across all patches of VZ 9 in the Subject Land. Attribute across all patches of PCT 44 (VZ 9) in the subject land conforms with the CEEC.	Of the exotic species across the Subject Land's grasslands, three annual grasses are by far dominant: *Lolium rigidum, Avena fatua,* and *Hordeum leporinum*. The principal perennial exotic in PCT is *Lycium ferocissimum* which is present at very low densities of <0.01% across all patches of VZ 10 in the Subject Land. Attribute across all patches of PCT 46 (VZ 9) in the subject land conforms with the CEEC.	Of the exotic species across the Subject Land's grasslands, three annual grasses are by far dominant: *Lolium rigidum*, *Avena fatua*, and *Hordeum leporinum*. The principal perennial exotic in PCT is *Lycium ferocissimum* which is present at very low densities of <0.01% across all patches of Riverine Plain Grasslands in the Subject Land. Attribute across all patches of Riverine Plain Grasslands in the subject land conforms with the CEEC.
Condition threshold: **comparison of species characteristic of Natural Grasslands of the Murray Valley Plains versus species not considered to be the CEEC (Listing Advice Table 1)**	All patches of VZ 9 PCT44 support more characteristic species not considered part of the CEEC than those noted to be more frequently associated with the CEEC. The largest patches support 14 species as described in Listing Advice as more frequent in the CEEC compared to 24 species supported that are more frequent in grassland vegetation not considered to be the CEEC in NSW. **Attribute across all patches of PCT 44 (VZ 9) in the subject land does not conform with the CEEC.**	All patches of VZ 10 PCT 46 show more species not considered part of the CEEC than those noted to be more frequent within the CEEC. The largest patches show 10 species occurring as described in Listing Advice as more frequent in the CEEC compared to 21 more frequent in grassland vegetation not considered to be the CEEC in NSW. **Attribute across all patches of PCT 46 (VZ 10) in the subject land does not conform with the CEEC.**	All patches of Riverine Plain Grasslands show more species not considered part of the CEEC than those noted to be more frequent within the CEEC. The largest patches show 14 species occurring as described in Listing Advice as more frequent in the CEEC compared to 21 species found which are more frequent in grassland vegetation not considered to be the CEEC in NSW. **Attribute across all patches of Riverine Plain Grasslands in the subject land does not conform with the CEEC.**

Key diagnostic characteristics and condition thresholds as per the Conservation Advice, Listing Advice and Policy Advice	Key diagnostic characteristics relative to VZ – 9. PCT44: Forb-rich Speargrass - Windmill Grass - White Top grassland of the Riverina Bioregion	Key diagnostic characteristics relative to VZ – 10. PCT46: Curly Windmill Grass - speargrass - wallaby grass grassland on alluvial clay and loam on the Hay Plain: Riverina Bioregion	Key diagnostic characteristics relative to all patches of Riverine Plain Grasslands (contiguous patches of VZ – 9 PCT44 and VZ – 10 PCT46.
Condition threshold: **Patch size and species within patch** **Condition A:** • **15 or more native vascular plant species are present,** • **One or more indicator species in Table 2 of the Listing Advice,** • **The size of the grassland patch is at least 0.04 ha or more in size** **Condition B** • **10 or more native vascular plant species are present, and** • **The size of the grassland patch is at least 1 ha or more in size.**	All patches of All patches of VZ 9 PCT44 that intersect the subject land likely meet the attributes of Condition A in that they likely support more than 15 native vascular species, including indicator species, and are greater than 0.04 ha.	All patches of VZ 10 PCT 46 that intersect the subject land likely meet the attributes of Condition A in that they support more than 15 native vascular species, including indicator species, and are greater than 0.04 ha.	The two largest patches of Riverine Plain Grassland that intersect the subject land meet the attributes of Condition A in that they support more than 15 native vascular species, including indicator species, and are greater than 0.04 ha. The two and smallest patches of Riverine Plain Grassland that intersect the subject land likely meets the attribute of Condition A in that they likely support 15 or more native vascular plant species, including at least one indicator species, and the patches are greater than 0.04 ha.
Summary of CEEC attributes of patches relative to the Listing Advice and Conservation Advice	No patches of the vegetation zone conform to all the required condition class criteria for the CEEC.	No patches of the vegetation zone conform to all the required condition class criteria for the CEEC.	No patches of Riverine Plain Grasslands conform to all the required condition class criteria for the CEEC.

4.6 Groundwater Dependent Ecosystems

Groundwater dependent ecosystems (GDEs) rely on the presence of groundwater to function and sustain the resident assemblage of species, populations, and ecological communities. The level of groundwater dependence of vegetation communities in the Subject Land has been identified using the GDE Atlas (BoM 2024) and the Risk assessment guidelines for groundwater dependent ecosystems (DPI 2012 & Serov et al. 2012).

The GDE Atlas delineates and provides information about the following three types of GDEs (BoM 2017):

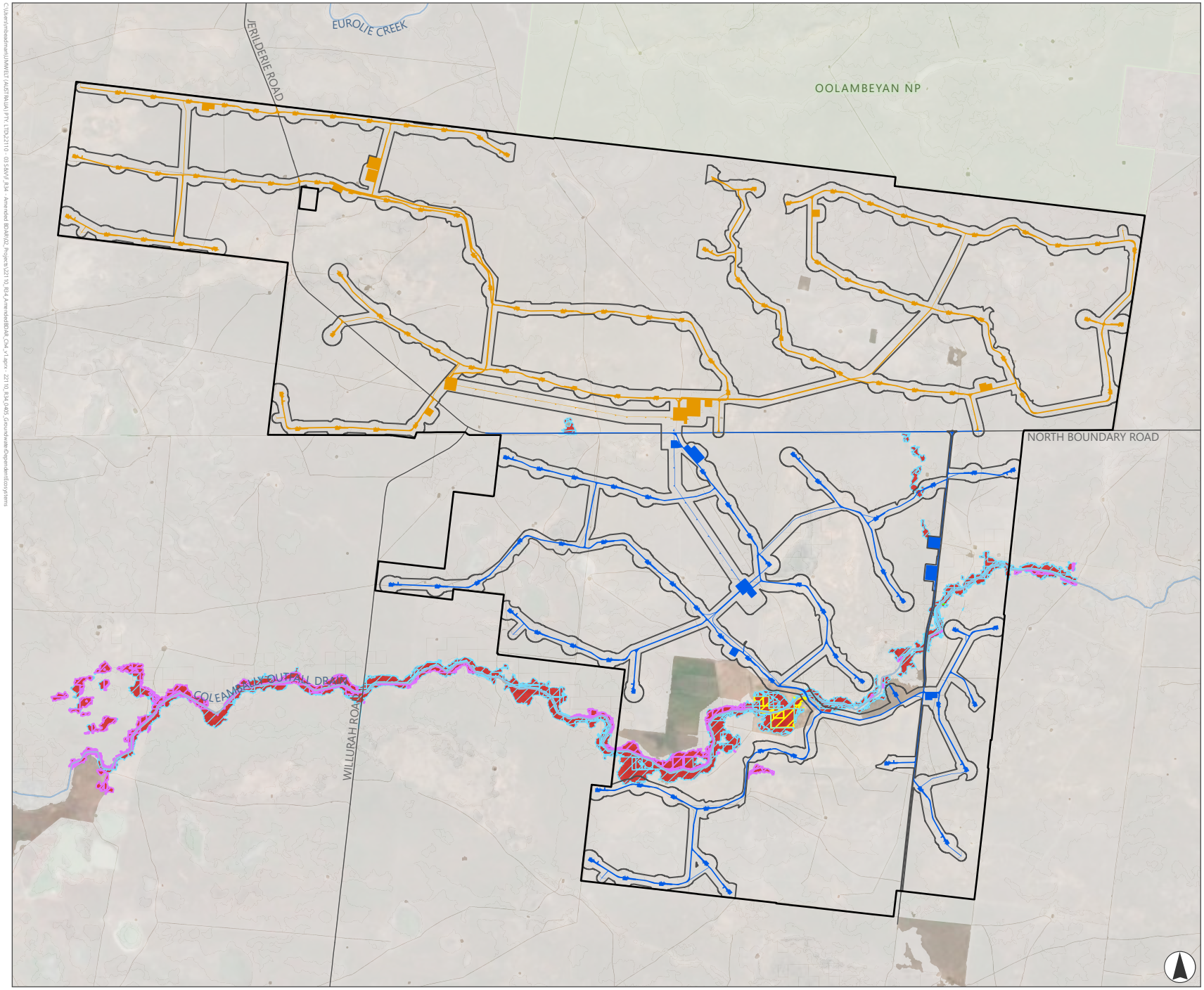
- Aquatic ecosystems that rely on the surface expression of groundwater – This includes surface water ecosystems which may have a groundwater component, such as rivers, wetlands, and springs. Marine and estuarine ecosystems can also be groundwater dependent, but they are not mapped in the GDEs Atlas.
- Terrestrial ecosystems that rely on the subsurface presence of groundwater – This includes all vegetation ecosystems.
- Subterranean ecosystems – This includes cave and aquifer ecosystems.

Within the terrestrial ecosystem type, an area of vegetation can be classified as either a high potential, moderate potential or low potential GDE. According to the GDEs Atlas, the Subject Land is mapped as containing both terrestrial and aquatic GDEs (**Figure 4.5**). The following GDEs were mapped within the Subject Land, all associated with wetland and riparian vegetation communities mapped throughout the Subject Land:

- High potential terrestrial GDEs.
- Very high potential aquatic GDEs.
- High potential GDEs.
- Moderate potential GDEs.
- Low potential GDEs.
- The high potential GDEs typically corresponds to River Red Gum - Black Box woodland wetland of the semi-arid (warm) climatic zone fringing the Coleambally Outfall Drain.

FIGURE 4.5.1

Groundwater Dependent Ecosystems



Legend

- Project Boundary
- Subject Land
- Stage 1 (South) Development Footprint
- Stage 2 (North) Development Footprint
- NPWS Reserves
- Road
- Watercourse

Terrestrial GDE Probability

- High
- Non GDE

Aquatic Groundwater Dependent Ecosystem Probability

- Very High
- High
- Medium
- Low

0 1,000 2,000

Meters

Scale 1:110,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

FIGURE 4.5.2

Groundwater Dependent Ecosystems

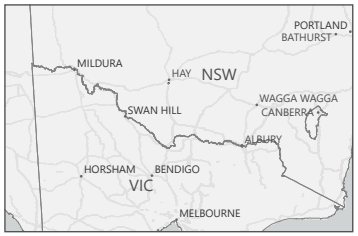
Legend

Stage 1 (South) Development Footprint

Road

Terrestrial GDE Probability

Low



0 90 180

Meters

Scale 1:5,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

FIGURE 4.5.3

Groundwater Dependent Ecosystems

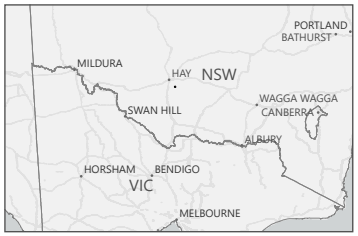
Legend

Stage 1 (South) Development Footprint

Road

Terrestrial GDE Probability

Non GDE



0 90 180

Meters

Scale 1:5,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

C:\Users\mbeadman\UMWELT (AUSTRALIA) PTY LTD\2110 - 03.SAVY_R34 - Amended IBDAR\02_Projects\2110_R34_AmendedIBDAR_CH4_v1.aprx - 2110_R34_0405_GroundwaterDependentEcosystems

FIGURE 4.5.4

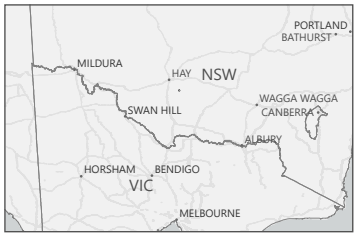
Groundwater Dependent Ecosystems

Legend

- Stage 1 (South) Development Footprint
- Road
- Watercourse

Terrestrial GDE Probability

- Non GDE



0 90 180

Meters

Scale 1:5,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

4.7 Other Vegetation

Areas of non-native vegetation have been mapped in the Subject Land in areas associated with intensive stocking or cropping around Bullawah Homestead, where vegetation is intensively managed for holding pens including the production of short-term forage crops. Between cropping these areas are typically devoid of any vegetation. The cleared top of banks of the Coleambally Outfall Drain are typically mapped as non-native vegetation, dominated by non-native forbs and grasses including *Lolium* spp., *Avena* spp., *Arctotheca calendula*, *Sisymbium irio*, *Marrubium vulgare*, *Solanum elaeagnifolium* and *Heliotropium europaeum,* with uncommon shrubs of *Lycium ferocissimum.*

Photo 4.1 Non-native Vegetation Within the Subject Land

5.0 Threatened Species

5.1 Ecosystem Species

5.1.1 Identification of Ecosystem Credit Species

Ecosystem credit species are those threatened species that can reliably be predicted to occur based on the PCTs identified within the Subject Land. The BAM-C generates a list of predicted ecosystem credit species from numerous inputs such as landscape features and the native vegetation communities present.
The ecosystem credit species applicable to the Project have been predicted using the BAM-C based on the following inputs:

- IBRA subregion: Murrumbidgee.
- Associated PCTs: 10, 13, 17, 24, 26, 44, 46, 160, 164.
- Percentage native vegetation cover class: >70%.
- Patch size class: >100 ha.
- Credit type: Ecosystem.

Table 5.1 provides the full suite of predicted ecosystem credit species applicable to the Project as generated by the BAM-C. Also included are species that were:

- Recorded within the Project Area during recent surveys.
- Identified in BioNet Atlas and PMST database searches and considered to have higher than moderate likelihood or utilising the Subject Land on occasion (**Appendix B**).

A number of species listed are classified as both ecosystem and species credit species. In this instance the species is listed in both **Table 5.1** and **Table 5.3**. Justification for the species' inclusion in further assessment is detailed in **Section 8.0**.

Table 5.1 Summary of Ecosystem Credit Species Considered as Part of This Assessment

Common Name *Species name*	BC Act	EPBC Act	Credit Status	Source	Associated PCTs	Habitat Constraint	Geographic Limitation	Sensitivity to gain class
Australasian Bittern *Botaurus poiciloptilus*	E	E	Ecosystem	BAM-C, Atlas, PMST	160, 10, 13, 17, 24	Brackish or freshwater wetlands	-	Moderate
Australian Painted Snipe *Rostratula australis*	E	E	Ecosystem	BAM-C, PMST	160, 10, 13, 17, 24	-	-	Moderate
Barking Owl *Ninox connivens*	V	-	Species/Ecosystem	BAM-C, Atlas	10, 13	Living or dead trees with hollows greater than 20 cm diameter and greater than 4 m above the ground.	-	High
Black Falcon *Falco subniger*	V	-	Ecosystem	BAM-C, Atlas	10, 13, 17, 26, 24, 44, 46, 164, 160	-	-	Moderate
Blue-billed Duck *Oxyura australis*	V	-	Ecosystem	BAM-C	160, 17, 24	-	-	Moderate
Blue-winged Parrot *Neophema chrysostoma*	V	V	Ecosystem	BAM-C, Atlas, PMST	13, 17, 24, 26, 28, 44, 46, 160	-	-	Low
Brolga *Grus rubicunda*	V	-	Ecosystem	BAM-C	160, 10, 13, 17, 26, 24	-	-	Moderate
Brown treecreeper (eastern subspecies) *Climacteris picumnus victoriae*	V	V	Ecosystem	Atlas, PMST	No associated PCTs on site	-	Is not known or predicted to occur within the Murrumbidgee IBRA subregion.	High
Curlew Sandpiper *Calidris ferruginea*	E	CE	Ecosystem/ Species	PMST	24	As per important habitat map	-	High
Diamond Firetail *Stagonopleura guttata*	V	V	Ecosystem	BAM-C, Atlas, PMST	44, 46, 10, 13, 26, 28	-	-	Moderate

Common Name *Species name*	BC Act	EPBC Act	Credit Status	Source	Associated PCTs	Habitat Constraint	Geographic Limitation	Sensitivity to gain class
Dusky Woodswallow *Artamus cyanopterus cyanopterus*	V	-	Ecosystem	BAM-C, Atlas	44, 46, 164, 160, 10, 13, 17, 24, 26, 28	-	-	Moderate
Flame Robin *Petroica phoenicea*	V	-	Ecosystem	Atlas	No associated PCTs on site	-	-	Moderate
Freckled Duck *Stictonetta naevosa*	V	-	Ecosystem	BAM-C, Atlas	160, 10, 13, 17, 24	-	-	Moderate
Gilbert's Whistler *Pachycephala inornata*	V	-	Ecosystem	BAM-C	10, 13, 17, 28	-	-	Moderate
Grey Falcon *Falco hypoleucus*	V	V	Ecosystem	BAM-C, PMST, supplementary SEARs	44, 46, 164, 160, 10, 13, 17, 24, 26, 28	-	-	Moderate
Grey-crowned Babbler (eastern subspecies) *Pomatostomus temporalis temporalis*	V	-	Ecosystem	BAM-C, Atlas	10, 13, 26, 28	-	-	Moderate
Hooded Robin (south-eastern form) *Melanodryas cucullata cucullata*	V	-	Ecosystem	BAM-C, PMST	10,13,26, 28	-	-	Moderate
Inland Forest Bat *Vespadelus baverstocki*	V	-	Ecosystem	BAM-C	13, 28	-	-	High
Little Eagle *Hieraaetus morphnoides*	V	-	Ecosystem	BAM-C, Atlas	44, 46, 164, 160, 10, 13, 17, 24, 26, 28	-	-	Moderate
Little Pied Bat *Chalinolobus picatus*	V	-	Ecosystem	BAM-C	164, 160, 10, 13, 17, 24, 26, 28,	-	-	High

Common Name *Species name*	BC Act	EPBC Act	Credit Status	Source	Associated PCTs	Habitat Constraint	Geographic Limitation	Sensitivity to gain class
Magpie Goose *Anseranas semipalmata*	V	-	Ecosystem	BAM-C	160	-	-	Moderate
Malleefowl *Leipoa ocellata*	E	V	Ecosystem	PMST	No associated PCTs onsite	-	Is not known or predicted to occur within the Murrumbidgee IBRA subregion	High
Masked Owl *Tyto novaehollandiae*	V	-	Ecosystem	BAM-C	10, 13, 26, 28	-	-	High
Painted Honeyeater *Grantiella picta*	V	V	Ecosystem	BAM-C, Atlas, PMST, supplementary SEARs	10, 13, 26, 28	Mistletoes present at a density of greater than five mistletoes per hectare	-	Moderate
Pied Honeyeater *Certhionyx variegatus*	V	-	Ecosystem	BAM-C	10, 13, 26, 28	-	-	Moderate
Pink Cockatoo *Lophochroa leadbeateri*	V	-	Ecosystem	BAM-C, PMST	10, 13, 26, 28	-	-	Moderate
Plains-wanderer *Pedionomus torquatus*	E	CE	Ecosystem	BAM-C, Atlas, PMST, supplementary SEARs	44, 46	-	-	High
Redthroat *Pyrrholaemus brunneus*	V	-	Ecosystem	BAM-C	17, 24	-	-	Moderate
Regent Parrot (eastern subspecies) *Polytelis anthopeplus monarchoides*	E	V	Ecosystem/ Species	BAM-C	10, 13	-	Within 10 km of the junction of the Murray River	Moderate

Common Name *Species name*	BC Act	EPBC Act	Credit Status	Source	Associated PCTs	Habitat Constraint	Geographic Limitation	Sensitivity to gain class
Scarlet Robin ***Petroica boodang***	V	-	Ecosystem	BAM-C	26	-	-	Moderate
Southern Whiteface ***Aphelocephala leucopsis***	V	V	Ecosystem	BAMC, Atlas, PMST	13, 17, 24, 26, 28, 44, 46, 160, 164,	-	--	Low
Spotted Harrier ***Circus assimilis***	V	-	Ecosystem	BAM-C, Atlas,	44, 46, 164, 160, 10, 13, 17, 24, 26, 28	-	-	Moderate
Spotted-tailed quoll ***Dasyurus maculatus***	V	E	Ecosystem	PMST	No associated PCTs on site	-	Is not known or predicted to occur within the Murrumbidgee IBRA subregion	High
Square-tailed Kite ***Lophoictinia isura***	V	-	Ecosystem	BAM-C	10, 13, 26, 28	-	-	Moderate
Superb Parrot ***Polytelis swainsonii***	V	V	Ecosystem	BAM-C, PMST, supplementary SEARs	46, 10, 13, 26, 28	-	-	Moderate
Swift Parrot ***Lathamus discolor***	E	CE	Ecosystem	BAM-C, MNES	10, 13, 24, 26	-	-	Moderate
Varied Sittella ***Daphoenositta chrysoptera***	V	-	Ecosystem	BAM-C	10, 13, 26, 28	-	-	Moderate
White-bellied Sea Eagle ***Haliaeetus leucogaster***	V	-	Ecosystem	BAM-C	44, 46, 164, 160, 10, 13, 17, 24, 26, 28	Within 1 km of a rivers, lakes, large dams or creeks, wetlands, and coastlines	-	High
White-fronted Chat ***Epthianura albifrons***	V	-	Ecosystem	BAM-C, Atlas	17, 24, 44, 46, 164, 160,	-	-	Moderate

Common Name *Species name*	BC Act	EPBC Act	Credit Status	Source	Associated PCTs	Habitat Constraint	Geographic Limitation	Sensitivity to gain class
White-throated Needletail ***Hirundapus caudacutus***	-	V	Ecosystem	BAM-C, Atlas	10, 13, 17, 24, 26, 44, 46, 160	-	-	High
Yellow-bellied Sheathtail-bat ***Saccolaimus flaviventris***	V	-	Ecosystem	BAM-C	10, 13, 17, 24, 26, 28, 160,	-	-	High

Key: CE = Critically Endangered, E = Endangered, V = Vulnerable, M = Migratory.

5.1.2 Assessment of Habitat Suitability

An assessment of habitat suitability was carried out for each of the species identified in **Table 5.1.** The assessment was based on details provided with in the TBDC including associated PCTs and known habitat or geographical constraints as detailed within **Table 5.2**. Justification is provided for any species identified in that were excluded from further assessment. Species were only excluded for assessment if the species was not identified within the BAM-C (i.e. identified within BioNet Atlas and PMST database searches), and the species has a known geographical constraint which precluded them from occurring within the Subject Land. For example, the Malleefowl was excluded as its range does not extend into the IBRA subregion on which the Subject Land occurs. A total of four species were excluded for further assessment on this basis: Brown treecreeper (eastern subspecies), Malleefowl, Regent Parrot (eastern subspecies), and Spotted-tailed quoll.

Species which do not have any known associated PCTs which occur on site have still been included in the assessment, where considered to have a moderate or higher likelihood of occurrence based on known habitat preferences.

Table 5.2 Assessment of Habitat Suitability Within the Subject Land for Ecosystem Credit Species

Common Name *Species Name*	Associated PCT	Vegetation Zone													Justification for inclusion / exclusion	Further assessment required?
		1	2	3	4	5	6	7	8	9	10	11	12	13^		
Australasian Bittern ***Botaurus poiciloptilus***	10, 13, 17, 24, 160	Y	Y	Y	Y	N	N	N	N	N	N	Y	N	N	Included. However, no current or historical records occur within 30 km. Potential habitat present in wetlands and low-lying areas, particularly after flooding. Use of the Subject Land likely to be intermittent.	Yes
Australian Painted Snipe ***Rostratula australis***	10, 13, 17, 24, 160	Y	Y	Y	Y	N	N	N	N	N	N	Y	N	N	Included. However, no current or historical records occur within 30 km. Potential habitat presents in wetlands and low-lying areas, particularly after flooding. Use of the Subject Land likely to be intermittent.	Yes
Barking Owl ***Ninox connivens***	10, 13	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Included. Recorded onsite.	Yes
Black Falcon ***Falco subniger***	10, 13, 17, 26, 24, 44, 46, 164, 160	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Included. Recorded onsite.	Yes
Blue-billed Duck ***Oxyura australis***	17, 24, 160	Y	Y	Y	Y	N	N	N	N	N	N	Y	N	N	Included. However, no current or historical records occur within 30 km. This species prefers deep water in large permanent wetlands as they are entirely aquatic. As the development corridor does not have this type of habitat, any occurrence would likely only be a pause on a water body between migration during spring and summer.	Yes
Blue-winged Parrot ***Neophema chrysostoma***	13, 17, 24,26, 28, 44, 46,	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Included. Recorded within Subject Land during current surveys.	Yes

Common Name *Species Name*	Associated PCT	Vegetation Zone													Justification for inclusion / exclusion	Further assessment required?
		1	2	3	4	5	6	7	8	9	10	11	12	13^		
Brolga ***Grus rubicunda***	10, 13, 17, 26, 24, 160	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Included. However, no current or historical records occur within 30 km. Brolgas will feed in dry grassland, ploughed paddocks or desert claypans, but are also dependant on wetlands and shallow swamps.	Yes
Brown treecreeper (eastern subspecies) ***Climacteris picumnus victoriae***	No associated PCTs on site	N	N	N	N	N	N	N	N	N	N	N	N	N	Excluded. The Eastern subspecies only occurs within the Murray Fans IBRA sub-region of the Riverina IBRA region, and no PCTs associated with the species are present onsite.	No
Curlew Sandpiper ***Calidris ferruginea***	24	Y	Y	Y	Y	N	N	N	N	N	N	Y	N	N	Included. However, no current or historical records occur within 30 km. Potential habitat present in wetlands and low-lying areas, particularly after flooding. Use of the Subject Land likely to be intermittent.	Yes
Diamond Firetail ***Stagonopleura guttata***	10, 13, 26, 28, 44, 46	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Included. Recorded onsite.	Yes
Dusky Woodswallow ***Artamus cyanopterus cyanopterus***	10, 13, 17, 24, 26, 28, 44, 46, 164, 160	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Included. A single record from 2014 occurs 20 km south east of the Project Area. Potential habitat occurs throughout site.	Yes
Flame Robin ***Petroica phoenicea***	No associated PCTs on site	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Included. Recorded on site.	Yes
Freckled Duck ***Stictonetta naevosa***	10, 13, 17, 24, 160	Y	Y	Y	Y	N	N	N	N	N	N	Y	N	Y	Included. A single record from 1990 occurs within 13 km north west of the Project Area boundary. Potential habitat presents in wetlands and low-lying areas, particularly after flooding. Use of the Subject Land likely to be intermittent.	Yes
Gilbert's Whistler ***Pachycephala inornata***	10, 13, 17, 28	Y	Y	Y	N	N	N	N	Y	N	N	N	N	N	Included. However, no records occur within 30 km of the Project Area boundary. Movements of	Yes

Common Name *Species Name*	Associated PCT	Vegetation Zone													Justification for inclusion / exclusion	Further assessment required?
		1	2	3	4	5	6	7	8	9	10	11	12	13^		
															these species largely unknown, however, the occasional record outside the normal distribution may indicate some dispersal does occur, particularly given the difficulty in detecting this species outside the breeding season when it isn't calling. Excluded from zone 4, 5, 6, 7, 9, 10, 11, 12 and 13 due to the species close association with vegetation featuring a dense shrub layer.	
Grey Falcon ***Falco hypoleucus***	44, 46, 164, 160, 10, 13, 17, 24, 26, 28	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Included. However, no records occur within 30 km of the Project Area boundary. The Subject Land is unlikely to be located within the breeding or regular foraging range of the Grey Falcon, however, rare foraging forays into the Subject Land are possible.	Yes
Grey-crowned Babbler (eastern subspecies) ***Pomatostomus temporalis temporalis***	10, 13, 26, 28	Y	Y	Y	N	N	Y	N	Y	N	N	N	N	N	Included. Recorded on site. Excluded from VZs 4, 5, 7, 9, 10, 11, 12 and 13 as the species is closely associated with vegetation featuring a canopy. Paddock trees are important habitat for this species as they can link remnant foraging habitat.	Yes
Hooded Robin (south-eastern form) ***Melanodryas cucullata cucullata***	10, 13, 26, 28	Y	Y	Y	N	N	Y	N	N	N	N	N	N	N	Included. However, no records occur within 30 km of the Project Area boundary. Excluded from VZs 4, 5, 7, 9, 10, 11, 12, 13 as species requires a structurally diverse habitat featuring mature trees, saplings, small shrubs and tall native gasses.	Yes

Common Name *Species Name*	Associated PCT	Vegetation Zone													Justification for inclusion / exclusion	Further assessment required?
		1	2	3	4	5	6	7	8	9	10	11	12	13^		
Inland Forest Bat ***Vespadelus baverstocki***	13, 28	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Included. However, no records occur within 30 km of the Project Area boundary. Roosts in tree hollows and abandoned buildings. Habitat requirements of this species are not well known, but they are known to inhabit a variety of woodland formations and may use other habitats for foraging or drinking.	Yes
Little Eagle ***Hieraaetus morphnoides***	10, 13, 17, 24, 26, 28, 44, 46, 164, 160	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Included. Recorded on site.	Yes
Little Pied Bat ***Chalinolobus picatus***	10, 13, 17, 24, 26, 28, 164, 160	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Included. However, no records occur within 30 km of the Project Area boundary. Is associated with the dry open forest, open woodland, chenopod shrubland, cypress pine forest which are known to occur on site. Known to sometimes roost in tree hollows and buildings.	Yes
Magpie Goose ***Anseranas semipalmata***	160	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Included. However, no records occur within 30 km of the Project Area boundary. Potential habitats present in wetlands and low-lying areas, particularly after flooding. Use of the Subject Land likely to be intermittent.	Yes
Malleefowl ***Leipoa ocellata***	No associated PCTs onsite	N	N	N	N	N	N	N	N	N	N	N	N	N	Excluded. The species is not known or predicted to occur in the IBRA subregion within which the Subject Land occurs.	No

Common Name *Species Name*	Associated PCT	Vegetation Zone													Justification for inclusion / exclusion	Further assessment required?
		1	2	3	4	5	6	7	8	9	10	11	12	13^		
Masked Owl ***Tyto novaehollandiae***	10, 13, 26, 28	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Included. Lack of sufficiently extensive, connected Eucalypt forest or woodland to support the species' large home-ranges. No species' records within 30 km of the Subject Land but it is within its known range. The Masked Owl is highly mobile and may sometimes occur in the woodland around the Coleambally Outfall Drain if it is able to also use other treed areas (e.g. along watercourses) in the landscape.	Yes
Painted Honeyeater ***Grantiella picta***	10, 13, 26, 28	Y	Y	N	N	N	Y	N	Y	N	N	N	N	N	Included. The Painted Honeyeater occurs in habitats with >5 mistletoes per hectare. It may occur within the woodland associated with the Coleambally Outfall Drain, pending the availability of mistletoes. Excluded from VZ 5 – PCT 26 DNG and VZ 7 – PCT 28 DNG as grasslands will not provide the density of mistletoes this species requires.	Yes
Pied Honeyeater ***Certhionyx variegatus***	10, 13, 26, 28	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Included. However, no records occur within 30 km of the project are boundary. Highly nomadic. May utilise the eucalyptus woodland surrounding the Coleambally Outfall Drain or the chenopod shrubland on site, when vegetation is flowering.	Yes
Pink Cockatoo ***Lophochroa leadbeateri***	10, 13, 26, 28	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Included. However, no records occur within 30 km of the Project Area boundary. Inhabits a wide range of treed and treeless inland habitats, always within easy reach of water.	Yes
Plains-wanderer ***Pedionomus torquatus***	44, 46	N	N	N	N	N	N	N	N	Y	Y	N	N	N	Included. Recorded on site.	Yes

Common Name *Species Name*	Associated PCT	Vegetation Zone													Justification for inclusion / exclusion	Further assessment required?
		1	2	3	4	5	6	7	8	9	10	11	12	13^		
Redthroat ***Anthochlaemus brunneus***	17, 24	N	N	Y	Y	N	N	N	N	N	N	N	N	N	Included. However, no records occur within 30 km of the Project Area boundary. The Project Area is outside of the species known range; however the site contains PCTs and vegetation types which are known to be associated with the species.	Yes
Regent Parrot (eastern subspecies) ***Polytelis anthopeplus monarchoides***	10, 13	N	N	N	N	N	N	N	N	N	N	N	N	N	Excluded. The Project Area does not occur within 10 km of the junction of the Murray River.	No
Scarlet Robin ***Petroica boodang***	26	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Included. However, no records occur within 30 km of the Project Area boundary. Excluded from VZ 5 – PCT 26 DNG as the species requires abundant logs and fallen timber as a part of its habitat. The species is primarily sedentary but can disperse into more open habitats after breeding. In autumn and winter the species live in open grassy woodlands, and grasslands or grazed paddocks with scattered trees.	Yes
Southern Whiteface ***Aphelocephala leucopsis***	13, 17, 24,26, 28, 44, 46, 160, 164,	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Included. Recorded on site.	Yes
Spotted Harrier ***Circus assimilis***	44, 46, 164, 160, 10, 13, 17, 24, 26, 28	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Included. Recorded on site.	Yes

Common Name *Species Name*	Associated PCT	Vegetation Zone													Justification for inclusion / exclusion	Further assessment required?
		1	2	3	4	5	6	7	8	9	10	11	12	13^		
Spotted-tailed quoll ***Dasyurus maculatus***	No associated PCTs on site	N	N	N	N	N	N	N	N	N	N	N	N	N	Excluded. The species is not known to occur, or predicted to occur in the IBRA subregion within which the Subject Land occurs. While the Spotted-tailed Quoll may along major, well-connected watercourses (e.g. Murrumbidgee River, Murray River), it is unlikely to occur in the Subject Land because there is relatively limited woodland habitat along the Coleambally Outfall Drain and this habitat is isolated from other potential habitat by extensive treeless areas. The Spotted-tailed Quoll is unlikely to traverse extensive treeless areas. No associated PCTs occur on site.	No
Square-tailed Kite ***Lophoictinia isura***	10, 13, 26, 28	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Included. Occurs in coastal and subcoastal woodlands and forests, and inland riparian woodland. Feeds in the canopy mostly preying on small birds and the contents of their nests. Potential woodland habitat occurs along the Coleambally Outfall Drain.	Yes
Superb Parrot ***Polytelis swainsonii***	10, 13, 26, 28, 46,	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Included. Mainly occurs in Eucalypt forests and woodland, especially in association with *Eucalyptus camaldulensis* and box eucalypts. Mostly feeds on the ground on a variety of native and introduced seeds. Often breeds in large River Red Gums near water. Potential foraging and breeding habitat present in the Subject Land and there are numerous records within 30 km.	Yes
Swift Parrot ***Lathamus discolor***	10, 13, 24, 26	Y	Y	N	Y	Y	Y	N	N	N	N	N	N	N	Included. However, no records occur within 30 km of the project are boundary. The Subject Land is west of the Swift Parrots known range and there is minimal tree cover present.	Yes

Common Name *Species Name*	Associated PCT	Vegetation Zone													Justification for inclusion / exclusion	Further assessment required?
		1	2	3	4	5	6	7	8	9	10	11	12	13^		
Varied Sittella ***Daphoenositta chrysoptera***	10, 13, 26, 28	Y	Y	N	N	N	Y	N	Y	N	N	N	N	N	Included. However, no records occur within 30 km of the Project Area. Excluded from VZ 5 - PCT 26 DNG and VZ 7 - PCT 28 DNG due to the species not being associated with grasslands. Species has potential to inhabit the Eucalyptus woodland surrounding the Coleambally Outfall Drain, however, this species is sedentary and as such is unlikely to use a habitat intermittently.	Yes
White-bellied Sea-eagle ***Haliaeetus leucogaster***	10, 13, 17, 24, 26, 28, 44, 46, 164, 160,	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Included. The White-bellied Sea-eagle generally forages over coastal seas, rivers, fresh and saline lakes, lagoons, reservoirs and occasionally terrestrial habitats such as grasslands (NSW Scientific Committee 2016). There is a lack of significant waterbodies available and there are no species records within 30 km of the Subject Land. It is unlikely that the species would occur onsite, however, this species is known to take advantage of ephemeral wetlands inland when filled with floodwaters.	Yes
White-fronted Chat ***Epthianura albifrons***	17, 24, 44, 46, 164, 160,	N	N	Y	Y	N	N	N	N	Y	Y	Y	Y	Y	Included. Recorded on site.	Yes
White-throated Needletail ***Hirundapus caudacutus***	10, 13, 17, 24, 26, 44, 46, 160	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Included. Forages in the aerial space above most habitat types. While the Subject Land is at the western limit of the species' range, it is likely to forage over the Subject Land occasionally.	Yes

Common Name *Species Name*	Associated PCT	Vegetation Zone													Justification for inclusion / exclusion	Further assessment required?
		1	2	3	4	5	6	7	8	9	10	11	12	13^		
Yellow-bellied Sheathtail-bat ***Saccolaimus flaviventris***	10, 13, 17, 24, 26, 28, 160,	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Included. Roosts in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows. Forages across most habitats, with and without trees. No records occur within 30 km of Project Area.	Yes

Key: CE = Critically Endangered, E = Endangered, V = Vulnerable, M = Migratory.

** In the absence of other data and for the purpose of this assessment, the species is reasonably considered to meet the criteria for an ecosystem credit.*

^Zone 13 represents areas of non-native vegetation.

5.2 Species Credit Species

5.2.1 Identification of Species Credit Species

Species credit species are those threatened species that cannot be reliably predicted to use an area of land based on habitat surrogates and therefore require further consideration through an assessment of habitat suitability.

The BAM-C generates a list of species credit species based on numerous inputs such as the distribution of the species occurring within the same IBRA subregion as the Subject Land and the presence of habitat features and components associated within these species. **Table 5.3** identifies species that were considered for assessment. Species have been identified using one or multiple of the BAM-C automatically populated list, Protected Matters Search Tool (PMST), or BioNet Atlas records.

A number of species listed are classified as both ecosystem and species credit species. In this instance the species is listed in both **Table 5.1** and **Table 5.3**, and will be subject to both types of assessment.

Table 5.3 Summary of Species Credit Species Considered as Part of This Assessment

Common Name *Species name*	BC Act	EPBC Act	SAII	Source	Associated PCTs	Habitat Constraint	Geographic Limitation	Vagrant species?	Sensitivity to gain class
Flora									
A burr daisy *Calotis moorei*	E	E	Yes	PMST	No associated PCTs on site	-	-	N	High
A spear-grass *Austrostipa wakoolica*	E	E	No	BAM-C, PMST	17, 26, 28,	Alluvial plains and plains	South of the Murrumbidgee River	N	Moderate
Austral Pillwort *Pilularia novae-hollandiae*	E	-	Yes	BAM-C, Atlas	13, 26, 44, 46	-	East of Deniliquin	N	High
Bindweed *Convolvulus tedmoorei*	E	-	Yes	BAM-C	17, 24, 26, 44, 46, 160, 164	-	-	N	High
Chariot Wheels *Maireana cheelii*	V	V	No	BAM-C, Atlas, PMST, supplementary SEARs	26, 44, 46, 164	Heavy grey soils and claypans or shallow depressions	West of Darlington Point, West of Jerilderie	N	High
Claypan Daisy *Brachyscome muelleroides*	V	V	Yes	BAM-C	44, 46	Floodplains on grey-brown or red-brown clays and claypan Semi-permanent/ephemeral wet areas Wetland-grassland communities on grey-brown or red-brown clays and claypans	East of the Cobb Highway and south of Griffith	N	High
Lanky Buttons *Leptorhynchos orientalis*	E	-	No	BAM-C	24, 26, 44, 46	-	-	N	Moderate
Menindee Nightshade *Solanum karsense*	V	V	No	BAM-C, PMST	13, 17, 24, 160,	Semi-permanent/ephemeral wet areas	West of Maude	N	High

Common Name *Species name*	BC Act	EPBC Act	SAII	Source	Associated PCTs	Habitat Constraint	Geographic Limitation	Vagrant species?	Sensitivity to gain class
Mossgiel Daisy *Brachyscome papillosa*	V	V	No	BAM-C, Atlas, MNES, supplementary SEARs	13, 24, 44, 46, 160, 164	-	-	N	High
Pine Donkey Orchid *Diuris tricolor*	V	-	No	BAM-C^	No associated PCTs onsite	-	-	N	Moderate
Red Darling Pea *Swainsona plagiotropis*	V	V	No	BAM-C	26, 44, 46	-	Hay Plain	N	High
Sand-hill Spider Orchid *Caladenia arenaria*	E	E	Yes	BAM-C	28	-	East of Jerilderie	N	Moderate
Silky Swainson-pea *Swainsona sericea*	V	-	No	BAM-C, Atlas	26, 28, 44, 46	-	-	N	High
Slender Darling Pea *Swainsona murrayana*	V	V	No	BAM-C, Atlas, PMST, supplementary SEARs	26, 28, 44, 46, 164	-	-	N	High
Small Scurf-pea *Cullen parvum*	E	-	No	BAM-C	44	-	Hay plains and to east	N	High
Spike-Rush *Eleocharis obicis*	V	V	No	Atlas, PMST	10, 13, 17, 24, 160, 164	Periodically waterlogged sites (including table drains and farm dams)	-	N	High
Turnip Copperburr *Sclerolaena napiformis*	E	E	No	BAM-C, MNES	26, 44, 46	-	Hay Plain	N	High
Winged Peppercress *Lepidium monoplocoides*	E	E	No	BAM-C, Atlas, PMST, supplementary SEARs	13, 24, 26, 46, 160	-	-	N	High

Common Name *Species name*	BC Act	EPBC Act	SAII	Source	Associated PCTs	Habitat Constraint	Geographic Limitation	Vagrant species?	Sensitivity to gain class
Yellow Gum *Eucalyptus leucoxylon subsp. pruinosa*	V	-	No	BAM-C	13	-	-	N	High
Birds									
Australian Bustard *Ardeotis australis*	E	-	No	BAM-C	24, 26, 28, 44, 46, 160, 164	-	-	N	High
Barking Owl *Ninox connivens*	V	-	No	BAM-C	10, 13	Living or dead trees with hollows greater than 20 cm diameter and greater than 4 m above the ground	-	N	High
Bush Stone-curlew *Burhinus grallarius*	E	-	No	BAM-C	10, 13, 26, 28	Fallen/standing dead timber including logs	-	N	High
Curlew sandpiper *Calidris ferruginea*	E	CE	Yes	PMST	24	As per Important Habitat Map	-	N	High
Little Eagle *Hieraaetus morphnoides*	V	-	No	BAM-C	10, 13, 17, 24, 26, 28, 44, 46, 160, 164	Nest trees - live (occasionally dead) large old trees within vegetation	-	N	Moderate
Masked Owl *Tyto novaehollandiae*	V	-	No	BAM-C	10, 13, 24, 26	Living or dead trees with hollows greater than 20 cm diameter	-	N	High
Pink Cockatoo *Lophochroa leadbeateri*	V	-	No	BAM-C, PMST	10, 13, 26, 28	Living or dead tree with hollows greater than 10 cm diameter	-	N	High
Plains-wanderer *Pedionomus torquatus*	E	CE	Yes	BAM-C, Atlas, PMST, supplementary SEARs	44, 46	As per Important Habitat	-	N	High

Common Name *Species name*	BC Act	EPBC Act	SAII	Source	Associated PCTs	Habitat Constraint	Geographic Limitation	Vagrant species?	Sensitivity to gain class
Regent Parrot (eastern subspecies) *Polytelis anthopeplus monarchoides*	E	V	No	BAM-C	10, 13	Living or dead *Eucalyptus camaldulensis* with hollows greater than 5 cm diameter, greater than 5 m above the ground or trees with diameter at breast height (DBH) of greater than 40 cm, within 1 km of watercourses or billabongs. Trees can be isolated but within 20 km of mallee.	Within 10 km of the junction of the Murray River	N	High
Square-tailed Kite *Lophoictinia isura*	V	-	No	BAM-C	10, 13, 28, 26	Nest Trees	-	N	Moderate
Superb Parrot *Polytelis swainsonii*	V	V	No	BAM-C, Atlas, PMST, supplementary SEARs	10, 13, 28, 46	Living or *dead E. blakelyi, E. melliodora, E. albens, E. camaldulensis, E. microcarpa, E. polyanthemos, E. mannifera, E. intertexta* with hollows greater than 5 cm diameter greater than 4 m above ground, or trees with a DBH of greater than 30 cm	-	N	High
Swift Parrot *Lathamus discolor*	E	CE	Yes	BAM-C, PMST	10, 13, 24, 26	As per Important Habitat Map	-	N	Moderate
White-bellied Sea-Eagle *Haliaeetus leucogaster*	V	-	No	BAM-C	10, 13, 17, 24, 28, 44, 46, 160, 164	Living or dead mature trees within suitable vegetation within 1 km of a rivers, lakes, large dams or creeks, wetlands and coastlines	-	N	High
Mammals									
Koala *Phascolarctos cinereus*	E	E	No	BAM-C, PMST	10, 13, 17, 24, 28, 160, 26	Presence of koala use trees	-	N	High

Common Name *Species name*	BC Act	EPBC Act	SAII	Source	Associated PCTs	Habitat Constraint	Geographic Limitation	Vagrant species?	Sensitivity to gain class
Southern Myotis *Myotis macropus*	V	-	No	BAM-C	10	Waterbodies with permanent pools/stretches 3 m or wider, including rivers, large creeks, billabongs, lagoons, estuaries, dams and other waterbodies, on or within 200 m of the site	-	N	High
Reptiles									
Grey Snake *Hemiaspis damelii*	E	E	No	BAM-C, PMST, supplementary SEARs	13, 17, 24, 46, 160	-	-	N	High
Pink-tailed Legless Lizard *Aprasia parapulchella*	V	V	No	BAM-C, PMST	164	Rocky area or within 50 m of rocky areas	-	N	High
Amphibians									
Sloane's Froglet *Crinia sloanei*	E	E	No	PMST	None on site	Semi-permanent/ephemeral wet areas containing relatively shallow sections with submergent and emergent vegetation, or within 500 m of wet area. Areas within 500 m of swamps or waterbodies.	-	N	Moderate
Southern Bell Frog *Litoria raniformis*	E	V	No	BAM-C, Atlas, PMST, supplementary SEARs	10, 13, 17, 24,	-	-	N	Moderate

Key: CE = Critically Endangered, E = Endangered, V = Vulnerable, M = Migratory.

^ Duirus tricolor was associated with a PCT that had been mapped within a previous iteration of the PCT mapping. Subsequent refinement of the PCT mapping has found that the associated PCT was not present within the Subject Land.

5.2.2 Assessment of Habitat Suitability

An assessment of habitat suitability was carried out for each of the species identified in **Table 5.3**. The assessment was based on details provided with in the TBDC including associated PCTs and known habitat or geographical constraints as detailed within **Table 5.4**. Justification is provided for any species identified in that were excluded from further assessment.

Species were excluded for assessment based on geographical limitations of absence of habitat constraints in accordance with Section 5.2.1(2)(b) and Section 5.2.2(2)(b) of the BAM.

An example of a geographical based exclusion is the *Solanum karsense*, distribution does not extend east of Maude, NSW, an area within which the Project Area occurs. An example of a habitat-based exclusion is the Pink-tailed Worm-lizard, which relies on rocky habitat, which does not occur on the Subject Land. A species may also be excluded from future assessment if it's Important Habitat Mapping does not occur with the Subject Land, like in the case of the Curlew sandpiper (*Calidris ferruginea*).

Species not identified by the BAM-C (i.e. identified within BioNet Atlas and PMST database searches, or within the Supplementary SEARs) that had a low likelihood of occurrence based on known habitat and floristic preferences were excluded from further assessment.

A total of two flora species and five fauna species were excluded from further assessment, including; *Solanum karsense*, *Caladenia arenaria*, Curlew sandpiper, Pink-tailed worm Lizard, Regent Parrot (eastern subspecies), Swift Parrot, Sloane's Froglet.

A retained candidate species may be subject to one of three further assessments: targeted surveys, an export report, or assuming presence across all potential habitat. For this assessment, all retained species were subject to targeted surveys. Further details of targeted surveys are detailed in **Section 5.3**.

Table 5.4 Assessment of Habitat Suitability Within the Subject Land and Assessment Approach of Retained Candidate Species

Common Name *Species Name*	Associated PCT	Vegetation Zone													Justification for inclusion or exclusion (either as a candidate species, or form within certain vegetation zones)	Candidate species retained for further assessment?	Assessment approach	Area (ha) of suitable habitat
		1	2	3	4	5	6	7	8	9	10	11	12	13				
Flora																		
A spear-grass *Austrostipa wakoolica*	17, 26, 28,	N	N	Y	N	Y	Y	Y	Y	N	N	N	N	N	Included. Suitable habitat is present within the development.	Yes	Targeted surveys	619.69
Austral Pillwort *Pilularia novae-hollandiae*	13, 26, 44, 46	N	Y	N	N	Y	Y	N	N	Y	Y	N	N	Y	Included. Suitable habitat is present within the development.	Yes	Targeted surveys	3,426.87
Bindweed *Convolvulus tedmoorei*	17, 24, 26, 44, 46, 160, 164	N	N	Y	Y	Y	Y	N	N	Y	Y	Y	Y	N	Included. Suitable habitat is present within the development.	Yes	Targeted surveys	3,766.98
A burr daisy *Calotis moorei*	No associated PCTs onsite	N	N	N	N	N	N	N	N	N	N	N	N	N	Included. Indicated on initial MNES search, considered to have a moderate likelihood of occurrence based on known habitat preferences.	Yes	Targeted surveys	3,766.98
Chariot Wheels *Maireana cheelii*	26, 44, 46, 164	N	N	N	N	Y	Y	N	N	Y	Y	N	Y	N	Included. Suitable habitat is present within the development.	Yes	Targeted surveys	3,720.33
Claypan Daisy *Brachyscome muelleroides*	44, 46	N	N	N	N	N	N	N	N	Y	Y	N	N	N	Included. Suitable habitat is present within the development.	Yes	Targeted surveys	3,309.68
Lanky Buttons *Leptorhynchos orientalis*	24, 26, 44, 46	N	N	N	Y	Y	Y	N	N	Y	Y	N	N	N	Included. Suitable habitat is present within the development.	Yes	Targeted surveys	3,434.45

Common Name *Species Name*	Associated PCT	Vegetation Zone													Justification for inclusion or exclusion (either as a candidate species, or form within certain vegetation zones)	Candidate species retained for further assessment?	Assessment approach	Area (ha) of suitable habitat
		1	2	3	4	5	6	7	8	9	10	11	12	13				
Menindee Nightshade *Solanum karsense*	13, 17, 24, 160,	N	Y	Y	Y	N	N	N	N	N	N	Y	N	Y	Excluded due to geographical constraint. The Subject Land is not located west of Maude.	No	-	49.10
Mossgiel Daisy *Brachyscome papillosa*	13, 24, 44, 46, 160, 164	N	Y	N	Y	N	N	N	N	Y	Y	Y	Y	N	Included. Suitable habitat is present within the development.	Yes	Targeted surveys	3,634.49
Pine Donkey Orchid *Diuris tricolor*	No associated PCTs onsite	N	N	N	N	N	N	N	N	N	N	N	N	N	Included. An earlier version of the vegetation mapping included a PCT which *Diuris tricolor* was associated with. The PCT was refined subsequent to the survey and is no longer mapped as being present onsite.	Yes	Targeted surveys	484.75
Red Darling Pea *Swainsona plagiotropis*	26, 44, 46,	N	N	N	N	Y	Y	N	N	Y	Y	N	N	N	Included. Suitable habitat is present within the development.	Yes	Targeted surveys	3,424.42
Sand-hill Spider Orchid *Caladenia arenaria*	28	N	N	N	N	N	N	Y	Y	N	N	N	N	N	Excluded due to geographical constraint. The Subject Land does not occur east of Jerilderie.	No	-	-
Silky Swainson-pea *Swainsona sericea*	26, 28, 44, 46	N	N	N	N	Y	Y	Y	Y	Y	Y	N	N	N	Included. Suitable habitat is present within the development.	Yes	Targeted surveys	3,909.17
Slender Darling Pea	26, 28, 44, 46, 164	N	N	N	N	Y	Y	Y	Y	Y	Y	N	Y	N	Included. Suitable habitat is present within the development.	Yes	Targeted surveys	4,205.08

Common Name *Species Name*	Associated PCT	Vegetation Zone													Justification for inclusion or exclusion (either as a candidate species, or form within certain vegetation zones)	Candidate species retained for further assessment?	Assessment approach	Area (ha) of suitable habitat
		1	2	3	4	5	6	7	8	9	10	11	12	13				
Swainsona murrayana																		
Small Scurf-pea *Cullen parvum*	44	N	N	N	N	N	N	N	N	Y	N	N	N	N	Included. Suitable habitat is present within the development.	Yes	Targeted surveys	1,120.44
Spike-rush *Eleocharis obicis*	10, 13, 17, 24, 160, 164	Y	Y	Y	Y	N	N	N	N	N	Y	Y	Y	Y	Included. Recorded in the Subject Land. Suitable habitat is present within the development.	Yes	Targeted surveys	364.70
Turnip Copperburr *Sclerolaena napiformis*	26, 44, 46	N	N	N	N	Y	Y	N	N	Y	Y	N	N	N	Included. Suitable habitat is present within the development.	Yes	Targeted surveys	3,424.42
Winged Peppercress *Lepidium monoplocoides*	13, 24, 26, 46, 160	N	Y	N	Y	Y	Y	N	N	N	Y	Y	N	N	Included. Suitable habitat is present within the development.	Yes	Targeted surveys	2,332.88
Yellow Gum *Eucalyptus leucoxylon subsp. Pruinosa*	13	N	Y	N	N	N	N	N	N	N	N	N	N	N	Included. Suitable habitat is present within the development.	Yes	Targeted surveys	2.45
Birds																		
Australian Bustard *Ardeotis australis*	24, 26, 28, 44, 46, 160, 164	N	N	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Included. The Australian Bustard has become rare within the southern part of its range, and it is now considered a vagrant to the Riverina. There is a 2005 record of two individuals within Oolambeyan National Park, just to the north of	Yes	Targeted surveys	4240.71

Common Name *Species Name*	Associated PCT	Vegetation Zone													Justification for inclusion or exclusion (either as a candidate species, or form within certain vegetation zones)	Candidate species retained for further assessment?	Assessment approach	Area (ha) of suitable habitat
		1	2	3	4	5	6	7	8	9	10	11	12	13				
															the Subject Land. It is possible that the Australian Bustard may occur in the Subject Land occasionally. Surveys are required to determine whether the Australian Bustard occurs in the Subject Land.			
Barking Owl *Ninox connivens*	10, 13	Y	Y	N	N	N	N	N	N	N	N	N	N	N	Included. Recorded in the Subject Land during Southern Myotis surveys. Hollow-bearing trees are present in this habitat and may possibly be used for breeding. May use adjacent grass or shrublands as hunting grounds	Yes	Targeted surveys	22.41
Bush Stone-curlew *Burhinus grallarius*	10, 13, 26, 28	Y	Y	N	N	Y	Y	Y	Y	N	N	N	N	Y	Included. Marginal suitable habitat is present within the Subject Land. Requires open forests and woodlands with a sparse grassy ground layer and fallen timber. Woodland habitat in the Subject Land is restricted to the area around the Coleambally Outfall Drain. Due to grazing impacts and management, fallen timber is uncommon and foxes are likely to be common in the locality. The lack of suitable groundcover and high predation risk for this ground-dwelling bird suggests that it is unlikely to occur in the Subject Land.	Yes	Targeted surveys	624.70

Common Name *Species Name*	Associated PCT	Vegetation Zone													Justification for inclusion or exclusion (either as a candidate species, or form within certain vegetation zones)	Candidate species retained for further assessment?	Assessment approach	Area (ha) of suitable habitat
		1	2	3	4	5	6	7	8	9	10	11	12	13				
Curlew sandpiper *Calidris ferruginea*	24	N	N	N	Y	N	N	N	N	N	N	N	N	N	Excluded. The Project Area does not include any areas of mapped important habitat for this species.	No	-	-
Little Eagle *Hieraaetus morphnoides*	10, 13, 17, 24, 26, 28, 44, 46, 160, 164	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Included. Recorded on site. It requires large, old live or, more rarely, dead trees for nesting. Nesting usually occurs within treed communities, but the Little Eagle has also been recorded breeding in paddock trees. There is potential nesting habitat along the Coleambally Outfall Drain, which provides a linear corridor of woodland in an otherwise largely treeless landscape. Smaller patches and/or paddock trees also have the potential to be used as nest sites.	Yes	Targeted surveys	4,283.32
Masked Owl *Tyto novaehollandiae*	10, 13, 24, 26	Y	Y	N	Y	Y	Y	N	N	N	N	N	N	N	Included. There is a lack of sufficiently extensive, connected eucalypt forest or woodland in the Subject Land to support the Masked Owl's large home-ranges and there are no species' records within 30 km of the Subject Land, however, the locale is within its known distribution range. The Masked Owl is highly mobile and may sometimes occur in the woodland around the	Yes	Targeted surveys	147.18

Common Name *Species Name*	Associated PCT	Vegetation Zone													Justification for inclusion or exclusion (either as a candidate species, or form within certain vegetation zones)	Candidate species retained for further assessment?	Assessment approach	Area (ha) of suitable habitat
		1	2	3	4	5	6	7	8	9	10	11	12	13				
															Coleambally Outfall Drain if it is able to also use other treed areas (e.g. along watercourses) in the landscape. Hollow-bearing trees are present in this habitat and may possibly be used for breeding.			
Pink Cockatoo *Lophochroa leadbeateri*	10, 13, 26, 28	Y	Y	N	N	Y	Y	Y	Y	N	N	N	N	Y	Included. Suitable habitat is present within the development. It requires trees with suitable nesting hollows and fresh surface water and feeds mainly on the seeds of native shrubs and trees (Department of Agriculture, Water and the Environment 2022). Suitable habitat is generally lacking from the Subject Land and there are no species records within 30 km of the Subject Land.	Yes	Targeted surveys	624.70
Plains-wanderer *Pedionomus torquatus*	44, 46	N	N	N	N	N	N	N	N	Y	Y	N	N	N	Included. Important Habitat Mapping for Plains Wanderer is located within the Project Area; however, the Project has avoided all extents of the mapping. As such, no areas of Important Habitat for Plains-wanderer occur within the Subject Land or Development Footprint such that no direct impacts to important habitat are expected to occur. The important	Yes	Assumed presence within areas of mapped important habitat. Targeted surveys.	3,315.57

Common Name *Species Name*	Associated PCT	Vegetation Zone													Justification for inclusion or exclusion (either as a candidate species, or form within certain vegetation zones)	Candidate species retained for further assessment?	Assessment approach	Area (ha) of suitable habitat
		1	2	3	4	5	6	7	8	9	10	11	12	13				
															habitat may be impacted by indirect or prescribed impacts. Commonwealth DCCEEW requires survey and assessment of secondary habitat.			
Regent Parrot (eastern subspecies) *Polytelis anthopeplus monarchoides*	10, 13	Y	Y	N	N	N	N	N	N	N	N	N	N	Y	Excluded. The Subject Land is located outside of the species geographic limitation for the species. The species mainly occurs in riparian or littoral *Eucalyptus camaldulensis* forests or woodlands and adjacent *Eucalyptus largiflorens* woodlands. It may also occur in in farmland with remnant patches of woodland. The Subject Land is east of the species' range and there are no records within 30 km.	No	-	-
Square-tailed Kite *Lophoictinia isura*	10, 13, 28, 26	Y	Y	N	N	Y	Y	Y	Y	N	N	N	N	N	Included. Suitable habitat is present within the development. Species occurs in coastal and subcoastal woodlands and forests, and inland riparian woodland. It feeds in the canopy mostly preying on small birds and the contents of their nests. Potential foraging habitat (woodland) occurs along the Coleambally Outfall Drain. There is also potential nesting habitat along the Coleambally Outfall Drain, which	Y	Targeted surveys	624.70

Common Name *Species Name*	Associated PCT	Vegetation Zone													Justification for inclusion or exclusion (either as a candidate species, or form within certain vegetation zones)	Candidate species retained for further assessment?	Assessment approach	Area (ha) of suitable habitat
		1	2	3	4	5	6	7	8	9	10	11	12	13				
															provides a linear corridor of woodland in an otherwise largely treeless landscape.			
Superb Parrot *Polytelis swainsonii*	10, 13, 28, 46	Y	Y	N	N	N	N	Y	Y	N	Y	N	N	Y	Included. Numerous species records within 30 km. Mainly occurs in eucalypt forests and woodland, especially in association with River Red Gums (*Eucalyptus camaldulensis*) and box eucalypts. It mostly feeds on the ground on a variety of native and introduced seeds. The Superb Parrot often breeds in large River Red Gums near water. Potential foraging and breeding habitat present in the Subject Land along the Coleambally Outfall Drain.	Y	Targeted surveys	2,699.19
Swift Parrot *Lathamus discolor*	10, 13, 24, 26	Y	Y	N	Y	Y	Y	N	N	N	N	N	N	Y	Excluded. The Project Area does not include any areas of mapped important habitat for this species.	N	-	-
White-bellied Sea-eagle *Haliaeetus leucogaster*	10, 13, 17, 24, 28, 44, 46, 160, 164	Y	Y	Y	Y	N	N	Y	Y	Y	Y	Y	Y	N	Included. Species requires large living or dead trees within 1 km of a river, lake, large dam or creek, wetlands, and coastlines. Most of the Subject Land is devoid of trees. Some isolated trees remain, however, and there is greater tree cover in the vicinity of the Coleambally Outfall Drain, a	N	Targeted surveys	4,168.57

Common Name *Species Name*	Associated PCT	Vegetation Zone													Justification for inclusion or exclusion (either as a candidate species, or form within certain vegetation zones)	Candidate species retained for further assessment?	Assessment approach	Area (ha) of suitable habitat
		1	2	3	4	5	6	7	8	9	10	11	12	13				
															modified watercourse. Coleambally Outfall Drain lacks significant instream habitat features, including aquatic vegetation and snags. As such it is not likely to provide significant foraging resources, particularly for breeding. There are no White-bellied Sea-eagle records within 30 km of the Subject Land.			
Mammals																		
Koala *Phascolarctos cinereus*	10, 13, 17, 24, 28, 160, 26	Y	Y	Y	Y	Y	Y	Y	Y	N	N	Y	N	N	Included. Presence of koala use trees. In the Darling Riverine Plains koala modelling region *Eucalyptus camaldulensis* and *Eucalyptus largiflorens* are described as Rank 1 – high preferred use feed trees. Both these tree species are present in the Subject Land, particularly along the Coleambally Outfall Drain. While there are no Koala records within 30 km of the Subject Land, the locality is within the species' distribution range.	Y	Targeted surveys	671.35
Southern Myotis *Myotis macropus*	10	Y	N	N	N	N	N	N	N	N	N	N	N	Y	Included. Southern Myotis occurs over a range of waterbodies, including rivers, large creeks, billabongs, lagoons, estuaries, dams and other waterbodies. It forages where the waterbodies are at least	Y	Targeted surveys	19.96

Common Name *Species Name*	Associated PCT	Vegetation Zone													Justification for inclusion or exclusion (either as a candidate species, or form within certain vegetation zones)	Candidate species retained for further assessment?	Assessment approach	Area (ha) of suitable habitat
		1	2	3	4	5	6	7	8	9	10	11	12	13				
															3 m wide. Prey includes aquatic insects and small fish, which are obtained by raking the water's surface with its large feet (Law and Urquhart 2000). Habitat within 200 m of foraging areas is used for roosting and breeding, with tree hollows and natural and artificial cavities (caves, crevices, bridges, culverts) being important (Campbell 2009). The Southern Myotis may occur along the Coleambally Outfall Drain and roost in tree hollows in the adjacent woodland.			
Reptiles																		
Grey Snake *Hemiaspis damelii*	13, 17 24, 46, 160	N	Y	Y	Y	N	N	N	N	N	Y	Y	N	N	Included. Species occurs on floodplains and ephemeral wetlands associated with heavy clay soils, including the margins of ephemeral wetlands within *Eucalyptus camaldulensis* and *Eucalyptus largiflorens* vegetation communities and *Duma florulenta* swamps. It shelters in soil cracks, rocks, logs, flood debris and abandoned burrows. Ground-dwelling frogs form the bulk of its diet. The Grey Snake is particularly likely to occur in the *Eucalyptus*	Y	Targeted surveys	2,238.34

Common Name *Species Name*	Associated PCT	Vegetation Zone													Justification for inclusion or exclusion (either as a candidate species, or form within certain vegetation zones)	Candidate species retained for further assessment?	Assessment approach	Area (ha) of suitable habitat
		1	2	3	4	5	6	7	8	9	10	11	12	13				
															camaldulensis/Eucalyptus largiflorens woodland and associated wetlands along the Coleambally Outfall Drain. It may also occur elsewhere in the Subject Land where frogs are abundant.			
Pink-tailed worm Lizard *Aprasia parapulchella*	164	N	N	N	N	N	N	N	N	N	N	N	Y	N	Excluded. The habitat constraints for this species listed on the TBDC (rocky areas, or within 50 m of) is not present within the Subject Land. On this basis, it is proposed that this species is removed from further consideration in accordance with Section 5.2.2(2)(b) of the BAM.	N	-	-
Amphibians																		
Sloane's Froglet *Crinia sloanei*	None on site	N	N	N	N	N	N	N	N	N	N	N	N	Y	Excluded. No suitable PCTs present within the Subject Land.	N	-	-
Southern Bell Frog *Litoria raniformis*	10, 13, 17, 24,	Y	Y	Y	Y	N	N	N	N	N	N	N	N	Y	Included. An individual was heard calling from the Coleambally Outfall Drain during BBUS surveys. The species was extensively recorded in the Subject Land between 5 and 12 December 2023. Initial survey focus was the main irrigation channel, however due to an abundance of individuals of the target species, the field team were then able to assess each body of	Y	Targeted surveys	52.63

Common Name *Species Name*	Associated PCT	Vegetation Zone													Justification for inclusion or exclusion (either as a candidate species, or form within certain vegetation zones)	Candidate species retained for further assessment?	Assessment approach	Area (ha) of suitable habitat
		1	2	3	4	5	6	7	8	9	10	11	12	13				
															water on site for presence or absence. Individuals were found at almost all water bearing dams or ponds. Calling and breeding was also seen.			

5.3 Threatened Species Survey Method

5.3.1 Review of Existing Information

Background research was undertaken in accordance with the BAM to identify known and/or likely values of the Project Area. This information was reviewed to prepare a list of potential threatened and migratory species for survey. The review included the following databases and information sources:

- Biodiversity Assessment Method Calculator (BAM-C) – case number 00047468.
- BioNet - the website for the Atlas of NSW Wildlife and Threatened Biodiversity Data Collection (TBDC) – searched 12/02/2025.
- BioNet Vegetation Classification – searched 10/02/2025.
- Commonwealth DCCEEW Protected Matters Search Tool – searched 20/01/2025.
- Important Area Maps - reviewed 05/01/2025.
- Surveying threatened plants and habitats NSW survey guide biodiversity assessment method (DPIE, 2020).
- Flora species with specific survey requirements (XLS) (NSW DCCEEW, 2024).
- Threatened reptiles biodiversity assessment method survey guide (DPE, 2022).
- Koala *Phascolarctos cinereus* biodiversity assessment method survey guide (DPE, 2022).
- Species credit threatened bats and their habitats NSW guide for biodiversity assessment method (OEH, 2018).
- Species credit threatened bats and their habitats NSW guide for biodiversity assessment method (DPIE, 2021).
- NSW survey guide for threatened frogs (DPIE, 2020).
- Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities (2004 Working Draft) (DEC, 2004).
- Threatened species survey and assessment guidelines: field survey methods for fauna. Amphibians (2009) (DECC, 2009).
- Survey guidelines for Australia's threatened bats: Guidelines for detecting bats listed as threatened under the EPBC Act (DEWHA, 2010a).
- Survey guidelines for Australia's threatened birds (DEWHA, 2010b).
- Survey Guidelines for Australia's threatened frogs (DEWHA, 2011a).
- Survey guidelines for Australia’s threatened mammals (DSEWPaC, 2011b).
- Survey guidelines for Australia’s threatened reptiles (DSEWPaC, 2011c).

5.3.2 General Weather Conditions During the Surveys

The Subject Land is located within an area classified as Climate Zone 4, which is characterised by hot dry summers, and cool winters (BOM, 2024). Winter rainfall is considered to be reliable, while autumn and spring rainfall can be unreliable (NPWS, 2003). Summer rainfall events tend to occur mainly from localised thunderstorms (NPWS, 2003). The landscape around Hay experiences frosts through winter and well into September (BOM, 2019).

The closest weather station which collects rainfall data is Hay (Bedarbidgal) (075173) which occurs approximately 17 km north of the Subject Land, however this station does not collect temperature data. The closest weather station which collects temperature data is Hay Airport AWS (075019), which occurs approximately 40 km northwest from the Subject Land. The mean rainfall, minimum and maximum temperatures for all years is collated in **Table 5.5**. The climate data for the survey period is summarised in **Figure 5.1**. Daily weather for the survey period is provided in **Appendix H**.

Table 5.5 Maximum and minimum monthly temperature data for all years – BOM Station 075019 and Average monthly rainfall data for all years – BOM Station 075173

Statistic	January	February	March	April	May	June	July	August	September	October	November	December	Annual
Maximum temperature (°C)	34.8	33.2	29.8	24.6	19.6	15.9	15.9	17.8	21.9	26.0	29.5	32.3	25.1
Minimum temperature (°C)	18.1	17.1	14.6	9.9	6.3	4.0	3.3	4.2	6.2	9.7	13.5	15.7	10.2
Mean Rainfall (mm)	34.7	20.2	18.8	30.4	30.6	29.2	33.9	34.3	31.7	39.8	32.9	34.6	387.0

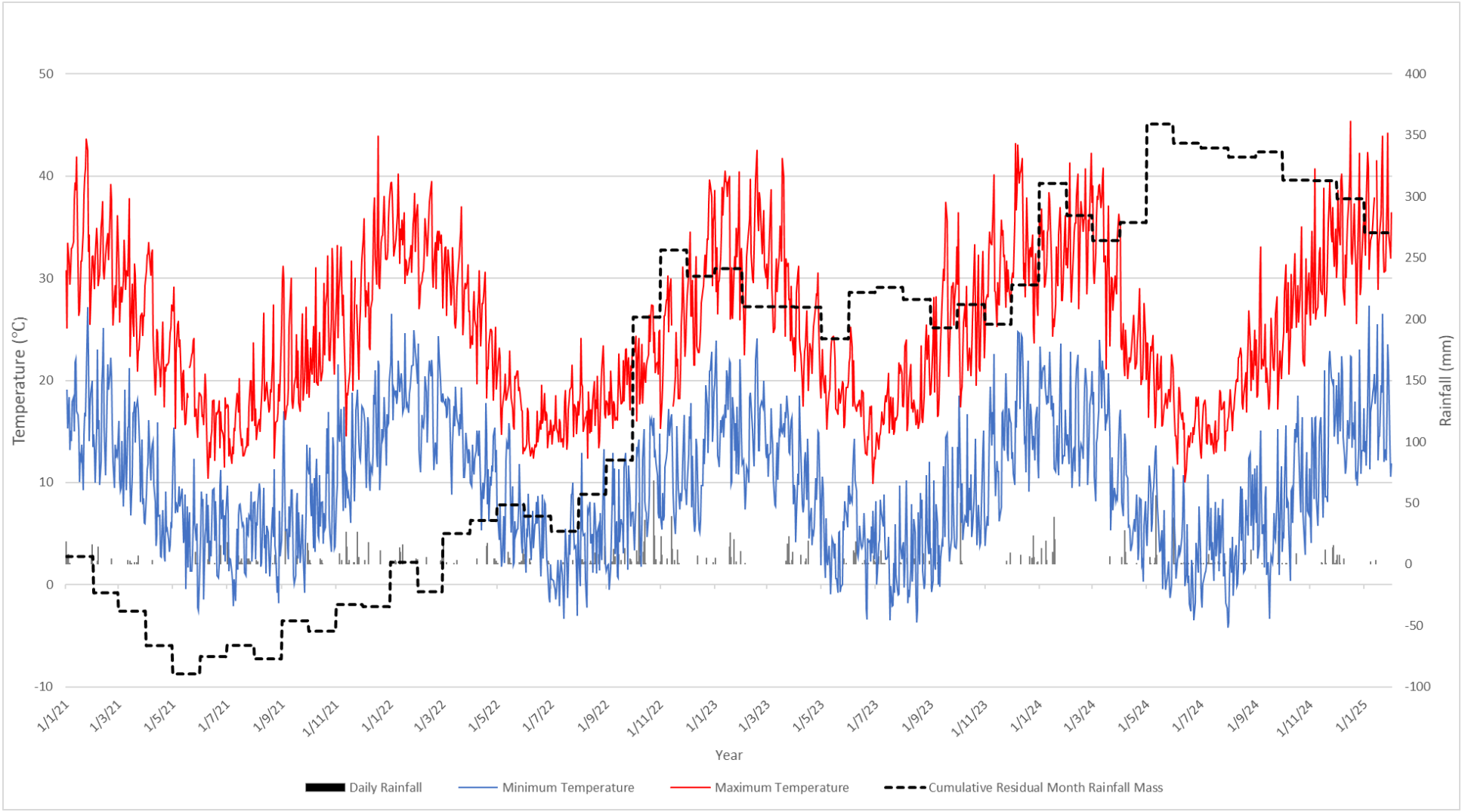


Figure 5.1 Weather Conditions for the Survey Period

Preceding the survey period, from 2018 to mid-2021, the Project Area and much of NSW was in a period of extended drought. Spring of 2021 marked the end of the dry period, and 2022 experienced almost double the average rainfall. The Combined Drought Indicator (CDI) for Powheep Parish, the county that a majority of the Subject Land occurs on, indicates that the area has experienced "Non-Drought" through 2023, 2024 and up until February 2025 (DPI, 2024) (see **Figure 5.2**).

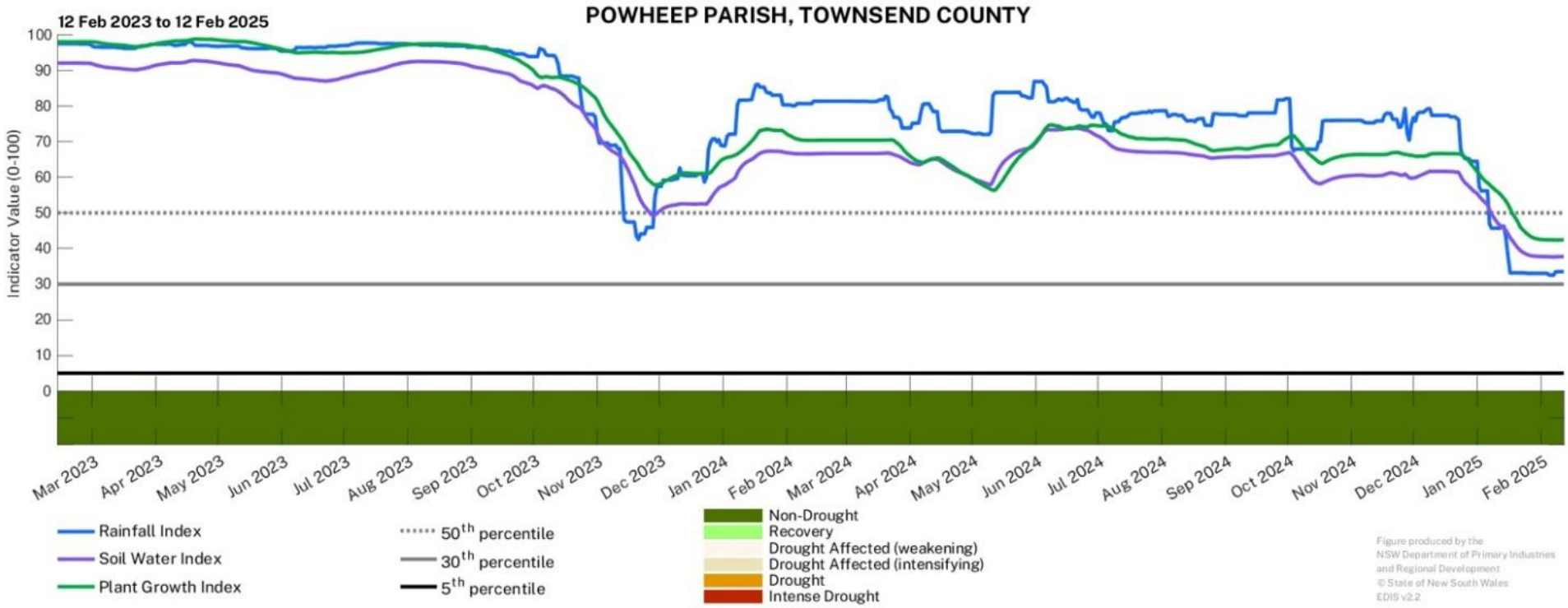


Figure 5.2 Combined Drought Indicator for Powheep County between March 2023 and February 2025

Weather conditions during flora and fauna surveys were generally appropriate for detection of a wide variety of flora and fauna. Weather during the periods of survey were generally warm and dry, with occasional thunderstorms and cool nights.

Conditions during the flora surveys were generally favourable for plant growth and production of features required for identification of most species. The area had experienced sufficient rainfall, and the Plant Growth Index in the CDI for Powheep County had not dropped below the 60th percentile in since April 2022 (see **Figure 5.2**).

Conditions during the diurnal fauna surveys were hot sunny days, with the occasional brief thunderstorm. Conditions during nocturnal fauna surveys remained hot for the first few hours after sunset, with one night of amphibian surveys recording a temperature of 37°C at 9 pm. Temperatures gradually dropped throughout the night, occasionally reaching as low as 10°C during summer. Amphibian and reptile surveys were only conducted on nights which remained warm.

5.3.3 Habitat Assessment

A desktop review was carried out to identify areas of potential habitat constraints in the landscape, and surrounding the Subject Land, relevant to the candidate threatened flora and fauna species which may influence habitat polygons for threatened flora and fauna. These habitat constraints include wetlands and dams, rocky areas, and hollow bearing trees. Fauna habitat assessments were undertaken within the development site and adjoining land in November 2020, early 2021, and early 2022. Fauna habitat assessments included consideration of important indicators of habitat condition and complexity including the occurrence of microhabitats such as tree hollows, fallen logs, bush rock, and wetland areas such as creeks and soaks, and the presence of mistletoe and flowering trees for nectivorous bird species. Hollows were used as a general indication of habitat quality for arboreal fauna and for hollow dependent birds and bats.

Flora habitat assessments including consideration of vegetation structure and floristics, edaphic conditions, fire history, and the presence of microhabitats such as creeklines, soaks, rock outcrops, and soil types. Habitat structure and habitat degradation potentially influencing threatened species habitat polygons were recorded.

The habitat constraints described within the TBDC present within the Subject Land are described in **Table 5.6** below. The habitat values and constraints recorded within the Project Area, including hollow bearing trees and stick nests, are found in **Figure 5.3.**

Table 5.6 Habitat Constraints as Listed Within the TBDC Present Within the Subject Land

Habitat Constraint	Details
Burrows	A number of rabbit warrens, often of extensive size, were observed within red and red-brown loams of the Subject Land. No other burrows were seen onsite, although larger fissures in cracking clays were observed to shelter snakes on the Subject Land.
Caves	No caves present within the Subject Land or wider locality.
Claypans	Extensive areas of claypan occur across the Subject Land particularly across PCT 46, PCT 17, PCT 24, PCT 160, and PCT 44.
Cliffs	No cliffs present within the Subject Land or wider locality.

Habitat Constraint	Details
Dunes	Soil testing identified only sub-dominant soils (arenosols) capable of supporting dunes, and only minor areas of low sand rises were found. It should be noted that arenosols and associated structures may be present within PCT 28 in limited occurrence. Notwithstanding, this habitat constraint is not associated with any threatened ecosystem or species credit species predicted to utilise the Subject Land.
Epiphytes	Mistletoes are present on *Acacia pendula* within PCT 26 at a density of >5 mistletoes per hectare.
Escarpments	No escarpments present within the Subject Land or wider locality.
Fallen/standing dead timber	Fallen / standing timber is present at moderate to very low density across woody vegetation types within the Subject Land, namely PCT 10, PCT 13, PCT 26 and PCT 28.
Hollow bearing trees	There are 180 hollow-bearing trees recorded within the Subject Land, mostly occurring along Coleambally Drainage Line.
Intertidal zones	The Subject Land is not located near the coast; therefore, no intertidal zones are present within the Subject Land or within the wider locality.
Rocky areas	No rocky areas, including surface rock, were recorded within the Subject Land.
Semi-permanent/ephemeral wet areas	Fresh water ephemeral wetlands and swamps occur in small patches throughout the Subject Land, or as a linear patch North and South of the Coleambally Outfall Drain. Freshwater ephemeral wetlands on the Subject Land occur as woodlands, shrublands and grasslands. A detailed description of this habitat constraint is found within **Section 5.3.3.4**.
Swamps	
Termite mounds	No termite mounds were recorded within the Subject Land.
Waterbodies	Waterbodies such as Coleambally Outfall Drain and farm dams are present across the Subject Land, providing suitable habitat for a variety of threatened and protected fauna, such as small mammals, microbats, amphibians, and birds.
Nest trees	Raptor nest trees have been recorded within the Subject Land. A number of these were observed to be occupied by fledglings.

The health and structure of all habitats on site are likely to change spatially, in response to changing in topography, historical disturbances, and ecotones, as well as temporally in response to seasonality, climate changes, fire or flooding events and grazing pressures. A description of the habitat types present within the Subject Land are discussed in **Section 5.3.3.1** to **Section 5.3.3.5**.

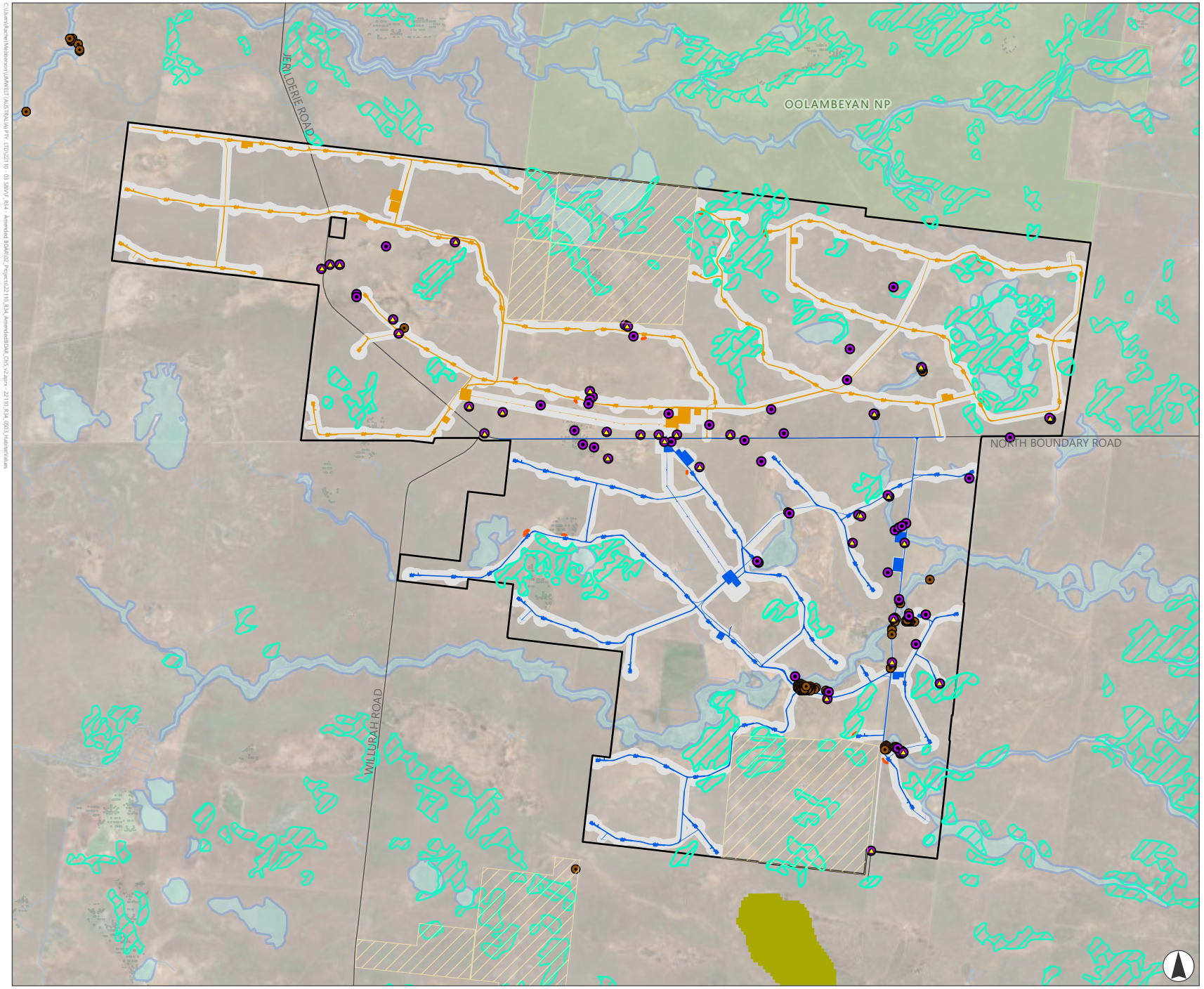


FIGURE 5.3.1

Habitat values present within the Subject Land and Project Area

Legend

- Project Boundary
- Subject Land
- Stage 1 (South) Development Footprint
- Stage 2 (North) Development Footprint
- Conservation Agreement Area
- Blade Overhang Area
- NPWS Reserves
- Road
- Floodplain Wetland
- Watercourse
- Waterbodies
- Swamps
- Plains Wanderer Important Habitat Mapping
- Hollow Bearing Trees
- Habitat Assessment Point
- Stick Nest Locations

0 2,000 4,000

Meters

Scale 1:122,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

FIGURE 5.3.2

Habitat values present within the Subject Land and Project Area

Legend

- Stage 1 (South) Development Footprint
- Road

0 30 60

Meters

Scale 1:2,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

FIGURE 5.3.3

Habitat values present within the Subject Land and Project Area

Legend

- Stage 1 (South) Development Footprint
- Road

0 30 60

Meters

Scale 1:2,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

C:\Users\RachelMeiberg\UMWELT (AUSTRALIA) PTY. LTD\22110 - 03 S86VF R04 - Amended BDAR\02_Projects\22110_R34_AmendedBDAR_Ch5_v2.aprx - 22110_R34_(003_HabitatValues

FIGURE 5.3.4

Habitat values present within the Subject Land and Project Area

Legend

- Stage 1 (South) Development Footprint
- Road
- Watercourse
- HydroArea

0 30 60

Meters

Scale 1:2,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

C:\Users\RachelMeiberg\on\UMWELT (AUSTRALIA) PTY. LTD\2210 - 03 SWVF R04 - Amended BDAR\02_Projects\22110_R34_AmendedBDAR_Ch5_v2.aprx - 22110_R34_0503_HabitatValues

5.3.3.1 Woodland Habitat

Within the Subject Land, three types of woodland occur: eucalypt woodland, Callitris woodland and Acacia woodland. The eucalypt woodlands are all associated with areas of ephemeral wetlands, and predominantly occur in a linear patch within 200 m either side of the Coleambally Outfall Drain. Other patches of eucalypt woodland, as well as all areas of Callitris woodland, occur as fragmented patches sporadically throughout the Subject Land. The Acacia woodland occurs in the southeast of the subject area, within 2.5 km of the Coleambally Outfall Drain. Woodland habitat occurs across the following vegetation zones:

- Zone 1 – PCT 10: River Red Gum - Black Box woodland wetland of the semi-arid (warm) climatic zone (mainly Riverina Bioregion and Murray Darling Depression Bioregion) - Moderate-good
- Zone 2 – 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) - Moderate-good
- Zone 6 – PCT 26: Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion - Moderate-good
- Zone 8 – PCT 28: White Cypress Pine open woodland of sand plains, prior streams and dunes mainly of the semi-arid (warm) climate zone - Moderate-good.

Woodland habitat is associated with most of the threatened bird species known or predicted to occur onsite. However, the fragmented nature of the woodland habitat occurring within the Subject Land means that it would be unlikely to support a number of those predicted species which require a well-connected remnant woodland, for example the Barking Owl. Species which are known or are likely to occur include species that occupy large ranges, are highly nomadic, or small sedentary woodland birds, such as the Little Eagle and Diamond Firetail. All threatened mammals potentially occurring on site are associated with woodland habitat, with koalas being almost entirely arboreal, and all the predicted bat species utilising woodland habitat as roosting or hunting grounds.

The eucalypt woodland habitat on site is predominantly open, with patches of dense shrub layer occurring throughout. These habitats feature a high density of hollows and logs of varying diameters, providing potential breeding or refuge habitat for hollow and log dependant threatened species. Callitris woodlands on site are generally very open, have a much lower density of hollows, and many of the logs in the area are a consequence of historical logging meaning they do not feature hollows. These areas have a high density of large stick nests, and in some areas almost every tree contains a stick nest. The Acacia woodlands on site are very open. And have minimal hollows or log coverage, but still have a high number of medium and small stick nests throughout. Most woodland patches on site are subject to frequent grazing, and trampling of livestock, who take shelter within the small woodland patches, causing some localised areas to be almost devoid of ground cover.

Only a small number of the flora known or predicted to occur on site are associated with woodland habitat, including *Eucalyptus leucoxylon subsp. pruinosa* and *Lepidium monoplocoides*.

Photo 5.1 Eucalyptus Woodland habitat adjacent to Coleambally Outfall Drain

Photo 5.2 Callitris Woodland Near BBUS Vantage Point 4

Photo 5.3 Acacia Woodland Near Bam Plot 67

5.3.3.2 Grassland Habitat

Grassland habitat covers a majority of the Subject Land and provides habitat for both threatened flora and fauna which are known or predicted to occur on site. Grassland habitat occurs in the following vegetation zones:

- Zone 5 - PCT 26: Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion - DNG
- Zone 7 - PCT 28: White Cypress Pine open woodland of sand plains, prior streams and dunes mainly of the semi-arid (warm) climate zone - DNG
- Zone 9 - PCT 44: Forb-rich Speargrass - Windmill Grass - White Top grassland of the Riverina Bioregion - Moderate-good
- Zone 10 - PCT 46: Curly Windmill Grass - Speargrass - wallaby grass grassland on alluvial clay and loam on the Hay Plain: Riverina Bioregion - Moderate-good.
- Areas of non-native grassland occur within areas mapped as exotic vegetation however, these areas provide minimal habitat for most native species, with the exception of generalist foraging species.

The grassland habitat on site is also associated with many of the fauna species known or predicted to occur onsite. Parts of the grasslands in the area are important habitat for all parts of the Plains-wanderer life history. Other threatened birds predicted to occur onsite, use the grasslands predominantly as foraging grounds for seeds, fruits or invertebrates, or hunting grounds for mammals, smaller birds such as quails, reptiles or amphibians. In many areas the soils underneath the grasslands have large cracks, suitable to provide shelter for threatened reptiles and amphibians occurring on site. These cracks may provide essential overwintering habitat for amphibians or be a critical water resource in times when water is scarce. Areas of grassland habitat which are edged by a more structurally diverse habitat type, such as a woodland or Lignum wetland, are more likely to provide refuge for the threatened amphibian and snake species potentially occurring on site. The grassland may also provide invertebrate foraging habitat for threatened bats species predicted to occur within the Subject Land, such as Yellow-bellied Sheathtail-bat and Inland Forest Bat.

The grasslands on site are generally completely devoid of logs and have no areas of rocky outcrops.

This habitat type is associated with a majority of the threatened flora species which are known or predicted to occur onsite, such as the *Swainsona murrayana* and the *Sclerolaena napiformis*.

Photo 5.4 Grassland habitat near BBUS Vantage Point 5

5.3.3.3 Shrubland Habitat

Shrubland habitat occurs over approximately a third of the Subject Land. Most of the shrubland onsite relatively open, and only growing to 0.8 m high. Small patches of tall dense shrubland also occurs across some areas of ephemeral wetland.

The following vegetation zones:

- Zone 3 - PCT 17: Lignum shrubland wetland of the semi-arid (warm) plains (mainly Riverina Bioregion and Murray Darling Depression Bioregion) - Moderate-good
- Zone 11 - PCT 160: Nitre Goosefoot shrubland wetland on clays of the inland floodplains - Moderate-good
- Zone 12 - Zone PCT 164: Cotton Bush open shrubland of the semi-arid (warm) zone - Moderate-good.

The low open shrublands on site have many of the same faunal associations as the grasslands, providing hunting grounds for threatened owls and raptors and some bat species known or predicted to occur on site, as well as foraging grounds for some woodland birds, and refuge for reptiles and amphibians within the cracking soils below or the shrubs themselves. The shrublands on site are devoid of logs, and in some areas are heavily grazed by livestock.

Small patches of tall dense shrubland also occur within the Subject Land, over areas of ephemeral wetlands. These areas would likely have similar faunal associations as the low open shrubland, as well as potentially providing habitat to those species requiring a higher level of structural diversity within their habitat. These areas are up to 2 m tall, and may have a sparse low canopy layer of *Acacia*, possibly contributing a sparse coverage of hollows and logs, as well as potential structures for nest building.

Threatened flora known or predicted to occur within the shrublands on site vary dependant on what type of shrubland is present, with no one species credit species predicted to occur across all shrubland habitat PCTs on site.

Photo 5.5 Shrubland Habitat near BBUS Vantage Point 2

5.3.3.4 Fresh Water Ephemeral Wetlands

Fresh water ephemeral wetlands occur in small patches throughout the Subject Land, or as a linear patch north and south of the Coleambally Outfall Drain. Freshwater ephemeral wetlands on the Subject Land occur as woodlands, shrublands and grasslands, and can be found in the following vegetation zones:

- Zone 1 - PCT 10: River Red Gum - Black Box woodland wetland of the semi-arid (warm) climatic zone (mainly Riverina Bioregion and Murray Darling Depression Bioregion) - Moderate-good
- Zone 2 - 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) - Moderate-good
- Zone 3 - PCT 17: Lignum shrubland wetland of the semi-arid (warm) plains (mainly Riverina Bioregion and Murray Darling Depression Bioregion) - Moderate-good
- Zone 4 - PCT 24: Cane grass swamp tall grassland wetland of drainage depressions: lakes and pans of the inland plains - Moderate-good
- Zone 11 - PCT 160: Nitre Goosefoot shrubland wetland on clays of the inland floodplains - Moderate-good.

The wetlands on site occur in depressions or around drainage lines in the landscape where water can pool, including some roadsides within the Subject Land. All of the wetlands on site are ephemeral and the threatened flora and fauna associated with these areas is likely to be intermittent. In periods of frequent rain, these areas have the potential to host a variety of vagrant threatened bird species which may take advantage of the water and food resource, such as the Australian Bittern or Australian Painted Snipe. Some local threatened bird species, like the White-fronted Chat, would likely establish a more permanent residence throughout these areas. During this time, the large bodies of water would provide breeding habitat for the Southern Bell Frog, which has been found in abundance on site. Reptiles may occupy the margins of the areas of wooded and lignum wetlands, feeding on the abundance of breeding frogs. Although not recorded during the field surveys, Southern Myotis may venture into these areas intermittently once fish or insects establish in the wetland. As the wetlands dry, the previously waterlogged soil will form deep cracks, providing refuge for the reptiles and amphibians within the area. Vagrant birds which may have been attracted to the temporary wetland habitat will move to another area. Local species, like the Southern Myotis which may have expanded their range into these areas, would retract back to permanent water sources, like the Coleambally Outfall Drain.

Wetland associated flora species predicted to occur onsite include *Eleocharis obicis* and *Pilularia novae-hollandiae*, both of which may be more conspicuous at particular times of the flooding, drying cycle. Other flora species may be associated with the margins of wetland areas, such as the *Austrostipa wakoolica.*

Photo 5.6 Lignum Wetland Near BBUS Vantage Point 8

Photo 5.7 Woodland Wetland Near BAM Plot 53

5.3.3.5 Coleambally Outfall Drain and Farm Dams

The Coleambally Outfall Drain is an important habitat feature as it is one of the only permanent water sources within the Subject Land. The drain supplies irrigation water for cropping and grazing land diverted from the Murrumbidgee River East of Yanco. The drain itself is approximately 3 m wide and over 1.5 m deep at points. Fringing vegetation occurs along small stretches, but most of the banks retain bare soil. The drain features levees along its length, allowing control of flows throughout the landscape, sometimes resulting in reduced or restricted flows for small periods of time. The drain is infested with Mosquito fish (*Gambusia holbrooki*) and European Carp (*Cyprinus carpioi*), with European foxes (*Vulpes* vulpes) and feral cats (*Felis silvestris*) also being seen during surveys. Livestock have free access to the drain, causing pugging and turbidity in areas of frequent use. It also likely has some level of agricultural pollution as a result of run off from nearby farmland.

The drain and its surrounding woodland have the potential to support a number of threatened species known or predicted to occur on site. Southern Bell Frogs were found within the channel in abundance during surveys. There is the potential for Southern Myotis to use the drain as hunting grounds, potentially roosting under the concrete bridges crossing the drain, however this species was not recorded within targeted surveys. Numerous hollow-bearing trees also occur along the drain.

Farm dams occur throughout the site, within most vegetation zones. Most of these areas are ephemeral, filling through drainage channels dug to collect water in the landscape. Some farm dams on site are serviced by water pumps, sourcing water from the Coleambally Outfall Drain, or pumping up groundwater, meaning they may be permanent water resources within the landscape.

Most of the farm dams have very minimal vegetation surrounding them, sometimes with a small number of shrubs, but often with bare soil. Most have poor water quality, with severe cattle pugging around the edges, high levels of sedimentation and many with dead sheep or macropods decaying at their edge. A number of these dams are infested with the invasive Mosquito fish, and a smaller number also hosting the invasive European Carp. Despite this, these water bodies appear to be a critical resource for threatened amphibians on site, with almost every dam within the subject area supporting at least one Southern Bell Frog. These waterbodies, especially the pump fed ones, may also provide critical water sources in dry periods for grassland hunters, such as the six species of threatened raptors known or predicted to occur on the Subject Land, as well as smaller threatened birds such as the White-fronted Chat.

Many farm dams on site have ephemeral drainage lines leading to/from these areas, which may intermittently provide connectivity between otherwise fragmented dam habitat. During periods of heavy rain, it is likely that much of the landscape would provide connectivity between farm dams.

Farm dams on site are unlikely to provide habitat for any of the threatened flora species known or predicted to occur on site, because of the poor water quality and frequent trampling and grazing by livestock.

Photo 5.8 Coleambally Outfall Drain

Photo 5.9 Farm Dam Near Coleambally Outfall Drain

5.3.4 Threatened Flora Surveys

Targeted surveys were carried out for all 15 candidate threatened flora species as outlined within **Table 5.7** over 104 days between September 2023 and January 2025. An assessment of habitat suitability for all potential candidate flora species credit species is detailed within **Table 5.4**.

Targeted threatened flora surveys have been carried out in accordance with *Surveying threatened plants and their habitats: NSW survey guide for the Biodiversity Assessment Method* (DPIE 2020c) with Stage 1 of the two-phase grid-based systematic survey approach carried out in spring 2023 for species with areas of suitable habitat greater than 50 ha across the Subject Land. Stage 1 surveys for *Cullen parvum* were completed in spring 2024 / summer 2025 within areas which were not surveyed the previous year (spring 2023 / summer 2024).

Where areas of potential habitat did not meet the size threshold (greater than 50 ha) to use the two-phase grid-based survey system, parallel field traverses were conducted as described in DPIE (2020). A single retained candidate species, *Eucalyptus leucoxylon* subsp. *pruinosa*, was identified to have an area of suitable habitat less than 50 ha. Parallel field traverses for threatened flora have also been carried out within the three offsite areas as the size of these three discrete site-based assessment areas were better suited to parallel field traverses rather than survey grids.

Stage 2 of the two-phased grid-based approach was carried out during spring 2024 for three of the four threatened flora species (*Swainsona sericea*, *Lepidium monoplocoides*, and *Maireana cheelii*) recorded during the Stage 1 surveys in spring 2023. DPIE (2020c) states that for the second phase of the two-phase method for large areas, the extent of the area covered by the finer-scale grid should be refined by considering the habitat type, vegetation type and condition and landscape attributes surrounding the locations where the target species was first detected.

For the purposes of the Stage 2 surveys, the refinement of suitable habitat defined by the initial survey phase was complicated by the very large areas of the PCTs that species are associated with, and an apparent absence of a clear preference to condition and surrounding landscape attributes, for example, aspect, soils, topography. Furthermore, the three target species had been recorded within areas with low cover and abundance of exotic species and are often associated with open areas possessing lower native diversity and cover. The pattern of distribution of the three target species indicated that the species were relatively clustered within patches up to 100 m - 200 m in width and were discrete and limited in extent. As such, the likely occurrence of unrecorded individuals was predicted to be strongly tied with the known occurrence localities of these species. Considering the maximum patch size of 100 m–200 m from these clustered occurrences, the area of 'suitable habitat' was defined as all native vegetation within 500 m of all known records of each of the three target species, including records both in and outside the Subject Land.

Targeted surveys were carried out in areas where the Subject Land intersected with 'suitable habitat' with surveys consisting of 10 m-wide parallel field traverses, in line with Section 4.1 of DPIE 2020. The smaller scale grids as detailed within Table 4 of DPIE 2020 were considered impractical given the inherent accuracy of the GPS in mobile devices (3–4 m at best) when compared to size of the grid circles (being 4 m diameter). Given the grids circles are spaced at 10 m widths, parallel field traverses at 10 m-wide were considered to provide to adequate coverage. Given the relative abundance of individuals and suitable habitat present across the Subject Land, Stage 2 surveys were not carried out for *Swainsona murryana*.

The width of the traverses used for both the Stage 1 and Stage 2 grid-based surveys and parallel field traverses was consistent with the maximum search width for open vegetation as specified within Table 1 of DPIE (2020).

Candidate flora species were grouped into survey groups based on growth form, defined survey period as per the TBDC, and associated PCTs. Following consultation with CPHR regarding the size of the Subject Land to be surveyed and short survey windows, proposed survey groups were consolidated so that up to eight species were surveyed concurrently. **Table 5.7** provides a breakdown of each survey group and a justification for their grouping.

Table 5.8 provides a summary of survey methodology and effort each species. Further details of the targeted flora surveys implemented for each species can be found within **Section 5.3.4.1** to **Section 5.3.4.17.** The Stage 1 survey effort carried out for each threatened flora species surveyed in shown in **Figure 5.4** to **Figure 5.8**, **Figure 5.10** to **Figure 5.15**, **Figure 5.17** to **Figure 5.22**. The Stage 2 survey effort carried out for *Swainsona sericea*, *Lepidium monoplocoides*, and *Maireana cheelii* is shown in **Figure 5.16**, **Figure 5.19**, and **Figure 5.8**.

Table 5.7 Candidate Flora Species Survey Groups

Survey Group	Species included	Life form	Associated PCTs considered suitable habitat	Reference Population	Justification
Survey Group 1	*Convolvulus tedmoorei*	Herb and forb	17, 24, 26, 44, 46, 160, 164	No reference population checked	*Convolvulus tedmoorei* was the only candidate flora species which could be surveyed for between June and August
Survey Group 2	*Convolvulus tedmoorei, Maireana cheelii, Sclerolaena napiformis, Swainsona murrayana, Swainsona plagiotropis, Swainsona sericea, Leptorhynchos orientalis, Brachyscome muelleroides*	Herb and forb, Sub-shrub	17, 24, 26, 28, 44, 46, 160, 164	Accountable officers contacted for details on reference population location and status.	All species within this survey group could be surveyed within September, and they were associated with a similar suite of PCTs. All species with exception of *Sclerolaena napiformis* are 'herbs and forbs'. *Sclerolaena napiformis* is a 'sub-shrub' which grows up to 30 cm high and is of a similar size and scale of the other species within the survey group.
Survey Group 3	*Brachyscome papillosa, Calotis moorei, Eleocharis obicis, Austrostipa wakoolica, Lepidium monoplocoides, Pilularia novae-hollandiae*	Herb and forb, Fern, Grass	10, 13, 17, 24, 26, 28, 44, 46, 160, 164	Accountable officers contacted for details on reference population location and status.	All species within this survey group could be surveyed within October and November, and they were associated with a similar suite of PCTs. All species with exception of *Austrostipa wakoolica* and *Pilularia novae-hollandiae* are 'herbs and forbs'. *Austrostipa wakoolica* is a 'grass' and *Pilularia novae-hollandiae* a 'fern'. They are of a similar size and scale of the other species within the survey group. It is noted that some of these species have specific microhabitat requirements, with *Pilularia novae-hollandiae* and *Eleocharis obicis* requiring drying mud after inundation and waterlogging, while others occurring in a mix wet and dry soils. This difference in habitat preference was addressed by surveying the whole of Subject Land surveys in accordance with the DPE (2020) guidelines with equal emphasis placed on areas of drying/waterlogged soils vs drier soils, whilst noting that some species may have a preference for one soil condition over another.

Survey Group	Species included	Life form	Associated PCTs considered suitable habitat	Reference Population	Justification
					The approach also allowed for a comprehensive survey of very small and shallow depressions and pugging created by cattle hoofs. These fine scale microhabitats are likely to have been less comprehensively surveyed if surveys were designed around microhabitats of a larger scale identified during habitat surveys. The surveys were carried out after a heavy rainfall event in early October 2023 and are considered suitable for rainfall dependent species.
Survey Group 4	*Cullen parvum*	Herb and forb	44	N/A – not cryptic species	*Cullen parvum* was the only candidate flora species which could be surveyed for between December and January.
Survey Group 5	*Diuris tricolor*	Orchid		Reference population at Buckingbong State Forest checked 18 September 2023. Species was seen flowering.	*Diuris tricolor* surveys for a short period of time between September and October. As this flowering time cannot necessarily be reliably predicted, it was placed in own survey group.
Survey Group 6	*Eucalyptus leucoxylon* subsp. *pruinosa*	Tree	13	N/A – not cryptic species	*Eucalyptus leucoxylon* subsp. *pruinosa* was the only candidate flora species within its growth form.

Table 5.8 Summary of Targeted Surveys carried out for Candidate Threatened Flora Species

Common Name *Species Name*	BC Act	EPBC Act	SAII	Area of suitable habitat (ha)	Minimum Survey Requirements	Survey Method Utilised	Seasonal Survey Requirements	Survey Date	Survey Effort	
									Transect Width	km
A spear-grass *Austrostipa wakoolica*	E	E	No	619.69	For a species with over 50 ha of suitable habitat the two-phase grid-based systematic survey approach is to be used.	Two-phase grid-based systematic approach – Stage 1 Surveys. Parallel field traverses carried out within the 3 offsite disturbance areas surveyed.	October – December	16–25 October 2023 30 October–8 November 2023 13–29 November 2023 30–31 October 2024	10 m	1,202.98 km 1,510 hours
Austral Pillwort *Pilularia novae-hollandiae*	E	-	Yes	3,426.87	For a species with over 50 ha of suitable habitat the two-phase grid-based systematic survey approach is to be used.	Two-phase grid-based systematic approach – Stage 1 Surveys. Parallel field traverses carried out within the 3 offsite disturbance area surveyed.	October – December	16–25 October 2023 30 October–8 November 2023 13–29 November 2023 30–31 October 2024	10 m	1,202.98 km 1,510 hours
Bindweed *Convolvulus tedmoorei*	E	-	Yes	3,766.98	For a species with over 50 ha of suitable habitat the two-phase grid-based systematic survey approach is to be used.	Two-phase grid-based systematic approach – Stage 1 Surveys. Parallel field traverses carried out within the 3 offsite disturbance area surveyed.	June – September	3–8 July 2023 14–23 August 2023 4–23 September 2023 17 September 2024	10 m	1,863.33 km 1,780 hours

Common Name *Species Name*	BC Act	EPBC Act	SAII	Area of suitable habitat (ha)	Minimum Survey Requirements	Survey Method Utilised	Seasonal Survey Requirements	Survey Date	Survey Effort	
									Transect Width	km
A burr daisy ***Calotis moorei***	E	E	Yes	3,766.98	For a species with over 50 ha of suitable habitat the two-phase grid-based systematic survey approach is to be used.	Two-phase grid-based systematic approach – Stage 1 Surveys. Parallel field traverses carried out within the 3 offsite disturbance area surveyed.	September – November	16–25 October 2023 30 October–8 November 2023 13–29 November 2023 17 September 2024 30–31 October 2024	10 m	1,202.98 km 1,510 hours
Chariot Wheels ***Maireana cheelii***	V	V	No	3,720.33 (Stage 1) 488.00 (Stage 2)	For a species with over 50 ha of suitable habitat the two-phase grid-based systematic survey approach is to be used.	Two-phase grid-based systematic approach – Stage 1 and Stage 2 surveys. Parallel field traverses carried out within the 3 offsite disturbance area surveyed.	September - December	4–23 September 2023 17–20 September 2024 30 September–3 October 2024 15–19 October 2024 29 October–2 November 2024 26–30 November 2024	10 m	Stage 1 – 1,226.79 km 1,260 hours Stage 2 – 684.80 km 860 hours

Common Name *Species Name*	BC Act	EPBC Act	SAII	Area of suitable habitat (ha)	Minimum Survey Requirements	Survey Method Utilised	Seasonal Survey Requirements	Survey Date	Survey Effort	
									Transect Width	km
Claypan Daisy ***Brachyscome muelleroides***	V	V	Yes	3,309.68	For a species with over 50 ha of suitable habitat the two-phase grid-based systematic survey approach is to be used	Two-phase grid-based systematic approach – Stage 1 surveys. Parallel field traverses carried out within the 3 offsite disturbance area surveyed.	September - November	4–23 September 2023 17 September 2024 30–31 October 2024	10 m	1,227.77 km 1,260 hours
Lanky Buttons ***Leptorhynchos orientalis***	E	-	No	3,434.45	For a species with over 50 ha of suitable habitat the two-phase grid-based systematic survey approach is to be used.	Two-phase grid-based systematic approach – Stage 1 surveys. Parallel field traverses carried out within the 3 offsite disturbance area surveyed.	September - November	4–23 September 2023 17 September 2024 30–31 October 2024	10 m	1227.77 km 1,260 hours
Mossgiel Daisy ***Brachyscome papillosa***	V	V	No	3,634.49	For a species with over 50 ha of suitable habitat the two-phase grid-based systematic survey approach is to be used.	Two-phase grid-based systematic approach – Stage 1 surveys. Parallel field traverses carried out within the 3 offsite disturbance area surveyed.	September – November	16–25 October 2023 30 October– 8 November 2023 13–29 November 2023 17 September 2024 30–31 October 2024	10 m	1,202.98 km 1,510 hours

Common Name *Species Name*	BC Act	EPBC Act	SAII	Area of suitable habitat (ha)	Minimum Survey Requirements	Survey Method Utilised	Seasonal Survey Requirements	Survey Date	Survey Effort	
									Transect Width	km
Pine Donkey Orchid ***Diuris tricolor***	V	-	No	484.75	For a species with over 50 ha of suitable habitat the two-phase grid-based systematic survey approach is to be used.	Two-phase grid-based systematic approach – Stage 1 surveys. Parallel field traverses carried out within the 1 offsite disturbance area surveyed.	September–October	20–23 September 2023	10 m	110.15 km 180 hours
Red Darling Pea ***Swainsona plagiotropis***	V	V	No	3,424.42	For a species with over 50 ha of suitable habitat the two-phase grid-based systematic survey approach is to be used.	Two-phase grid-based systematic approach – Stage 1 surveys. Parallel field traverses carried out within the 3 offsite disturbance area surveyed.	September	4–23 September 2023 17 September 2024	10 m	1,227.77 km 1,260 hours
Silky Swainson-pea ***Swainsona sericea***	V	-	No	3,909.17 (Stage 1) 1,119.88 (Stage 2)	For a species with over 50 ha of suitable habitat the two-phase grid-based systematic survey approach is to be used.	Two-phase grid-based systematic approach – Stage 1 and Stage 2 surveys. Parallel field traverses carried out within the 3 offsite disturbance area surveyed.	September – October (Riverina)	4–23 September 2023 17–20 September 2024 30 September–3 October 2024 15–19 October 2024 29 October–2 November 2024 26–30 November 2024	10 m	Stage 1 – 1,227.77 km 1,260 hours Stage 2 – 684.80 km 400 hours

Common Name *Species Name*	BC Act	EPBC Act	SAII	Area of suitable habitat (ha)	Minimum Survey Requirements	Survey Method Utilised	Seasonal Survey Requirements	Survey Date	Survey Effort	
									Transect Width	km
Slender Darling Pea ***Swainsona murrayana***	V	V	No	4,205.08	For a species with over 50 ha of suitable habitat the two-phase grid-based systematic survey approach is to be used.	Two-phase grid-based systematic approach – Stage 1 surveys. Stage 2 surveys not carried out for this species. Parallel field traverses carried out within the 3 offsite disturbance area surveyed.	September	4–23 September 2023 17–20 September 2024 30 September 2024	10 m	1,227.77 km 1,360 hours
Small Scurf-pea ***Cullen parvum***	E	-	No	1,120.44	For a species with over 50 ha of suitable habitat the two-phase grid-based systematic survey approach is to be used.	Two-phase grid-based systematic approach – Stage 1 surveys. Parallel field traverses carried out within the 3 offsite disturbance area surveyed.	December–January	11–16 December 2023 14–19 January 2024 17–19 December 2024 12–14 January 2025	10 m	403.37 km 780 hours
Spike-rush ***Eleocharis obicis***	V	V	No	364.70	For a species with over 50 ha of suitable habitat the two-phase grid-based systematic survey approach is to be used.	Two-phase grid-based systematic approach – Stage 1 surveys. Parallel field traverses carried out within the 3 offsite disturbance area surveyed.	October–November	16–25 October 2023 30 October–8 November 2023 13–29 November 2023 30–31 October 2024.	10 m	1,202.98 km 1,510 hours

Common Name *Species Name*	BC Act	EPBC Act	SAII	Area of suitable habitat (ha)	Minimum Survey Requirements	Survey Method Utilised	Seasonal Survey Requirements	Survey Date	Survey Effort	
									Transect Width	km
Turnip Copperburr ***Sclerolaena napiformis***	E	E	No	3,424.42	For a species with over 50 ha of suitable habitat the two-phase grid-based systematic survey approach is to be used.	Two-phase grid-based systematic approach – Stage 1 surveys. Parallel field traverses carried out within the 3 offsite disturbance area surveyed.	September - December	4–23 September 2023 17 September 2024 30–31 October 2024.	10 m	1,227.77 km 1,260 hours
Winged Peppercress ***Lepidium monoplocoides***	E	E	No	2,332.88 (Stage 1) 494.96 (Stage 2)	For a species with over 50 ha of suitable habitat the two-phase grid-based systematic survey approach is to be used.	Two-phase grid-based systematic approach – Stage 1 Surveys. Parallel field traverses carried out within the 3 offsite disturbance area surveyed.	September – December	16–25 October 2023 30 October–8 November 2023 13–29 November 2023 17–20 September 2024 30 September–3 October 2024 15–19 October 2024 29 October–2 November 2024 26–30 November 2024	10 m	Stage 1 – 1,202.98 km 1,510 hours Stage 2 – 684.80 km 860 hours

Common Name *Species Name*	BC Act	EPBC Act	SAII	Area of suitable habitat (ha)	Minimum Survey Requirements	Survey Method Utilised	Seasonal Survey Requirements	Survey Date	Survey Effort	
									Transect Width	km
Yellow Gum ***Eucalyptus leucoxylon subsp. pruinosa***	V	-	No	2.45	Parallel field traverse. For a tree in dense vegetation the recommended maximum distance between field traverses is 20 m. In open vegetation this distance is 40 m.	Parallel field traverse within associated PCTs mapped within Subject Land.	All year	13–17 May 2024	20 m	4.19 km 4 hours

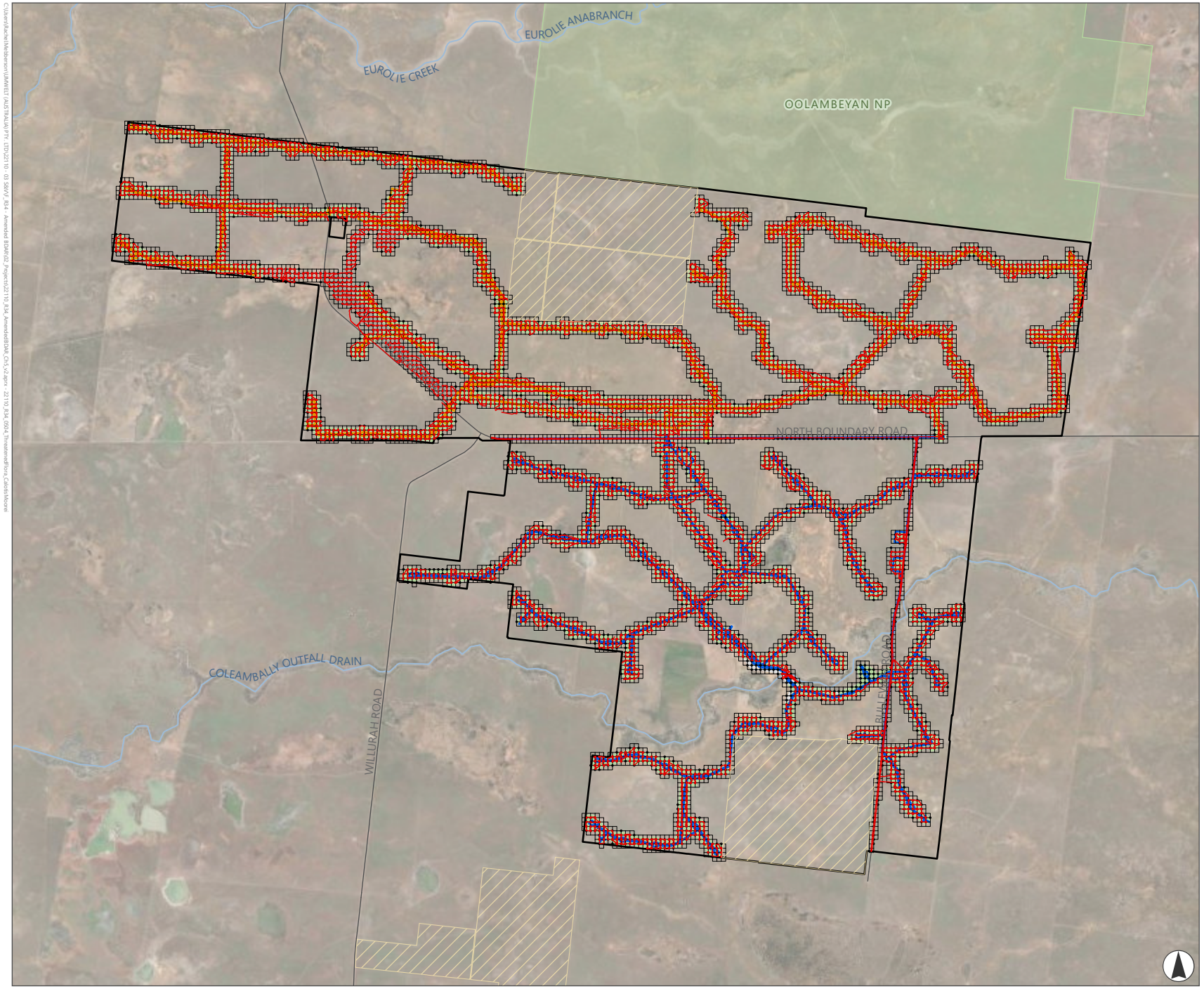
5.3.4.1 A Burr Daisy (*Calotis moorei*)

Table 5.9 Detailed Description of Surveys – A Burr-Daisy (*Calotis moorei*)

Survey details – A Burr Daisy (*Calotis moorei*)	
Habitat Description	Grows in sandy soil on flats, low dunes and small hills and appears to be associated with *Acacia* woodlands and chenopod shrublands. Apparently, a perennial that flowers in the first year of growth; no plants have been observed to survive for more than two years at one of the four know population sites (the Mt Mulyah site); flowering is recorded for September and fruit have been collected in October. *Calotis moorei* can often be found with other *Calotis* species such as *Calotis cymbacantha* and *Calotis erinacea* and are very similar morphologically.
Associated PCTs/VZs	None
Habitat or Geographical Constraints	Habitat constraints - None Geographic constraints - None
Survey Requirement	The suitable habitat identified on site for this species was found to be 3,766.98 ha. Therefore, this species was subject to a two-phase grid-based systematic approach. A grid of 100 m^2 was overlayed over a topographic map of the Subject Land, with a 40 m diameter circle nested within the intersection of each x and y gridline. Surveyors used this grid overlay to target systematic surveys within circles and along gridlines between circles. 10 m wide transects were walked within each grid circle. Parallel field traverses have been carried out within small patches of suitable habitat, such as habitat in the offsite disturbance areas located within Stage 1 – site-based assessment area.
Species-specific Survey Requirements	Short-lived perennial. Use flowering/fruiting material to locate. Flowering occurs in the first year of growth.
Survey Period	September–November
Survey Group	SG3
Surveys Completed	Stage 1 of the two-phase staged approach was carried out across the Stage 1 – Linear and Stage 2 – Linear assessment areas. Parallel field traverses were carried out within all 3 offsite disturbance areas. Approximately 1,510 hours of survey has been completed for SG3. A total of 1,202.98 km of transects were walked. Transect width was 10 m wide. Surveys were carried out between: • 16–25 October 2023 • 30 October–8 November 2023 • 13–29 November 2023 • 17 September 2024 • 30–31 October 2024.
Weather Conditions	Weather conditions during the survey period for Survey Group 3 were favourable for identifying *Calotis moorei.* Daily weather conditions for Survey Group 3 are presented in **Appendix H.**
Comments/Additional Information/Justification of approach	This species was not recorded during surveys therefore has been **assessed as not present**. The species is confined to NSW and is known from only four populations in NSW, the type locality north-west of Louth near the homestead of Mt Mulyah sheep station, west of Wilcannia, around the Menindee area and an old record at Zara Station near Deniliquin (south-west of Hay).

FIGURE 5.4.1

Threatened Flora Surveys
Calotis moorei



Legend

- Project Boundary
- Subject Land
- Stage 1 (South) Development Footprint
- Stage 2 (North) Development Footprint
- Conservation Agreement Area
- NPWS Reserves
- Road
- Watercourse
- Survey Area
- Survey Grid
- Threatened Species Transect

0 1,000 2,000

Meters

Scale 1:122,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

FIGURE 5.4.2

Threatened Flora Surveys
Calotis moorei

Legend

- Stage 1 (South) Development Footprint
- Road
- Survey Area
- Threatened Species Transect

0 20 40

Meters

Scale 1:2,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

C:\Users\RachelMeiberan\UMWELT (AUSTRALIA) PTY. LTD\22110 - 03 SWVF R04 - Amended BDAR\02_Projects\22110_R34_AmendedBDAR_Ch5_v2.aprx - 22110_R34_0504_ThreatenedFlora_CalotisMoorei

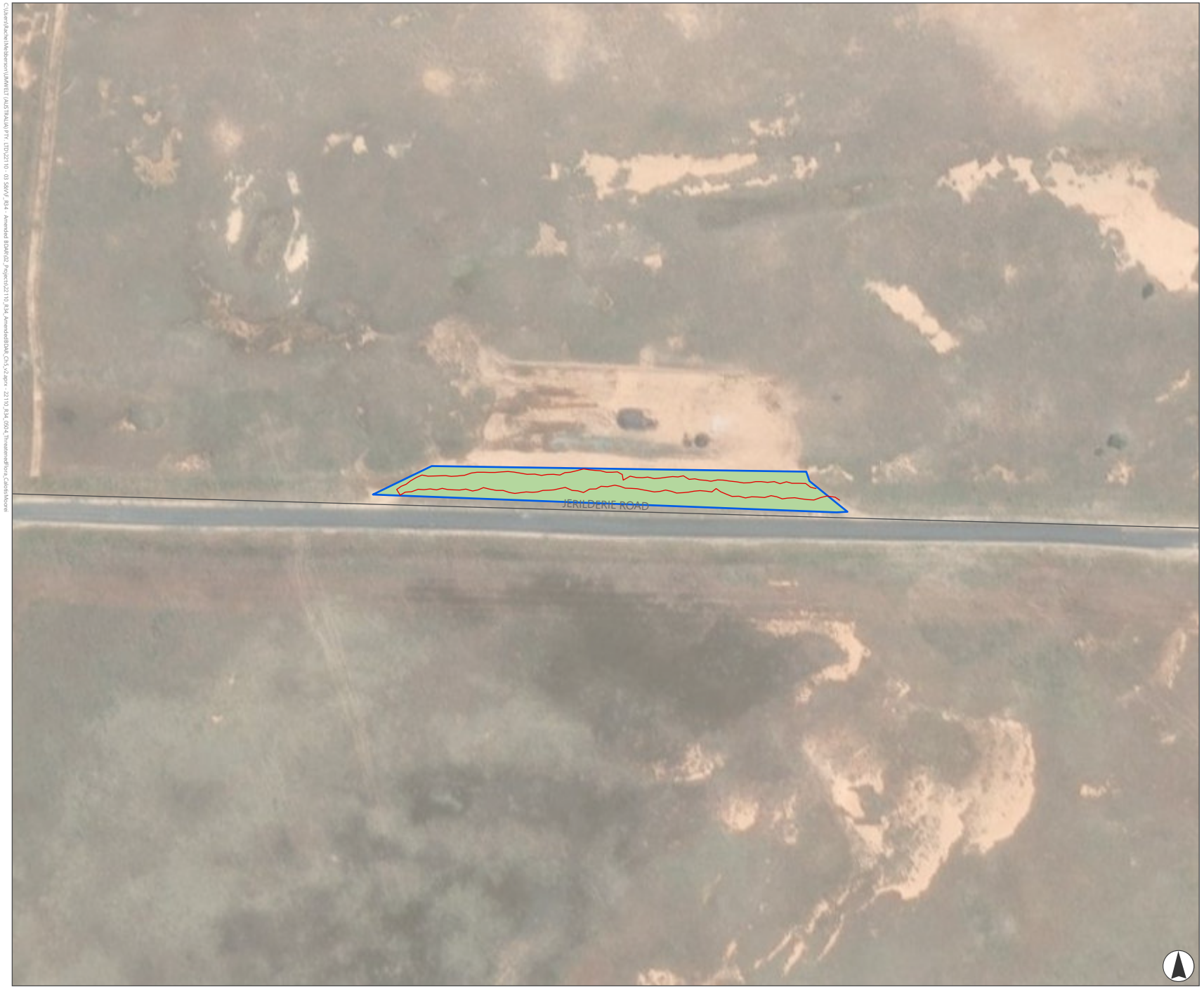


FIGURE 5.4.3

Threatened Flora Surveys
Calotis moorei

Legend

- Stage 1 (South) Development Footprint
- Road
- Survey Area
- Threatened Species Transect

0 20 40

Meters

Scale 1:2,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

C:\Users\RachelMeiberg\on\UMWELT (AUSTRALIA) PTY. LTD\22110 - 03 SWVF R04 - Amended BDAR\02_Projects\22110_R34_AmendedBDAR_Ch5_v2.aprx - 22110_R34_0504_ThreatenedFlora_CalotisMoore

FIGURE 5.4.4

Threatened Flora Surveys
Calotis moorei

Legend

- Stage 1 (South) Development Footprint
- Road
- Watercourse
- Survey Area
- Threatened Species Transect

0 20 40

Meters

Scale 1:2,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

C:\Users\RachelMeiberg\on\UMWELT (AUSTRALIA) PTY. LTD\22110 - 03 S86VF R04 - Amended BDAR\02_Projects\22110_R34_AmendedBDAR_Ch5_v2.aprx - 22110_R34_0504_ThreatenedFlora_CalotisMoore

5.3.4.2 A spear-grass (*Austrostipa wakoolica*)

Table 5.10 Detailed Description of Surveys – A spear-grass (*Austrostipa wakoolica*)

Survey details – A spear-grass (*Austrostipa wakoolica*)	
Habitat Description	Grows on floodplains of the Murray River tributaries, in open woodland on grey, silty clay or sandy loam soils. Habitats include the edges of a lignum swamp with box and mallee; creek banks in grey, silty clay; mallee and lignum sandy-loam flat; open Cypress Pine forest on low sandy range; and a low, rocky rise. Associated species include *Callitris glaucophylla, Eucalyptus microcarpa, Eucalyptus populnea, Austrostipa eremophila, Austrostipa drummondii, Rytidosperma erianthum* and *Einadia nutans.* Patches of suitable habitat are spread throughout the site.
Associated PCTs/VZs	PCTs: 17, 26, 28 VZs: 3, 5, 6, 7, 8
Habitat or Geographical Constraints	Habitat constraints - Alluvial plains or plains. Geographic constraints - South of the Murrumbidgee River. Confined to the floodplains of the Murray River tributaries of central-western and south-western NSW, with localities including Manna State Forest, Matong, Lake Tooim, Merran Creek, Tulla, Cunninyeuk and Mairjimmy State Forest (now part of South West Woodland Nature Reserve
Survey Requirement	The suitable habitat identified on site for this species was found to be 619.69 ha. Therefore, this species was subject to a two-phase grid-based systematic approach. A grid of 100 m^2 was overlayed over a topographic map of the Subject Land, with a 40 m diameter circle nested within the intersection of each x and y gridline. Surveyors used this grid overlay to target systematic surveys within circles and along gridlines between circles. 10 m wide transects were walked within each grid circle. Parallel field traverses have been carried out within small patches of suitable habitat, such as habitat in the offsite disturbance areas located within Stage 1 – site-based assessment area.
Species-specific Survey Requirements	Use fertile material to identify. Flowers in response to above average rain in winter and spring.
Survey Period	October–December
Survey Group	SG3
Surveys Completed	Stage 1 of the two-phase staged approach was carried out across the Stage 1 – Linear and Stage 2 – Linear assessment areas. Parallel field traverses were carried out within the offsite disturbance. Approximately 1,510 hours of survey has been completed for SG3. A total of 1,202.98 km of transects were walked. Transect width was 10 m wide. Surveys were carried out between: • 16–25 October 2023 • 30 October–8 November 2023 • 13–29 November 2023 • 30–31 October 2024.
Weather Conditions	Weather conditions during the survey period for Survey Group 3 were favourable for identifying *Austrostipa wakoolica.* Daily weather conditions for Survey Group 3 are presented in **Appendix H.**
Comments/Additional Information/Justification of approach	This species was not observed during surveys and this species has been **assessed as not present**.

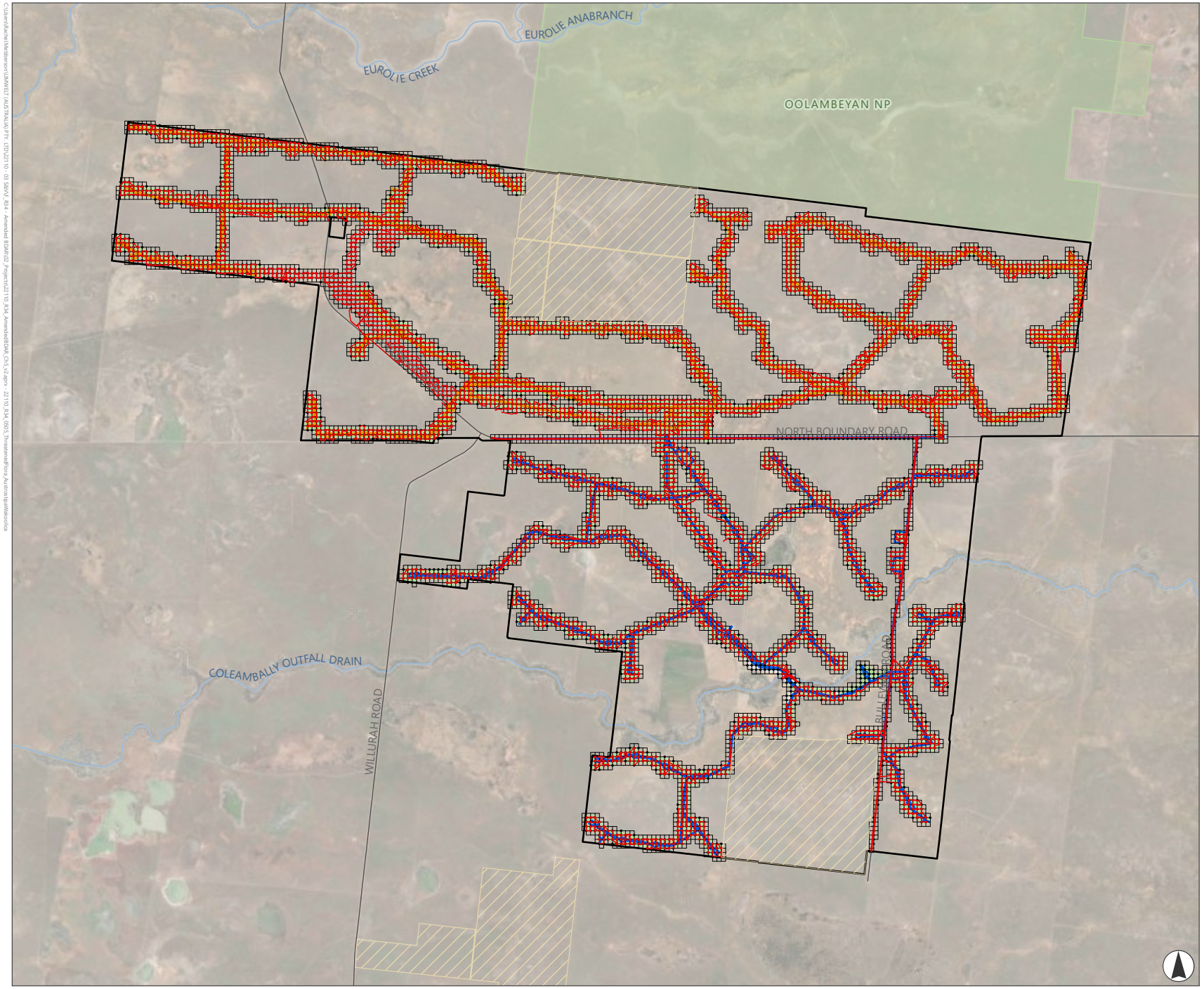


FIGURE 5.5.1

Threatened Flora Surveys
Austrostipa wakoolica

Legend
- Project Boundary
- Subject Land
- Stage 1 (South) Development Footprint
- Stage 2 (North) Development Footprint
- Conservation Agreement Area
- NPWS Reserves
- Road
- Watercourse
- Survey Area
- Survey Grid
- Threatened Species Transect

0 1,000 2,000

Meters

Scale 1:122,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

FIGURE 5.5.2

Threatened Flora Surveys
Austrostipa wakoolica

Legend

- Stage 1 (South) Development Footprint
- Road
- Survey Area
- Threatened Species Transect

0 20 40

Meters

Scale 1:2,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

C:\Users\RachelMeberson\UMWELT (AUSTRALIA) PTY. LTD\2210 - 03 SWVF R04 - Amended BDAR\02_Projects\2210_R34_AmendedBDAR_Ch5_v2.aprx - 2210_R34_0505_ThreatenedFlora_AustrostipaWakoolica

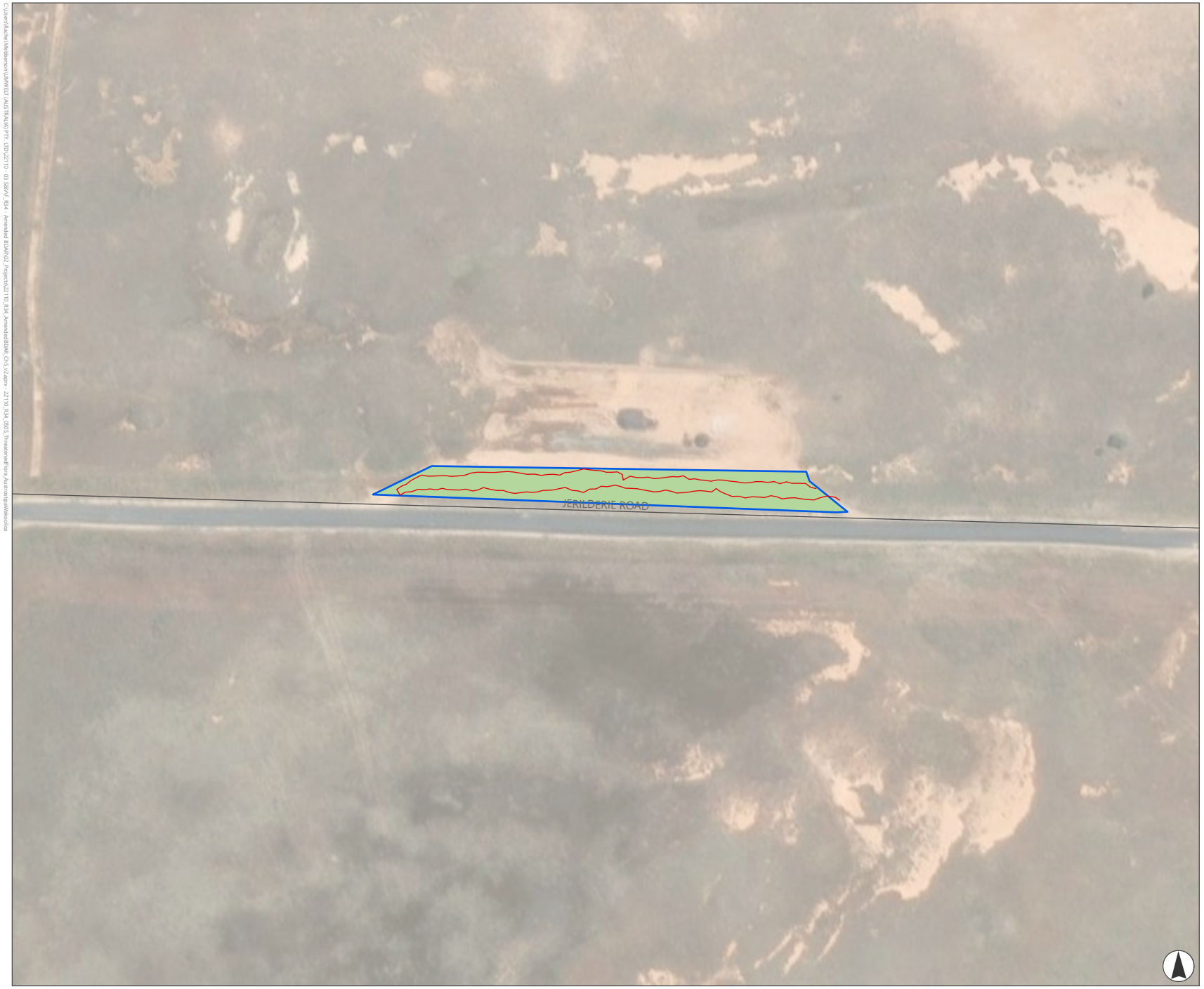


FIGURE 5.5.3

Threatened Flora Surveys
Austrostipa wakoolica

Legend

- Stage 1 (South) Development Footprint
- Road
- Survey Area
- Threatened Species Transect

0 20 40

Meters

Scale 1:2,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

C:\Users\RachelMeiberg\n\UMWELT (AUSTRALIA) PTY. LTD\2210 - 03 SWVF R44 - Amended BDAR\02_Projects\22110_R34_AmendedBDAR_Ch5_v2.aprx - 22110_R34_(005) ThreatenedFlora_AustrostipaWakoolica

FIGURE 5.5.4

Threatened Flora Surveys
Austrostipa wakoolica

Legend

- Stage 1 (South) Development Footprint
- Road
- Watercourse
- Survey Area
- Threatened Species Transect

0 20 40

Meters

Scale 1:2,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

5.3.4.3 Austral Pillwort (*Pilularia novae-hollandiae*)

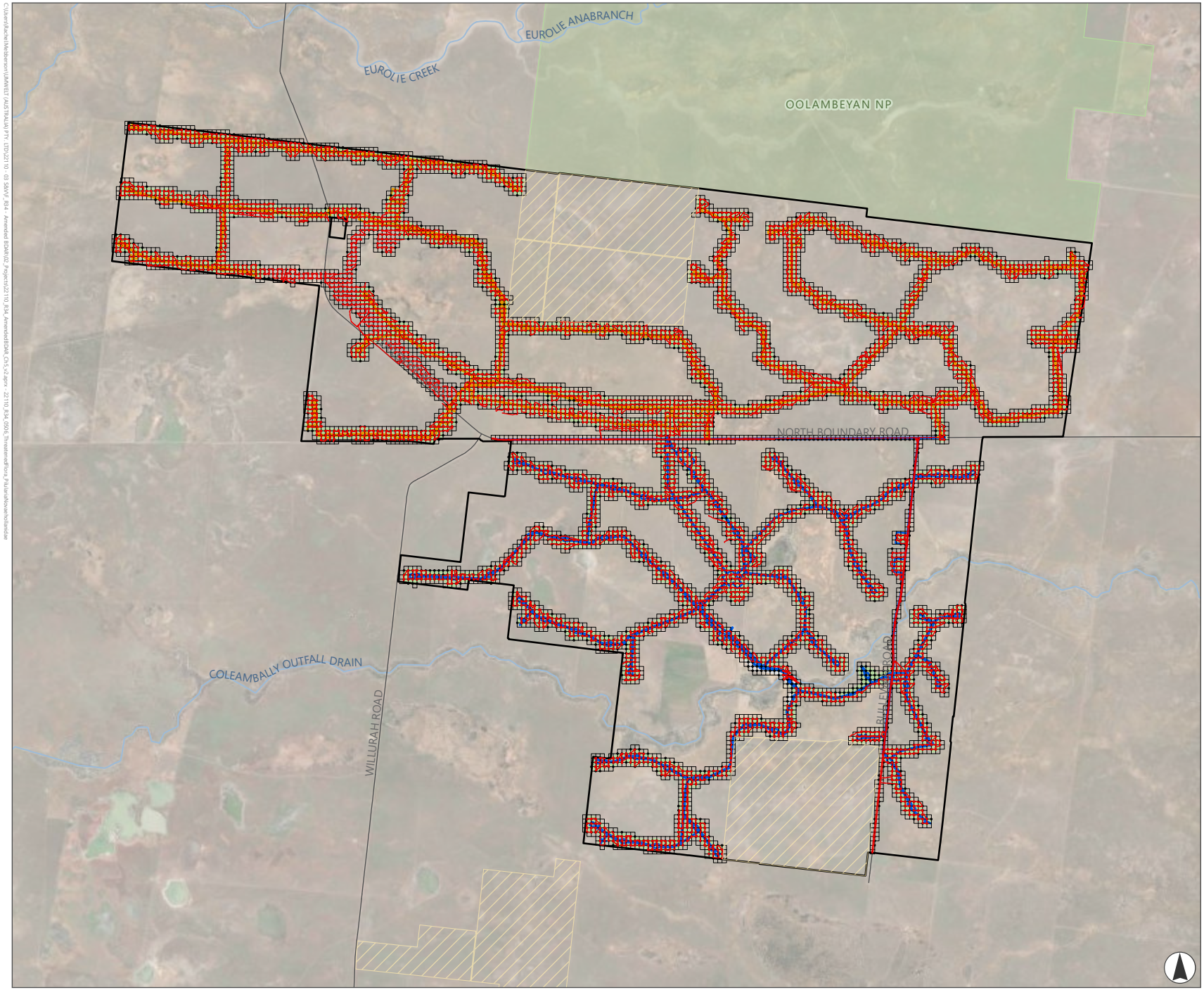
Table 5.11 Detailed Description of Surveys – Austral Pillwort (*Pilularia novae-hollandiae*)

Survey details – Austral Pillwort (*Pilularia novae-hollandiae*)	
Habitat Description	Grows in shallow swamps and waterways, often among grasses and sedges. It is most often recorded in drying mud as this is when it is most conspicuous. Most records from table drains on the sides of roads.
Associated PCTs/VZs	PCTs: 13, 26, 44, 46 VZs: 2, 5, 6, 9, 10
Habitat or Geographical Constraints	Geographical constraint - East of Deniliquin In NSW, Austral Pillwort has been recorded from suburban Sydney, Khancoban, the Riverina between Albury and Urana (including Henty, Walbundrie, Balldale and Howlong), Oolambeyan National Park near Carrathool and at Lake Cowal near West Wyalong. The populations at Lake Cowal and Oolambeyan NP are the only known extant populations in NSW, although the species is obscure and has possibly been overlooked elsewhere. The species has also been recorded in the Australian Capital Territory, Victoria, Tasmania, South Australia and Western Australia.
Survey Requirement	The suitable habitat identified on site for this species was found to be 3,426.87 ha. Therefore, this species was subject to a two-phase grid-based systematic approach. A grid of 100 m^2 was overlayed over a topographic map of the Subject Land, with a 40 m diameter circle nested within the intersection of each x and y gridline. Surveyors used this grid overlay to target systematic surveys within circles and along gridlines between circles. 10 m wide transects were walked within each grid circle. Parallel field traverses have been carried out within small patches of suitable habitat, such as habitat in the offsite disturbance areas located within Stage 1 – site-based assessment area.
Species-specific Survey Requirements	Survey in drying mud after inundation. Strongly recommend expert report to discount presence or absence if conditions do not meet requirements
Survey Period	October–December
Survey Group	SG3
Surveys Completed	Stage 1 of the two-phased staged approach was carried out across the Stage 1 – Linear and Stage 2 – Linear assessment areas. Parallel field traverses were carried out within the offsite disturbance areas. Approximately 1,510 hours of survey has been completed for SG3. A total of 1,202.98 km of transects were walked. Transect width was 10 m wide. Surveys were carried out between: • 16–25 October 2023 • 30 October–8 November 2023 • 13–29 November 2023 • 30–31 October 2024.
Weather Conditions	Weather conditions during the survey period for Survey Group 3 were favourable for identifying *Pilularia novae-hollandiae* with substantial rainfall across the locality during a significant La Niña weather event between 2021 and early 2023. The Subject Land was completely inundated with water during December 2022, and was subject above average rainfall over six months of 2023, including June and October.

Survey details – Austral Pillwort (*Pilularia novae-hollandiae*)	
	A total of 52.2 mm of rain fell in October which included a large rainfall event at the beginning of the month just as field surveys were commencing. Evidence of inundation and drying soils during surveys is provided in **Photo 5.4** and **Photo 5.5** below. Daily weather conditions for Survey Group 3 are presented in **Appendix H.** **Photo 5.4 Evidence of inundation and drying soils during surveys** **Photo 5.5 Evidence of inundation and drying soils during surveys**
Comments/Additional Information/Justification of approach	This species was not observed during surveys and this species has been **assessed as not present.**

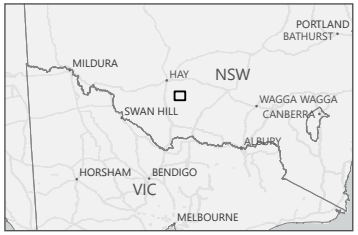
FIGURE 5.6.1

Threatened Flora Surveys
Pilularia novae-hollanidae



Legend

- Project Boundary
- Subject Land
- Stage 1 (South) Development Footprint
- Stage 2 (North) Development Footprint
- Conservation Agreement Area
- NPWS Reserves
- Road
- Watercourse
- Survey Area
- Survey Grid
- Threatened Species Transect



0 1,000 2,000

Meters

Scale 1:122,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

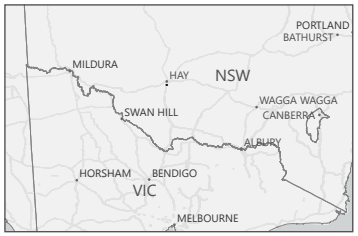
Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

FIGURE 5.6.2

Threatened Flora Surveys
Pilularia novae-hollanidae

Legend

- Stage 1 (South) Development Footprint
- Road
- Survey Area
- Threatened Species Transect



0 20 40

Meters

Scale 1:2,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

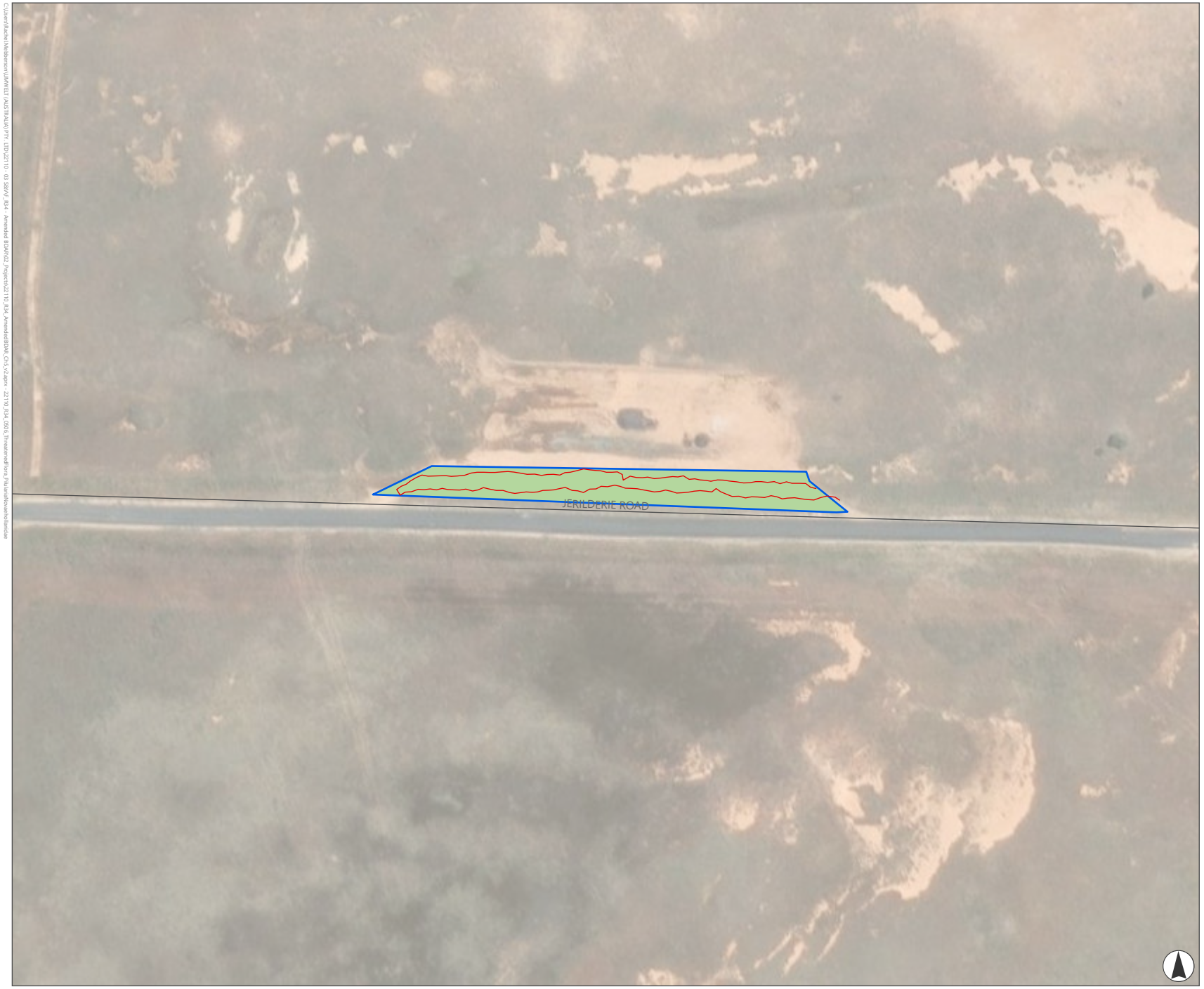
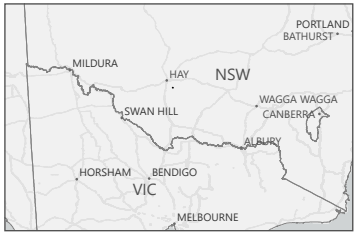


FIGURE 5.6.3

Threatened Flora Surveys
Pilularia novae-hollanidae

Legend

- Stage 1 (South) Development Footprint
- Road
- Survey Area
- Threatened Species Transect



0 20 40

Meters

Scale 1:2,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

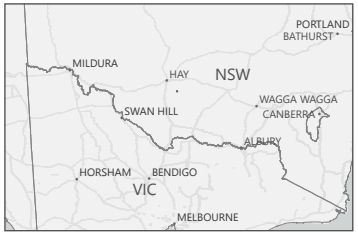
C:\Users\RachelMeberson\UMWELT (AUSTRALIA) PTY. LTD\2210 - 03 SWVF R44 - Amended BDAR\02_Projects\2210_R34_AmendedBDAR_Ch5_v2.aprx - 2210_R34_0506_ThreatenedFlora_PilulariaNovaeHollandiae

FIGURE 5.6.4

Threatened Flora Surveys
Pilularia novae-hollanidae

Legend

- Stage 1 (South) Development Footprint
- Road
- Watercourse
- Survey Area
- Threatened Species Transect



0 20 40

Meters

Scale 1:2,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

C:\Users\RachelMeiberg\on\UMWELT (AUSTRALIA) PTY. LTD\2210 - 03 SWJV - R34 - Amended BDAR\02_Projects\22110_R34_AmendedBDAR_Ch5_v2.aprx - 22110_R34_0506_ThreatenedFlora_PilulariaNovaeHollandiae

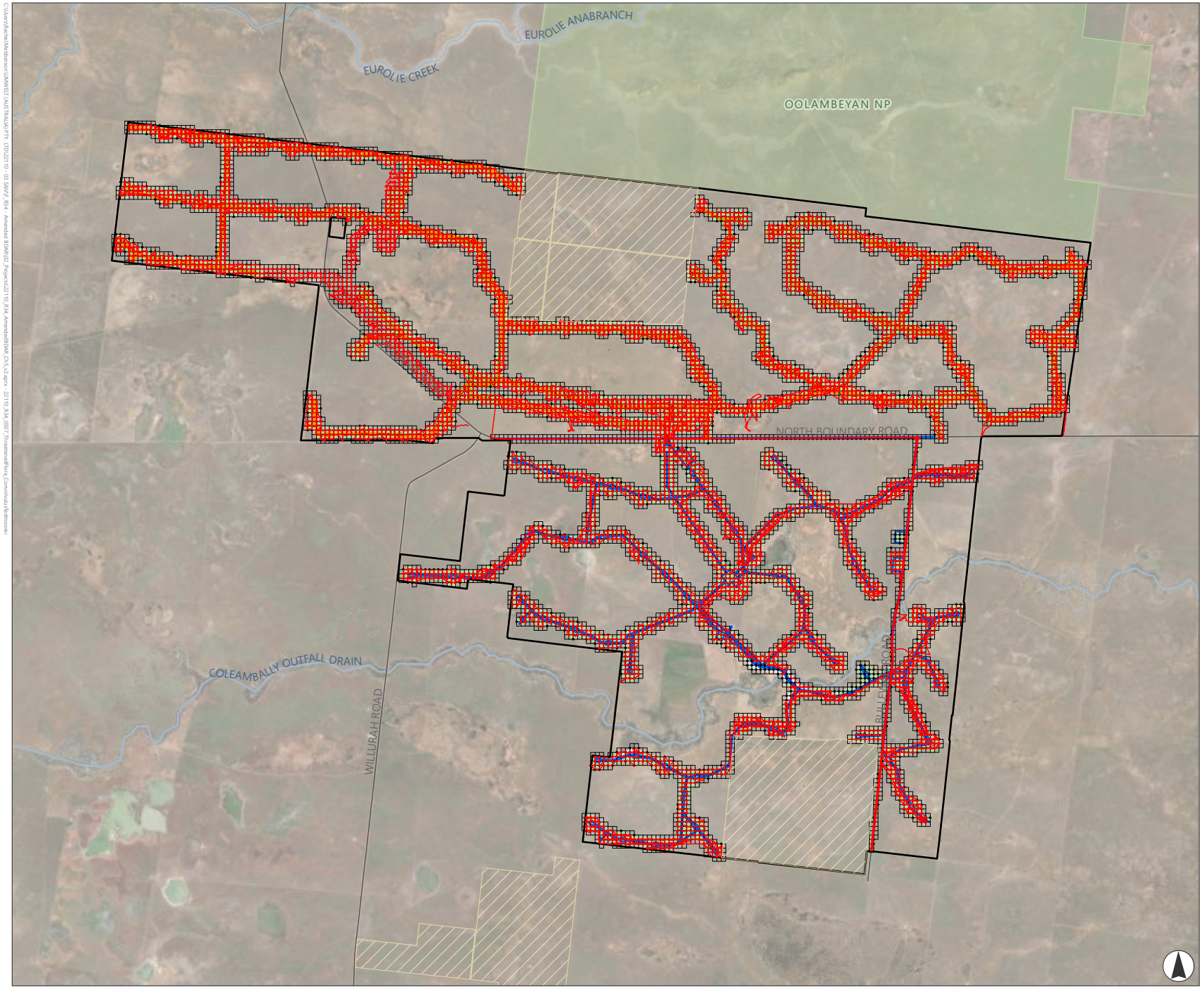
5.3.4.4 Bindweed (*Convolvulus tedmoorei*)

Table 5.12 Detailed Description of Surveys – Bindweed (*Convolvulus tedmoorei*)

Survey details – Bindweed (*Convolvulus tedmoorei*)	
Habitat Description	Not much is known about the habitat of *Convolvulous tedmoorei* as the species is only known from two collections in 1969 and 1971. Grows in self-mulching grey clay soils on the floodplains of the Darling and Murrumbidgee Rivers. Disturbance regimes are not known, although the species may require periodic flooding of its habitat to maintain the wet conditions suitable for seed set and germination.
Associated PCTs/VZs	PCTs: 17, 24, 26, 44, 46, 160, 164 VZs: 3, 4, 5, 6, 9, 10, 11, 12
Habitat or Geographical Constraints	*Convolvulus tedmoorei* is a NSW endemic with only two known collections in NSW (from 1969 and 1971).
Survey Requirement	The suitable habitat identified on site for this species was found to be 3,766.98 ha. Therefore, this species was subject to a two-phase grid-based systematic approach. A grid of 100 m^2 was overlayed over a topographic map of the Subject Land, with a 40 m diameter circle nested within the intersection of each x and y gridline. Surveyors used this grid overlay to target systematic surveys within circles and along grid lines between circles. 10 m wide transects were walked within each grid circle. Parallel field traverses have been carried out within small patches of suitable habitat, such as habitat in the offsite disturbance areas located within Stage 1 – site-based assessment area.
Species-specific Survey Requirements	Surveyor should use the fruit to make a positive identification. Survey should be timed after good rain, to maximise chance of finding identifiable material. Flowering specimens of *Convolvulus tedmoorei* were collected in late winter (August) and early spring (September).
Survey Period	June–September
Survey Group	SG1 and SG2
Surveys Completed	Stage 1 of the two-phased staged approach was carried out across the Stage 1 – Linear and Stage 2 – Linear assessment areas. Parallel field traverses were carried out within the offsite disturbance areas. Approximately 1,780 hours of survey has been completed for SG1 and SG2. A total of 1,863.33 km of transects were walked. Transect width was 10 m wide. Surveys were carried out between: • 3–8 July 2023 • 14–23 August 2023 • 4–23 September 2023 • 17 September 2024.
Weather Conditions	Weather conditions during the survey period for Survey Group 2 were favourable for identifying *Convolvulus tedmoorei*, with substantial rainfall across the locality during a significant La Niña weather event between 2021 and early 2023. The Subject Land was completely inundated with water during December 2022, and was subject above average rainfall over six months of 2023, including June and October. Daily weather conditions for Survey Group 1 and 2 are presented in **Appendix H**.
Comments/Additional Information/Justification of approach	This species was not observed during surveys and this species **has been assessed as not present.**

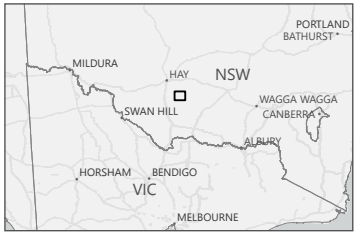
FIGURE 5.7.1

Threatened Flora Surveys
Convolvulus tedmoorei



Legend

- Project Boundary
- Subject Land
- Stage 1 (South) Development Footprint
- Stage 2 (North) Development Footprint
- Conservation Agreement Area
- NPWS Reserves
- Road
- Watercourse
- Survey Area
- Survey Grid
- Threatened Species Transect



0 1,000 2,000

Meters

Scale 1:122,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

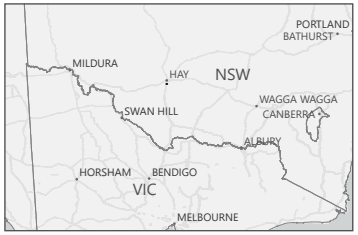
Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

FIGURE 5.7.2

Threatened Flora Surveys
Convolvulus tedmoorei

Legend

- Stage 1 (South) Development Footprint
- Road
- Survey Area
- Threatened Species Transect



0 20 40

Meters

Scale 1:2,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

C:\Users\RachelMeiberan\UMWELT (AUSTRALIA) PTY. LTD\2210 - 03 SWVF R04 - Amended BDAR\02_Projects\2210_R34_AmendedBDAR_Ch5_v2.aprx - 2210_R34_0507_ThreatenedFlora_ConvolvulusTedmoorei

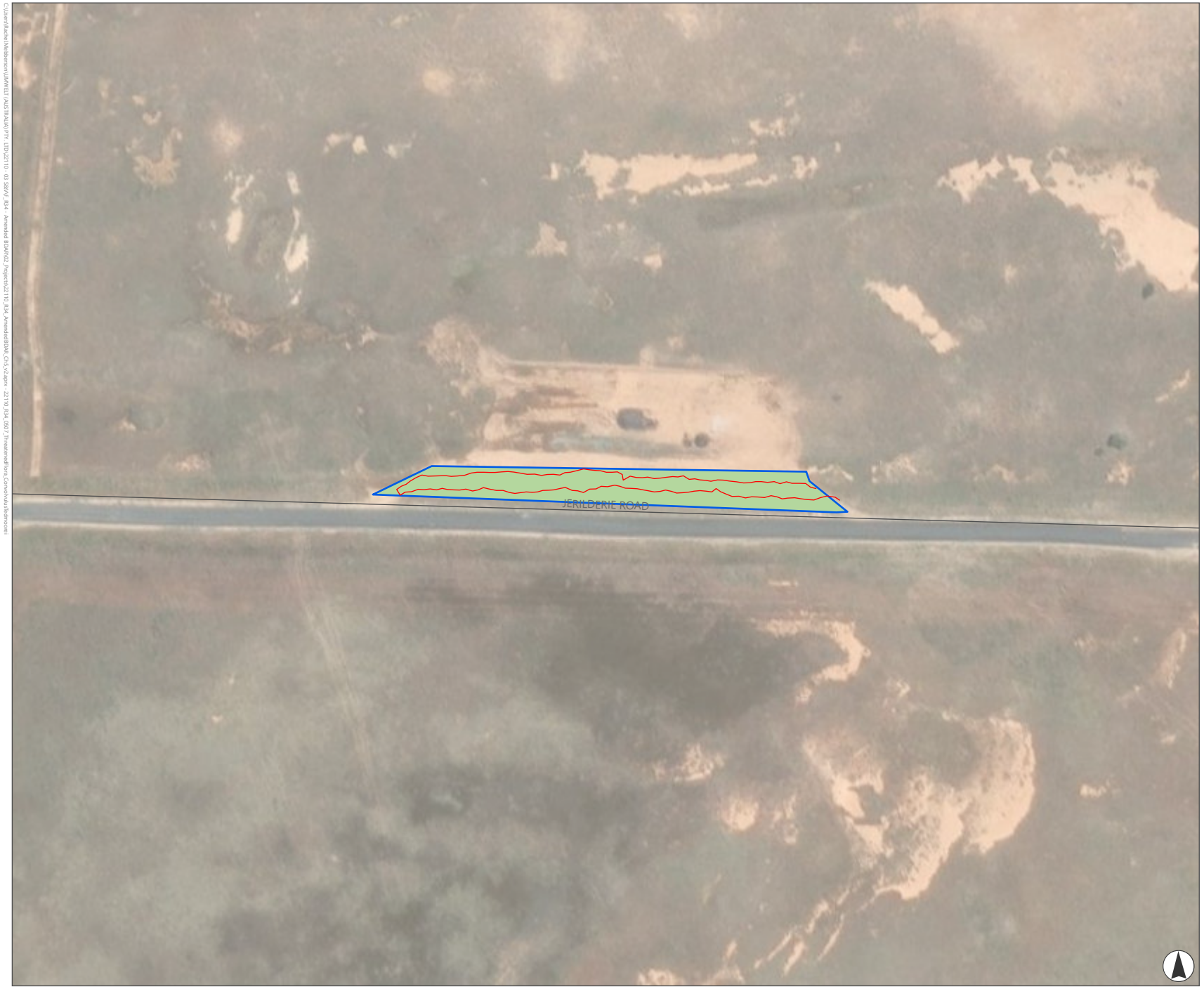
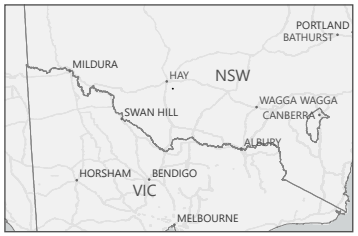


FIGURE 5.7.3

Threatened Flora Surveys
Convolvulus tedmoorei

Legend

- Stage 1 (South) Development Footprint
- Road
- Survey Area
- Threatened Species Transect



0 20 40

Meters

Scale 1:2,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

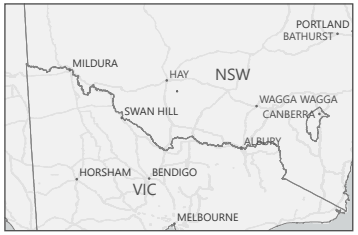
C:\Users\RachelMeibersom\UMWELT (AUSTRALIA) PTY. LTD\2210 - 03 SWVF R44 - Amended BDAR\02_Projects\2210_R34_AmendedBDAR_Ch5_v2.aprx - 2210_R34_(007_ThreatenedFlora_ConvolvulusTedmoorei

FIGURE 5.7.4

Threatened Flora Surveys
Convolvulus tedmoorei

Legend

- Stage 1 (South) Development Footprint
- Road
- Watercourse
- Survey Area
- Threatened Species Transect



0 20 40

Meters

Scale 1:2,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

5.3.4.5 Chariot Wheels (*Maireana cheelii*)

Table 5.13 Detailed Description of Surveys – Chariot Wheels (*Maireana cheelii*)

Survey details – Chariot Wheels (*Maireana cheelii*)	
Habitat Description	Usually found on heavier, grey clay soils with *Atriplex vesicaria*. Recorded on the Hay Plain in *Atriplex vesicaria, Maireana aphylla* and *Acacia homalophylla* shrublands. Soils include heavy brown to red-brown clay-loams, hard cracking red clay, other heavy texture-contrast soils. Tends to grow in shallow depressions, often on eroded or scalded surfaces, and does not extend to the higher soils in the habitat. It has been found on the edges of bare, windswept claypans, in shallow depressions of eroded surfaces where rainwater collects and on a "shelf" in the crabhole complex of heavy grey soils. Associated species include *Atriplex vesicaria, Maireana pentagona, Maireana excavata, Maireana ciliata, Cressa cretica, Avena sp.* and *Acacia homalophylla*.
Associated PCTs/VZs	PCTs: 26, 44, 46, 164 VZs: 5, 6, 9, 10, 12
Habitat or Geographical Constraints	Habitat constraints - Heavy grey clay soils and claypans or shallow depressions Geographical constraints - West of Darlington Point, West of Jerilderie Restricted to the southern Riverina region of NSW, mainly in the area between Deniliquin and Hay. Also has a limited distribution in Victoria where very rare. NSW collections have mainly been from the Moulamein, Deniliquin and Hay districts, including Tchelery and Zara Stations. There is an outlying record from "Wangareena east of Wanaaring".
Survey Requirement	The suitable habitat identified on site for this species was found to be 3,720.33 ha. Therefore, this species was subject to a two-phase grid-based systematic approach. Initially, a grid of 100 m^2 was overlayed over a topographic map of the Subject Land, with a 40 m diameter circle nested within the intersection of each x and y gridline. Surveyors used this grid overlay to target systematic surveys within circles and along grid lines between circles. 10 m wide transects were walked within each grid circle. Following the identification of the species during the Stage 1 of the two-phased grid-based approach, the Stage 2 of two-phased approach was carried out within areas of the Subject Land that fell within a 500 m buffer around known *Maireana cheelii* records. A fine-scale grid of 10 m^2 was overlayed over a topographic map of the Subject Land, with a 4 m diameter circle nested within the intersection of each x and y gridline. Surveyors initially used this grid to inform systematic surveys, however, this approach was deemed impractical given the inherent accuracy of the GPS in mobile devices (3–4 m at best) when compared to size of the grid circles. Given the grids circles were spaced at 10 m widths, and consistent with the parallel field traverse approach for 'forbs' as detailed within Section 4.1 of DPIE 2020, surveyors carried out targeted surveys consisting of 10 m-wide parallel field traverses. Given the grid circles are spaced at 10 m widths, parallel field traverses at 10 m-wide were considered to provide to adequate coverage. Parallel field traverses have been carried out within small patches of suitable habitat, such as habitat in the offsite disturbance areas located within Stage 1 – site-based assessment area.
Species-specific Survey Requirements	N/A
Survey Period	September–December
Survey Group	SG2

Survey details – Chariot Wheels (*Maireana cheelii*)	
Surveys Completed	Stage 1 of the two-phased staged approach was carried out across the Stage 1 – Linear and Stage 2 – Linear assessment areas. Parallel field traverses were carried out within offsite disturbance areas. Approximately 1,260 hours of survey has been completed for SG2. A total of 1,226.79 km of transects were walked. Transect width was 10 m wide. Stage 2 of the two-phase staged approach was carried out as parallel field traverses across the Stage 1 – Linear and Stage 2 – Linear assessment areas, within 500 m of records found during Stage 1. Targeted surveys were conducted as part of the Projects RtS. Approximately 860 hours of survey has been completed for Stage 2 surveys. A total of 684.80 km of transects were walked. Transect width was 10 m wide. Surveys were carried out between: • 4–23 September 2023 • 17–20 September 2024 • 30 September–3 October 2024 • 15–19 October 2024 • 29 October–2 November 2024 • 26–30 November 2024.
Weather Conditions	Weather conditions during the survey period for Survey Group 2 were favourable for identifying *Maireana cheelii.* Daily weather conditions for Survey Group 2 are presented in **Appendix H**.
Comments/Additional Information/Justification of approach	This species was recorded during surveys therefore has been **assessed as present.** Confirmation of species identification from Royal Botanic Gardens herbarium is provided in **Appendix L**.

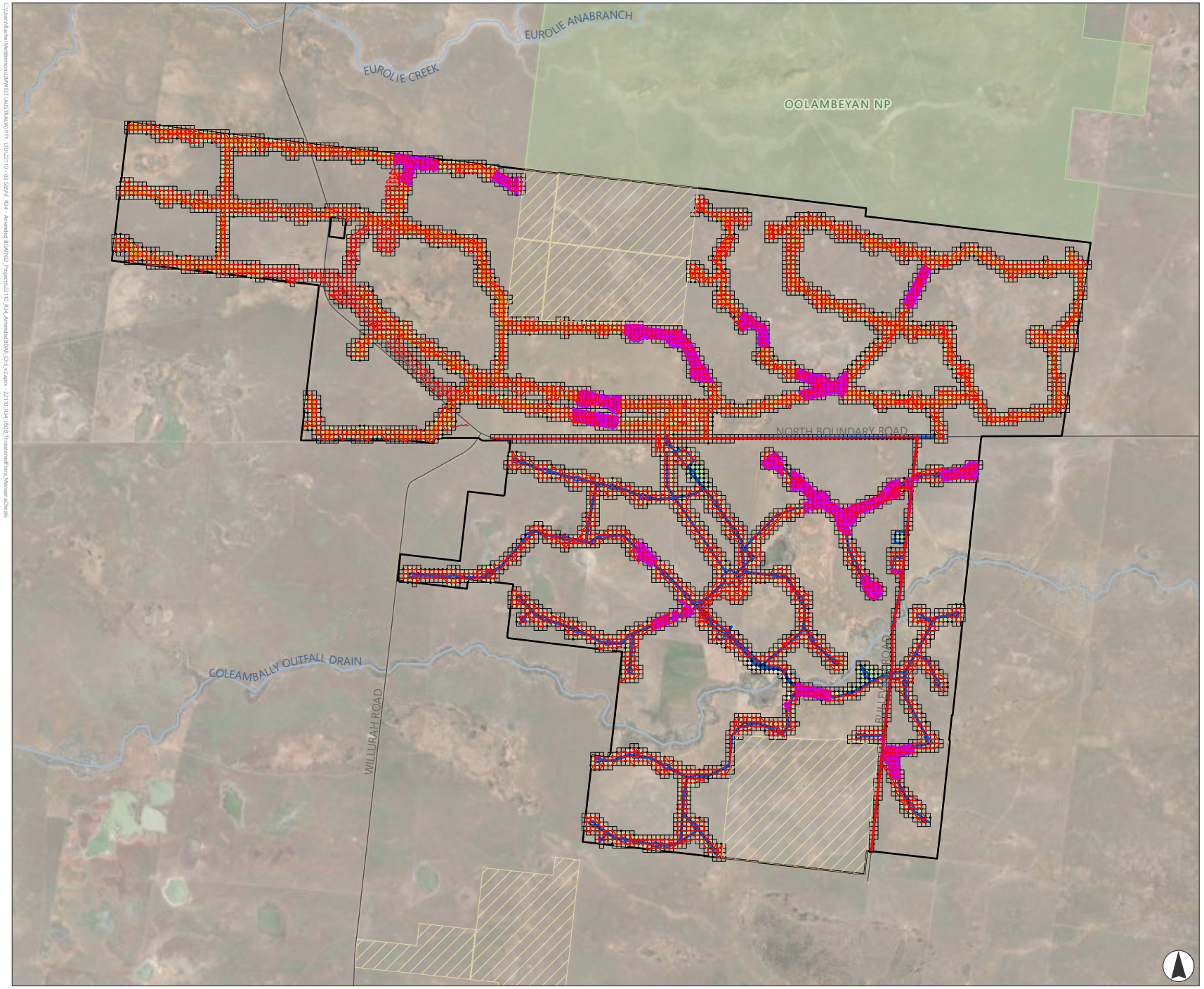
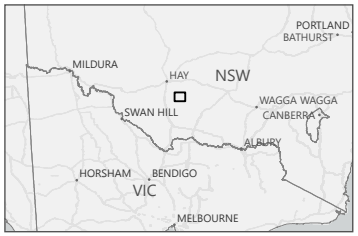


Figure 5.8.1

Threatened Flora Surveys
Marieana cheelii

Legend

- Project Boundary
- Subject Land
- Stage 1 (South) Development Footprint
- Stage 2 (North) Development Footprint
- Conservation Agreement Area
- NPWS Reserves
- Road
- Watercourse
- Survey Area
- Survey Grid
- Threatened Species Transect (Stage 1 Surveys)
- Threatened Species Transect (Stage 2 Surveys)



0 1,000 2,000

Meters

Scale 1:122,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

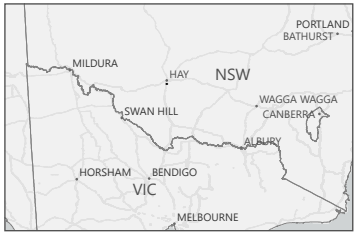
Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

Figure 5.8.2

Threatened Flora Surveys
Marieana cheelii

Legend

- Stage 1 (South) Development Footprint
- Road
- Survey Area
- Threatened Species Transect (Stage 1 Surveys)



0 20 40

Meters

Scale 1:2,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

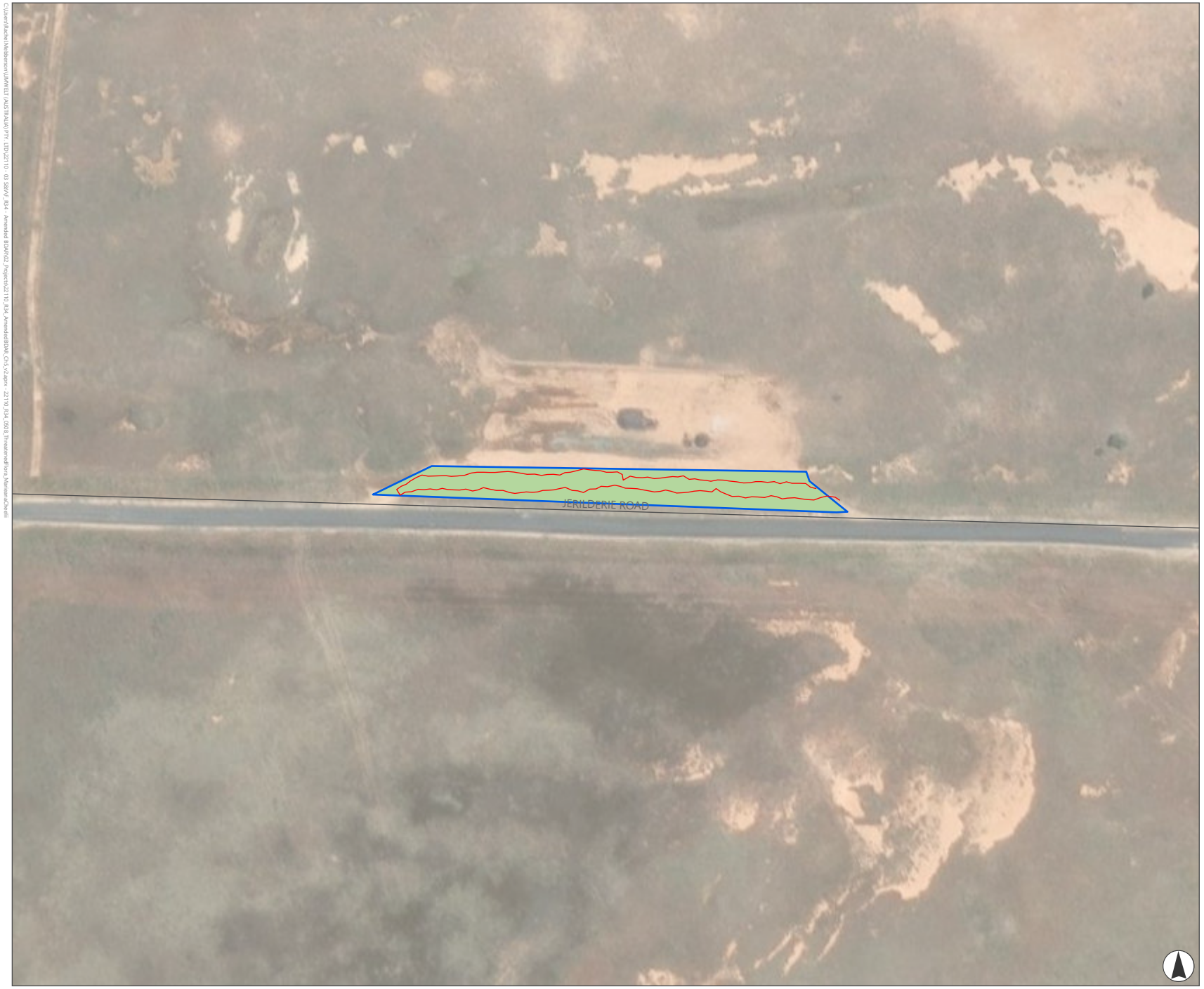
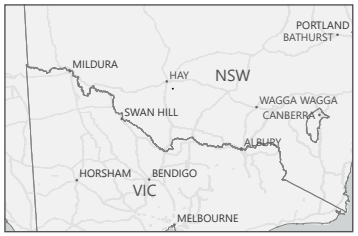


Figure 5.8.3

Threatened Flora Surveys
Marieana cheelii

Legend

- Stage 1 (South) Development Footprint
- Road
- Survey Area
- Threatened Species Transect (Stage 1 Surveys)



0 20 40

Meters

Scale 1:2,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

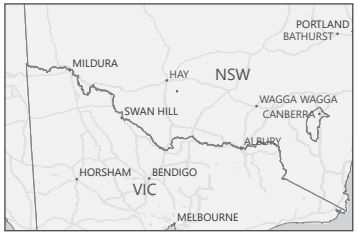
C:\Users\RachelMeibersom\UMWELT (AUSTRALIA) PTY. LTD\2210 - 03 SWVF R04 - Amended BDAR\02_Projects\2210_R34_AmendedBDAR_Ch5_v2.aprx - 2210_R34_(003)_ThreatenedFlora_MarieanaCheelii

Figure 5.8.4

Threatened Flora Surveys
Marieana cheelii

Legend

- Stage 1 (South) Development Footprint
- Road
- Watercourse
- Survey Area
- Threatened Species Transect (Stage 1 Surveys)



0 20 40

Meters

Scale 1:2,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

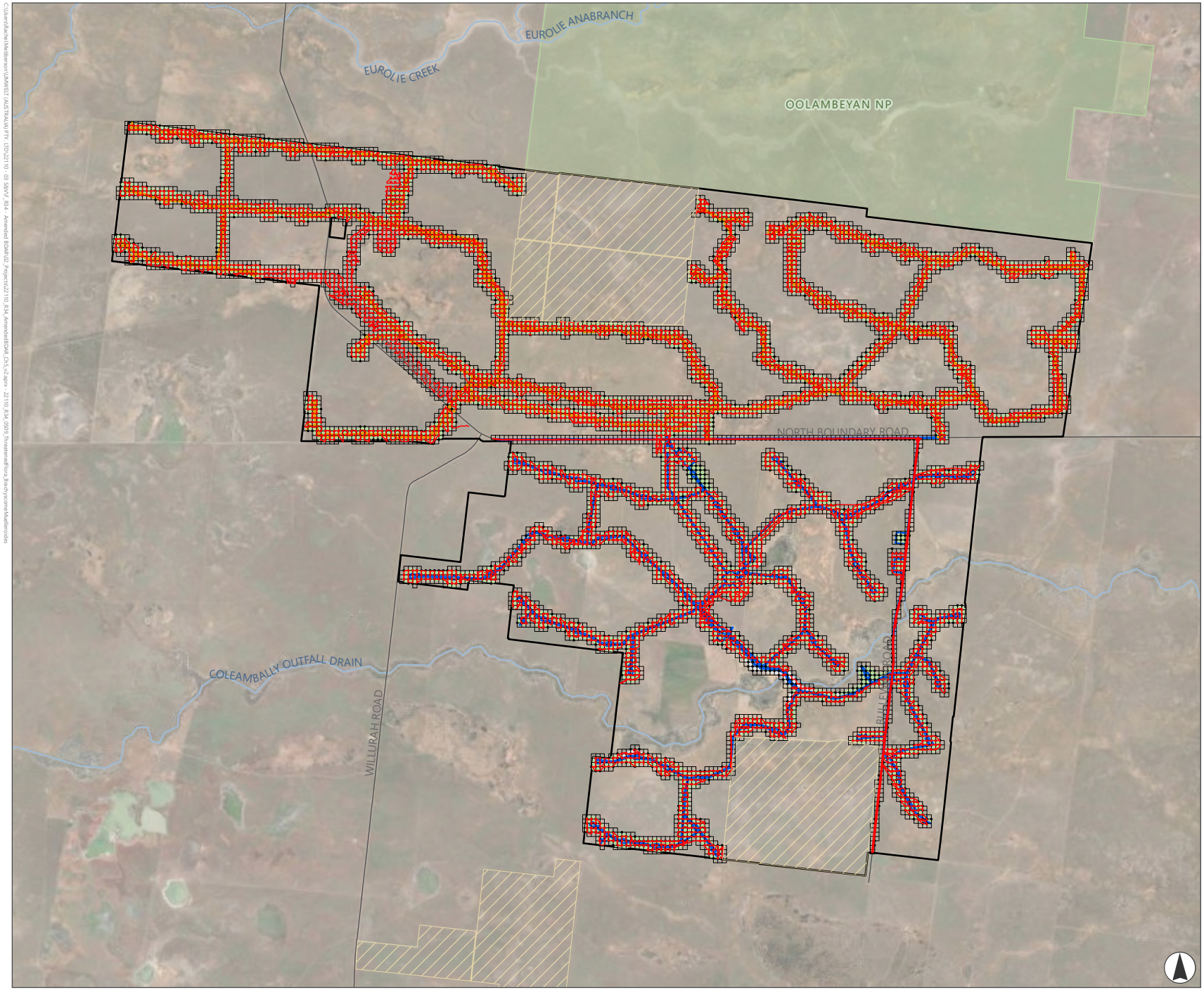
5.3.4.6 Claypan Daisy (*Brachyscome muelleroides*)

Table 5.14 Detailed Description of Surveys – Claypan Daisy (*Brachyscome muelleroides*)

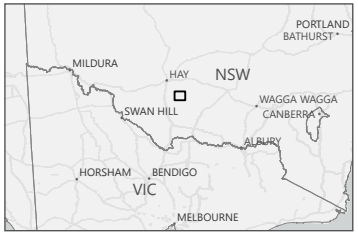
Survey details – Claypan Daisy (*Brachyscome muelleroides*)	
Habitat Description	Usually found on heavier, grey clay soils with *Atriplex vesicaria*. Recorded on the Hay Plain in *Atriplex vesicaria, Maireana aphylla* and *Acacia homalophylla* shrublands. Soils include heavy brown to red-brown clay-loams, hard cracking red clay, other heavy texture-contrast soils. Tends to grow in shallow depressions, often on eroded or scalded surfaces, and does not extend to the higher soils in the habitat. It has been found on the edges of bare, windswept claypans, in shallow depressions of eroded surfaces where rainwater collects and on a "shelf" in the crabhole complex of heavy grey soils. Associated species include *Atriplex vesicaria, Maireana pentagona, Maireana excavata, Maireana ciliata, Cressa cretica, Avena sp.* and *Acacia homalophylla*. The species is never common, with small, localised occurrences in scattered localities. It has been recorded as common, dense and very abundant in its localised populations.
Associated PCTs/VZs	PCTs: 44, 46 VZs: 9, 10
Habitat or Geographical Constraints	Habitat constraints – Floodplains on grey-brown or red-brown clays and claypans, and semi-permanent/ephemeral wet areas. Geographic constraints - East of the Cobb Highway and south of Griffith.
Survey Requirement	The suitable habitat identified on site for this species was found to be 3,309.68 ha. Therefore, this species was subject to a two-phase grid-based systematic approach. A grid of 100 m^2 was overlayed over a topographic map of the Subject Land, with a 40 m diameter circle nested within the intersection of each x and y gridline. Surveyors used this grid overlay to target systematic surveys within circles and along grid lines between circles. 10 m wide transects were walked within each grid circle. Parallel field traverses have been carried out within small patches of suitable habitat, such as habitat in the offsite disturbance areas located within Stage 1 – site-based assessment area.
Species-specific Survey Requirements	N/A
Survey Period	September–November
Survey Group	SG2
Surveys Completed	Stage 1 of the two-phased staged approach was carried out across the Stage 1 – Linear and Stage 2 – Linear assessment areas. Parallel field traverses were carried out within offsite disturbance areas. Approximately 1,260 hours of survey has been completed for SG2. A total of 1,227.77 km of transects were walked. Transect width was 10 m wide. Surveys were carried out between: • 4–23 September 2023 • 17 September 2024 • 30–31 October 2024.
Weather Conditions	Weather conditions during the survey period for Survey Group 2 were favourable for identifying *Brachyscome muelleroides*. Daily weather conditions for Survey Group 2 are presented in **Appendix H**.
Comments/Additional Information/ Justification of approach	This species was not observed during surveys and this species has been **assessed as not present.**

FIGURE 5.9.1

Threatened Flora Surveys
Brachyscome muelleroides



Legend
- Project Boundary
- Subject Land
- Stage 1 (South) Development Footprint
- Stage 2 (North) Development Footprint
- Conservation Agreement Area
- NPWS Reserves
- Road
- Watercourse
- Survey Area
- Survey Grid
- Threatened Species Transect



0 1,000 2,000

Meters

Scale 1:122,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

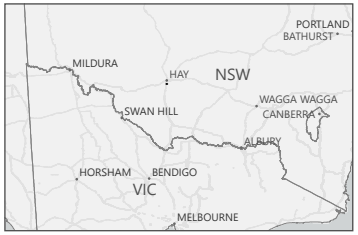
Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

FIGURE 5.9.2

Threatened Flora Surveys
Brachyscome muelleroides

Legend

- Stage 1 (South) Development Footprint
- Road
- Survey Area
- Threatened Species Transect



0 20 40

Meters

Scale 1:2,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

C:\Users\RachelMeiberg\UMWELT (AUSTRALIA) PTY. LTD\22110 - 03 S8(V) F R4 - Amended BDAR\02_Projects\22110_R34_AmendedBDAR_Ch5_v2.aprx - 22110_R34_(0503_ThreatenedFlora_BrachyscomeMuelleroides

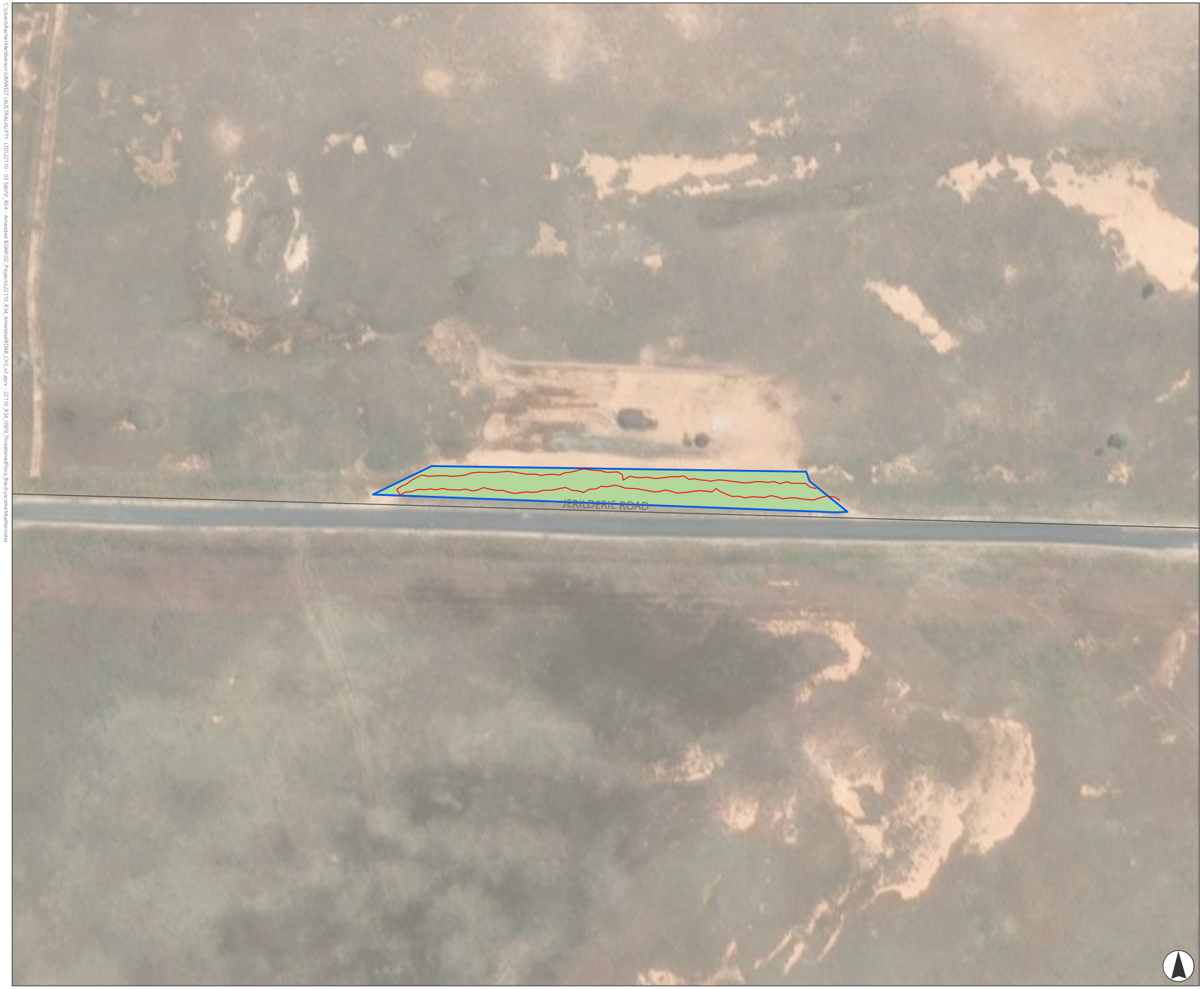
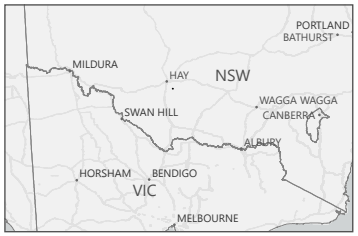


FIGURE 5.9.3

Threatened Flora Surveys
Brachyscome muelleroides

Legend

- Stage 1 (South) Development Footprint
- Road
- Survey Area
- Threatened Species Transect



0 20 40

Meters

Scale 1:2,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

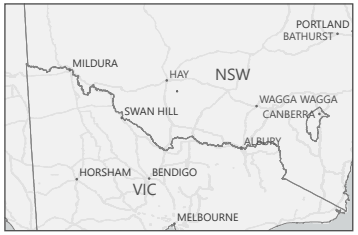
Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

FIGURE 5.9.4

Threatened Flora Surveys
Brachyscome muelleroides

Legend

- Stage 1 (South) Development Footprint
- Road
- Watercourse
- Survey Area
- Threatened Species Transect



0 20 40

Meters

Scale 1:2,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

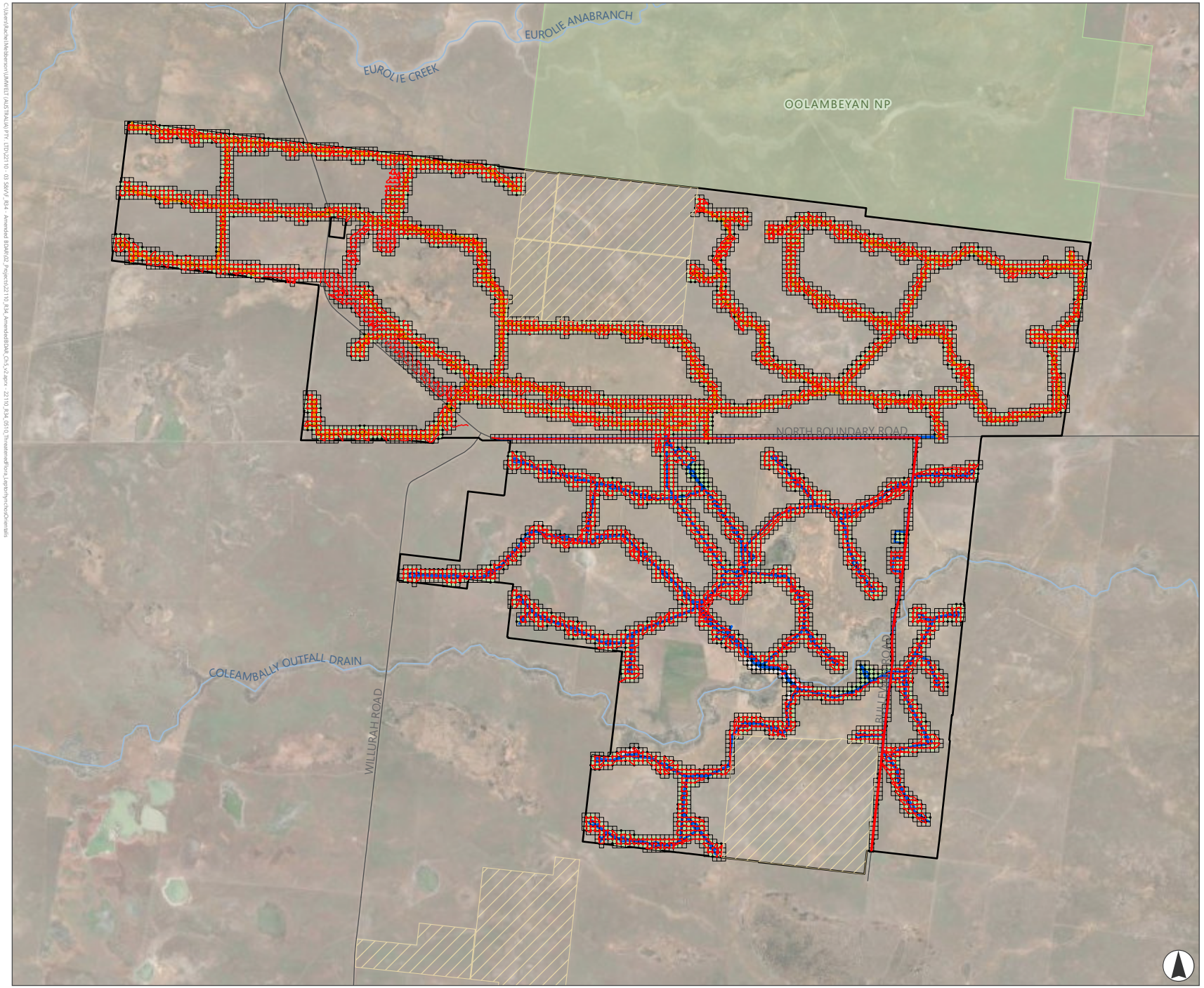
5.3.4.7 Lanky Buttons (*Leptorhynchos orientalis*)

Table 5.15 Detailed Description of Surveys – Lanky Buttons (*Leptorhynchos orientalis*)

Survey details – Lanky Buttons (*Leptorhynchos orientalis*)	
Habitat Description	Grows in woodland or grassland, sometimes on the margins of swamps. Communities include a Bimble Box plain in red-brown soil, dense *Acacia pendula* woodland with herbaceous understorey on red clay to clay-loam, open grassland areas on red soils, and red clay plains at the edge of a Canegrass swamp. Associated species include *Eucalyptus populnea* ssp. *bimbil, Acacia pendula, Eragrostis australasica, Lepidium monoplocoides, Enchylaena tomentosa, Minuria leptophylla, Rhodanthe floribunda, Rhodanthe pygmaea* and *Ptilotus spathulatus*. Recorded as rare and locally occasional in populations.
Associated PCTs/VZs	PCTs: 24, 26, 44, 46 VZs: 4, 5, 6, 9, 10
Habitat or Geographical Constraints	Recorded from several Hay Plain and southern Riverina localities, including Willanthry east of Hillston, Zara-Wanganella via Hay, McKinley Road SW of Hillston, and "Morundah" navy land west of Buckingbong State Forest. A large population has most recently been recorded from Cowl Cowl Station SSW of Hillston along a Travelling Stock Reserve.
Survey Requirement	The suitable habitat identified on site for this species was found to be 3,434.45 ha. Therefore, this species was subject to a two-phase grid-based systematic approach. A grid of 100 m^2 was overlayed over a topographic map of the Subject Land, with a 40 m diameter circle nested within the intersection of each x and y gridline. Surveyors used this grid overlay to target systematic surveys within circles and along gridlines between circles. 10 m wide transects were walked within each grid circle. Parallel field traverses have been carried out within small patches of suitable habitat, such as habitat in the offsite disturbance areas located within Stage 1 – site-based assessment area.
Species-specific Survey Requirements	N/A
Survey Period	September–November
Survey Group	SG2
Surveys Completed	Stage 1 of the two-phased staged approach was carried out across the Stage 1 – Linear and Stage 2 – Linear assessment areas. Parallel field traverses were carried out within offsite disturbance areas. Approximately 1,260 hours of survey has been completed for SG2. A total of 1,227.77 km of transects were walked. Transect width was 10 m wide. Surveys were carried out between: • 4 and 23 September 2023 • 17 September 2024 • 30–31 October 2024.
Weather Conditions	Weather conditions during the survey period for Survey Group 2 were favourable for identifying *Leptorhynchos orientalis*. Daily weather conditions for Survey Group 2 are presented in **Appendix H**.
Comments/Additional Information/Justification of approach	This species was not observed during surveys and this species has been **assessed as not present.**

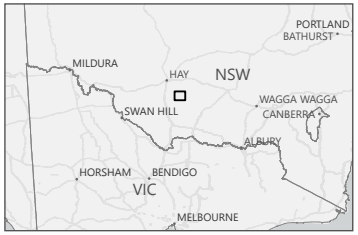
FIGURE 5.10.1

Threatened Flora Surveys
Leptorhynchos orientalis



Legend

- Project Boundary
- Subject Land
- Stage 1 (South) Development Footprint
- Stage 2 (North) Development Footprint
- Conservation Agreement Area
- NPWS Reserves
- Road
- Watercourse
- Survey Area
- Survey Grid
- Threatened Species Transect



0 1,000 2,000

Meters

Scale 1:122,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

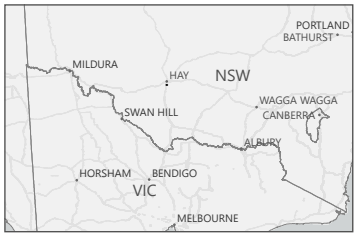
Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

FIGURE 5.10.2

Threatened Flora Surveys
Leptorhynchos orientalis

Legend

- Stage 1 (South) Development Footprint
- Road
- Survey Area
- Threatened Species Transect



0 20 40

Meters

Scale 1:2,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

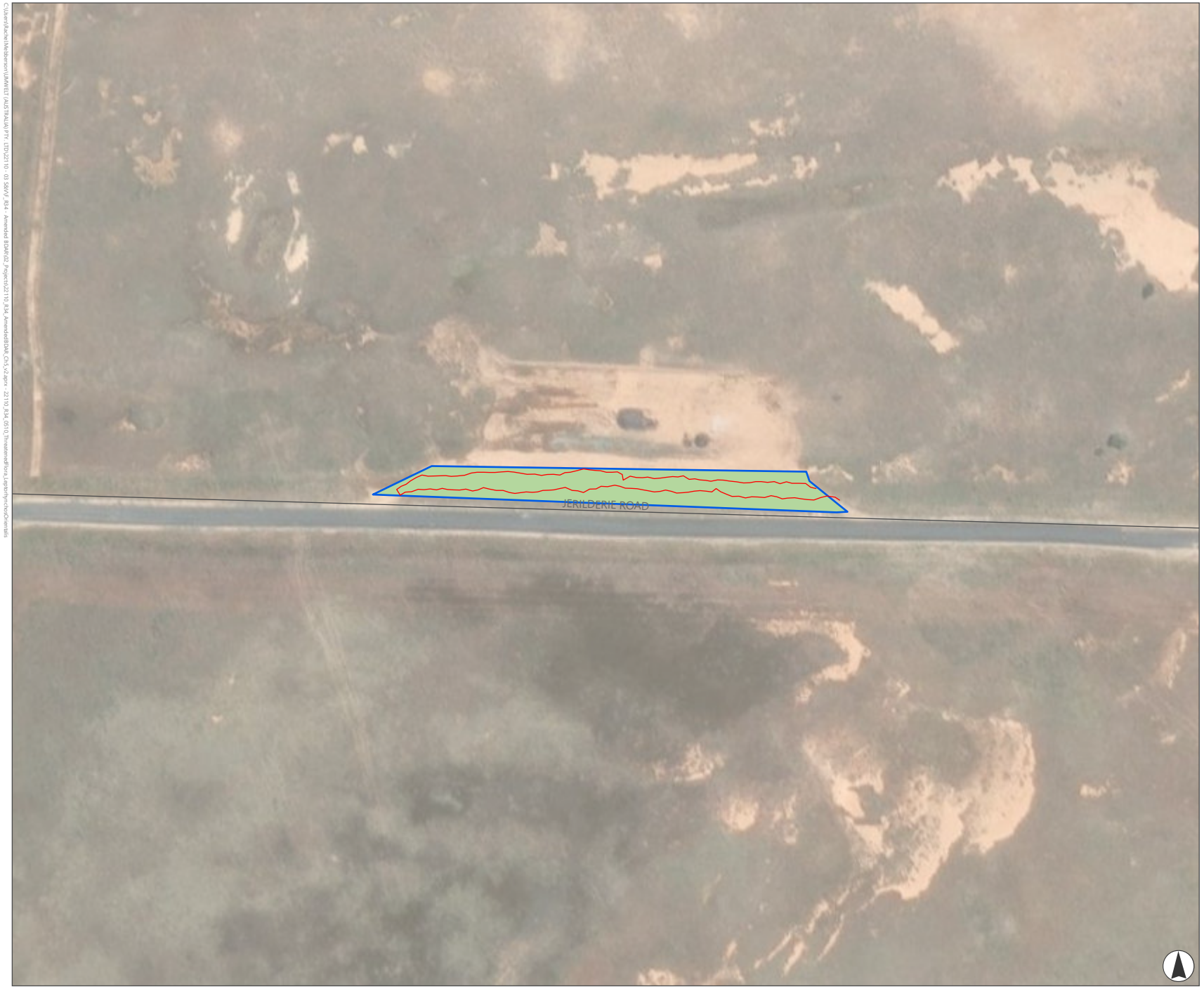
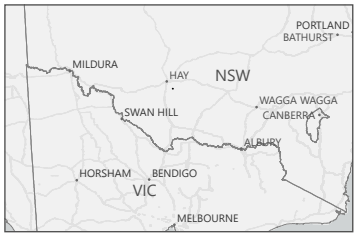


FIGURE 5.10.3

Threatened Flora Surveys
Leptorhynchos orientalis

Legend

- Stage 1 (South) Development Footprint
- Road
- Survey Area
- Threatened Species Transect



0 20 40

Meters

Scale 1:2,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

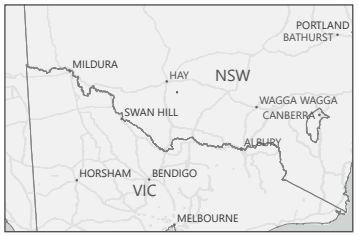
Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

FIGURE 5.10.4

Threatened Flora Surveys
Leptorhynchos orientalis

Legend

- Stage 1 (South) Development Footprint
- Road
- Watercourse
- Survey Area
- Threatened Species Transect



0 20 40

Meters

Scale 1:2,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

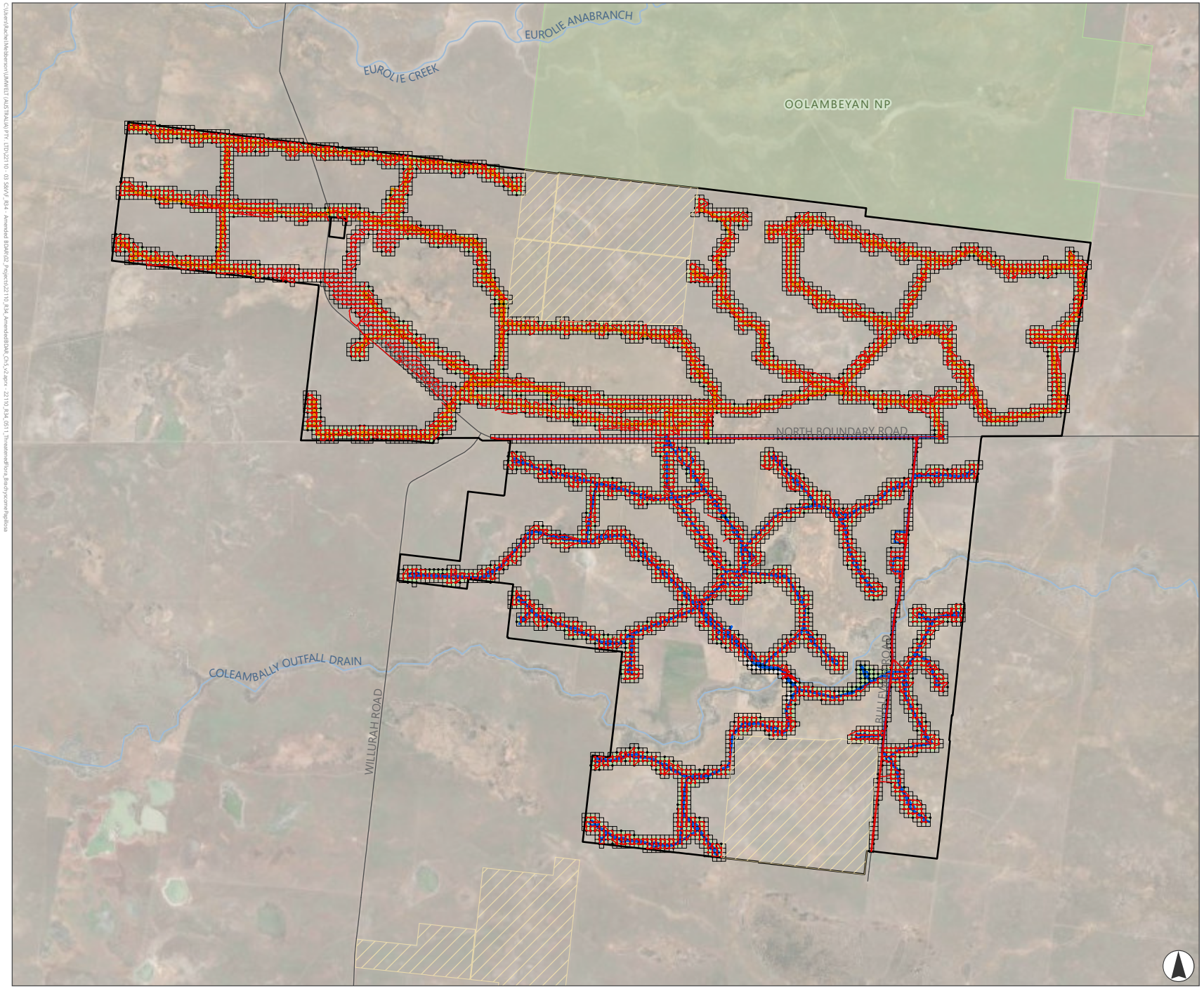
5.3.4.8 Mossgiel Daisy (*Brachyscome papillosa*)

Table 5.16 Detailed Description of Surveys – Mossgiel Daisy (*Brachyscome papillosa*)

Survey details – Mossgiel Daisy (*Brachyscome papillosa*)	
Habitat Description	Recorded primarily in clay soils on *Atriplex vesicaria* and *Maireana aphylla* plains, but also in grassland and in *Eucalyptus microcarpa* - *Callitris* spp. woodland.
Associated PCTs/VZs	PCTs: 13, 24, 44, 46, 160, 164 VZs: 2, 4, 9, 10, 11, 12
Habitat or Geographical Constraints	*Brachyscome papillosa* is endemic to NSW and chiefly occurs within the Riverina Bioregion, from Mossgiel in the north, Murrumbidgee Valley (Yanga) National Park in the south west to Urana in the south east. Sites are scattered across this Bioregion including the Jerilderie area, the Hay Plain (Maude and Oxley) and around Darlington Point. In addition, there are a number of records from the Willandra Lakes World Heritage Area (including Mungo National Park) with a north-western outlier at Byrnedale Station, north of Menindee. The only known site on South Western Slopes is Ganmain Reserve.
Survey Requirement	The suitable habitat identified on site for this species was found to be 3,634.49 ha. Therefore, this species was subject to a two-phase grid-based systematic approach. A grid of 100 m^2 was overlayed over a topographic map of the Subject Land, with a 40 m diameter circle nested within the intersection of each x and y gridline. Surveyors used this grid overlay to target systematic surveys within circles and along grid lines between circles. 10 m wide transects were walked within each grid circle. Parallel field traverses have been carried out within small patches of suitable habitat, such as habitat in the offsite disturbance areas located within Stage 1 – site-based assessment area.
Species-specific Survey Requirements	N/A
Survey Period	September–November
Survey Group	SG3
Surveys Completed	Stage 1 of the two-phased staged approach was carried out across the Stage 1 – Linear and Stage 2 – Linear assessment areas. Parallel field traverses were carried out within offsite disturbance areas. Approximately 1,510 hours of survey has been completed for SG2. A total of 1,202.98 km of transects were walked. Transect width was 10 m wide. Surveys were carried out between: • 16–25 October 2023 • 30 October–8 November 2023 • 13–29 November 2023 • 17 September 2024 • 30–31 October 2024.
Weather Conditions	Weather conditions during the survey period for Survey Group 3 were favourable for identifying *Brachyscome papillosa.* Daily weather conditions for Survey Group 3 are presented in **Appendix H**.
Comments/Additional Information/Justification of approach	This species was not observed during surveys and this species has been **assessed as not present.**

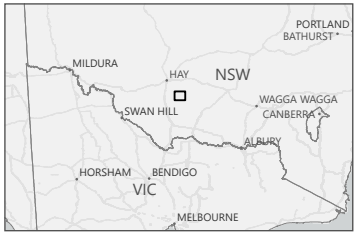
FIGURE 5.11.1

Threatened Flora Surveys
Brachyscome papillosa



Legend

- Project Boundary
- Subject Land
- Stage 1 (South) Development Footprint
- Stage 2 (North) Development Footprint
- Conservation Agreement Area
- NPWS Reserves
- Road
- Watercourse
- Survey Area
- Survey Grid
- Threatened Species Transect



0 1,000 2,000

Meters

Scale 1:122,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

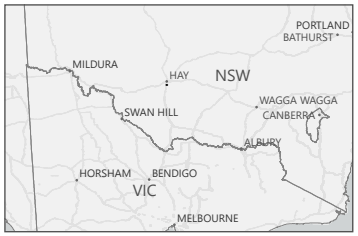
Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

FIGURE 5.11.2

Threatened Flora Surveys
Brachyscome papillosa

Legend

- Stage 1 (South) Development Footprint
- Road
- Survey Area
- Threatened Species Transect



0 20 40

Meters

Scale 1:2,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

C:\Users\RachelMeiberson\UMWELT (AUSTRALIA) PTY. LTD\2210 - 03 SWVF R44 - Amended BDAR\02_Projects\2210_R34_AmendedBDAR_Ch5_v2.aprx - 2210_R34_051_ThreatenedFlora_BrachyscomePapillosa

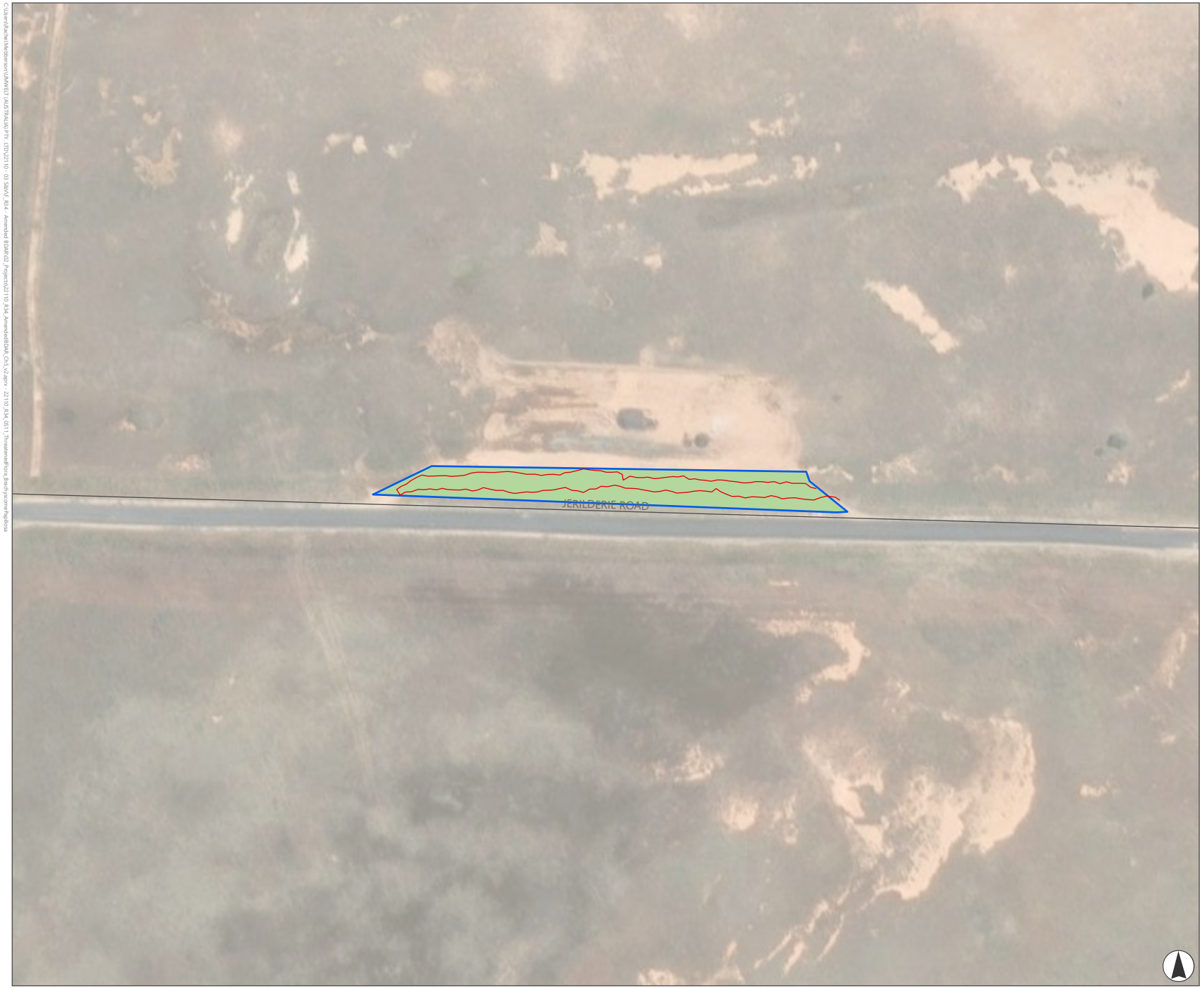
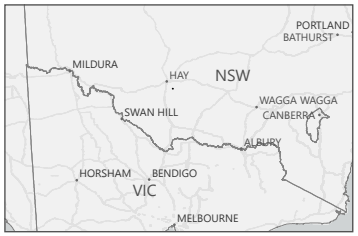


FIGURE 5.11.3

Threatened Flora Surveys
Brachyscome papillosa

Legend

- Stage 1 (South) Development Footprint
- Road
- Survey Area
- Threatened Species Transect



0 20 40

Meters

Scale 1:2,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

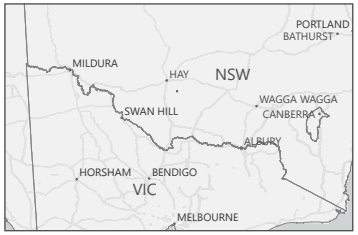
C:\Users\RachelMebberson\UMWELT (AUSTRALIA) PTY. LTD\2210 - 03 SWVF R44 - Amended BDAR\02_Projects\22110_R34_AmendedBDAR_Ch5_v2.aprx - 22110_R34_051_ThreatenedFlora_BrachyscomePapillosa

FIGURE 5.11.4

Threatened Flora Surveys
Brachyscome papillosa

Legend

- Stage 1 (South) Development Footprint
- Road
- Watercourse
- Survey Area
- Threatened Species Transect



0 20 40

Meters

Scale 1:2,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

C:\Users\RachelMeiberson\UMWELT (AUSTRALIA) PTY. LTD\2210 - 03 SWJV\ R34 - Amended BDAR\02_Projects\22110_R34_AmendedBDAR_Ch5.v2.aprx - 22110_R34_051_ThreatenedFlora_BrachyscomePapillosa

5.3.4.9 Pine Donkey Orchid (*Diuris tricolor*)

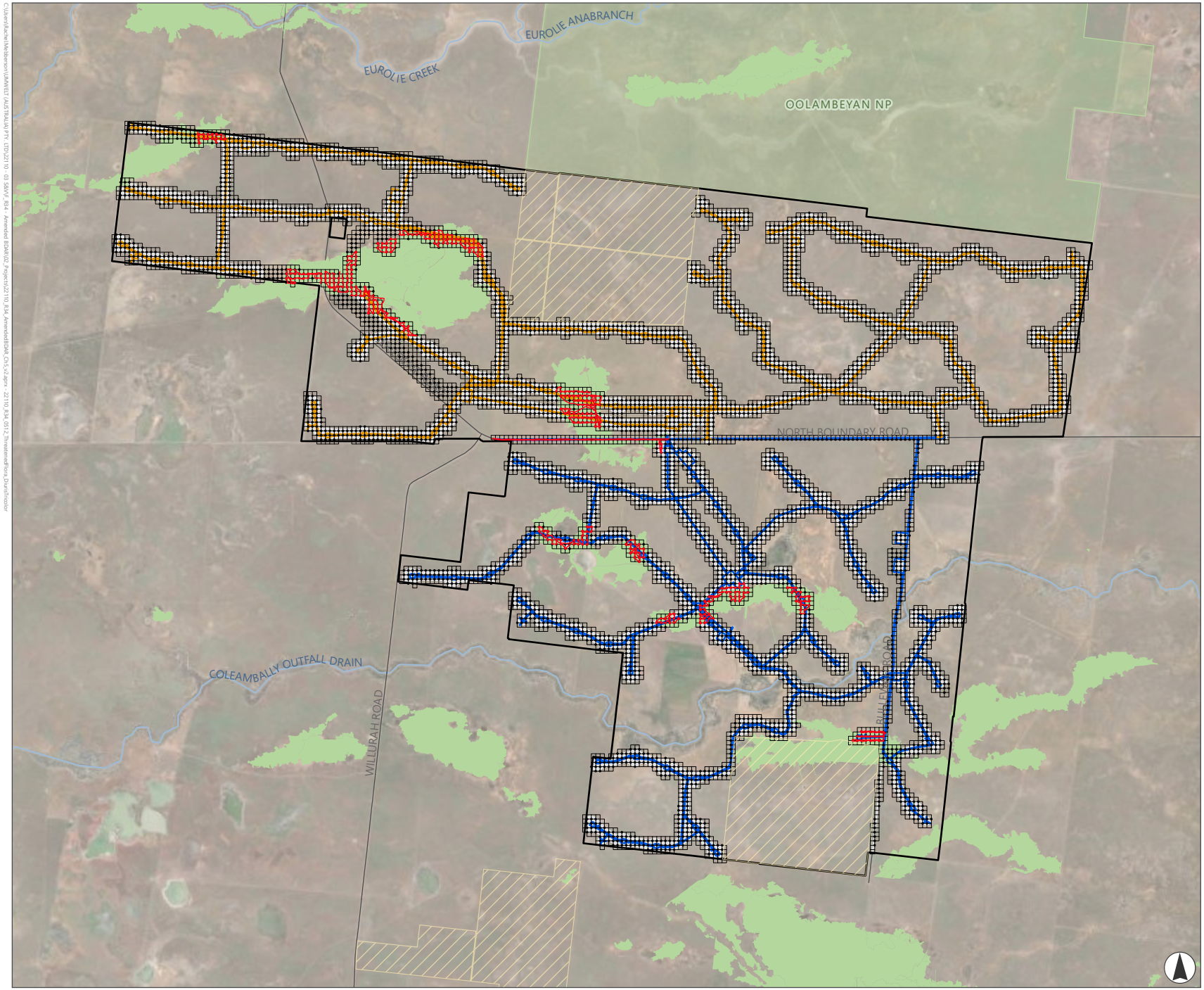
Table 5.17 Detailed Description of Surveys – Pine Donkey Orchid (*Diuris tricolor*)

Survey details – Pine Donkey Orchid *(Diuris tricolor)*	
Habitat Description	The Pine Donkey Orchid grows in sclerophyll forest among grass, often with native Cypress Pine (*Callitris* spp.). It is found in sandy soils, either on flats or small rises. Also recorded from a red earth soil in a Bimble Box community in western NSW. Disturbance regimes are not known, although the species is usually recorded from disturbed habitats. Associated species include *Callitris glaucophylla*, *Eucalyptus populnea*, *Eucalyptus intertexta*, Ironbark and *Acacia* shrubland. The understorey is often grassy with herbaceous plants such as *Bulbine* species. The species has been noted as growing in large colonies.
Associated PCTs/VZs	No associated PCTs present onsite. One PCT (PCT 70) was mapped as being present within the Subject Land at the time the species was surveyed, and both PCT 70 and PCT 28 was surveyed for the species given the similar floristic composition of the PCTs. Subsequent updates to vegetation mapping following data analysis refined PCT selection such that PCT 70 was found not to occur within the Subject Land.
Habitat or Geographical Constraints	Sporadically distributed on the western slopes of NSW, extending from south of Narrandera all the way to the north of NSW. Localities in the south include Red Hill north of Narrandera, Coolamon, and several sites west of Wagga Wagga. Condobolin-Nymagee road, Wattamondara towards Cowra, Eugowra, Girilambone, Dubbo and Cooyal, in the Central West. Pilliga SCA, Pilliga National Park and Bibblewindi State Forest in the north (and extending into Queensland) and Muswellbrook in the east.
Survey Requirement	The suitable habitat identified on site for this species was found to be 484.75 ha. Therefore, this species was subject to a two-phase grid-based systematic approach. A grid of 100 m2 was overlayed over a topographic map of the Subject Land, with a 40 m diameter circle nested within the intersection of each x and y gridline. Surveyors used this grid overlay to target systematic surveys within circles and along gridlines between circles. 10 m wide transects were walked within each grid circle. Parallel field traverses have been carried out within small patches of suitable habitat, such as habitat in the offsite disturbance areas located within Stage 1 – site-based assessment area.
Species-specific Survey Requirements	N/A Reference population at Buckingbong State Forest checked 18 September 2023. Species was seen flowering.
Survey Period	September–October
Survey Group	SG5
Surveys Completed	Stage 1 of the two-phased staged approach was carried out across the Stage 1 – Linear and Stage 2 – Linear assessment areas. Parallel field traverses were carried out within offsite disturbance areas. Approximately 180 hours of survey has been completed for SG5. A total of 110.15 km of transects were walked. Transect width was 10 m wide. Surveys were carried out between: • 16–25 October 2023 • 30 October–8 November 2023 • 13–29 November 2023.
Weather Conditions	Weather conditions during the survey period for SG5 were favourable for identifying *Diuris tricolor.* Daily weather conditions for SG5 are presented in **Appendix H**.

Survey details – Pine Donkey Orchid *(Diuris tricolor)*	
Comments/Additional Information/ Justification of approach	This species was not observed during surveys and this species has been **assessed as not present.**

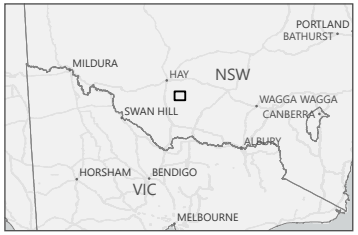
FIGURE 5.12.1

Threatened Flora Surveys
Diuris tricolor



Legend

- Project Boundary
- Subject Land
- Stage 1 (South) Development Footprint
- Stage 2 (North) Development Footprint
- Conservation Agreement Area
- NPWS Reserves
- Road
- Watercourse
- Survey Grid
- Survey Area
- Threatened Species Transect



0 1,000 2,000

Meters

Scale 1:122,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

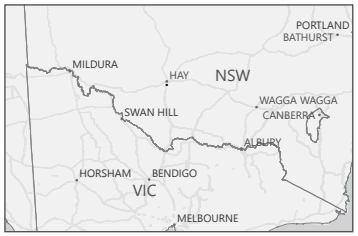
Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

FIGURE 5.12.2

Threatened Flora Surveys
Diuris tricolor

Legend

- Stage 1 (South) Development Footprint
- Road
- Threatened Species Transect



0 20 40

Meters

Scale 1:2,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

C:\Users\RachelMeiberan\UMWELT (AUSTRALIA) PTY. LTD\22110 - 03 S8(V)F - R34 - Amended BDAR\02_Projects\22110_R34_AmendedBDAR_Ch5_v2.aprx - 22110_R34_0512_ThreatenedFlora_DiurisTricolor

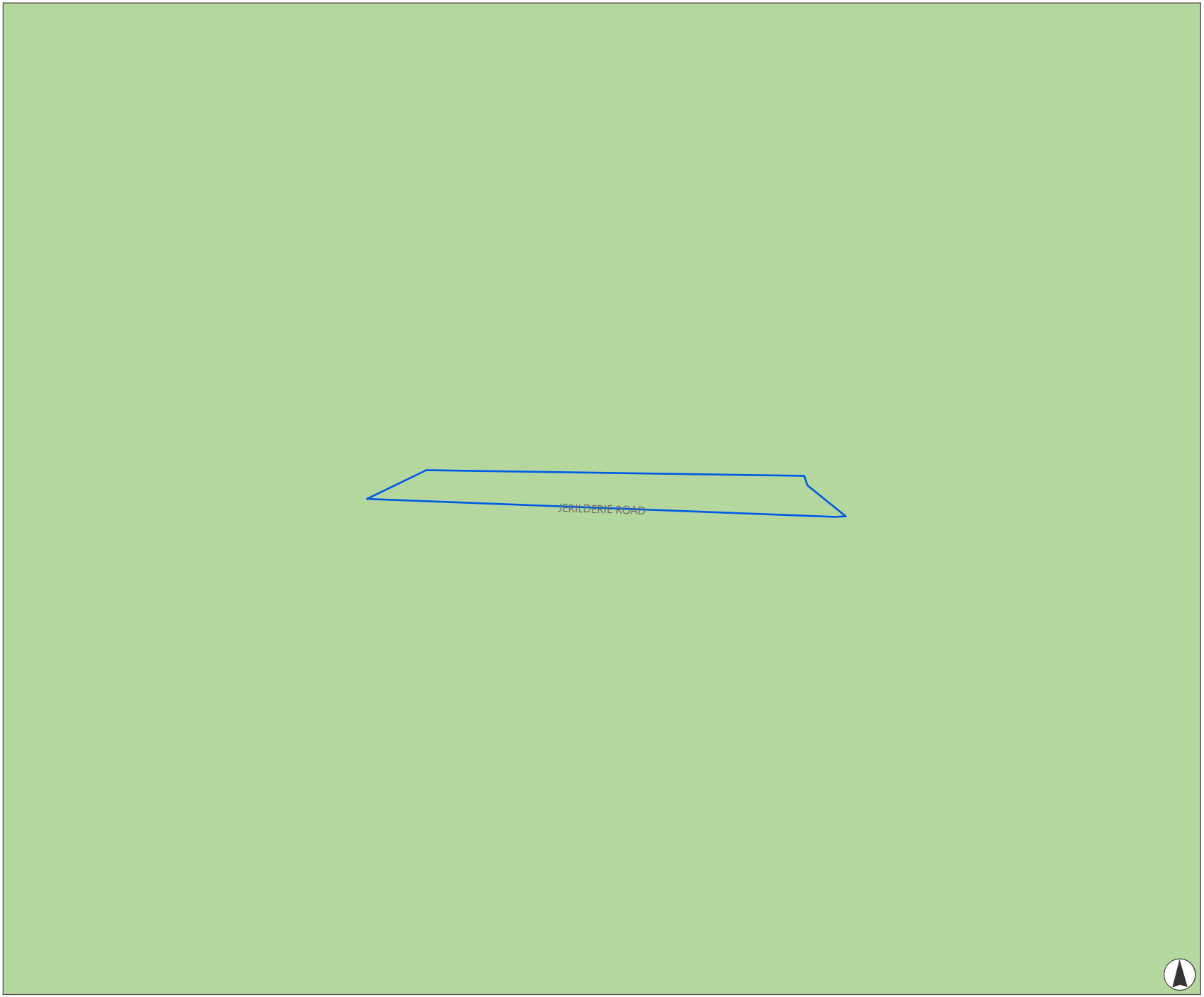
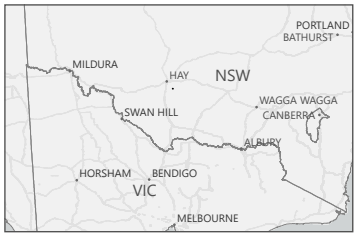


FIGURE 5.12.3

Threatened Flora Surveys
Diuris tricolor

Legend

- Stage 1 (South) Development Footprint
- Road
- Survey Area



0 20 40

Meters

Scale 1:2,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

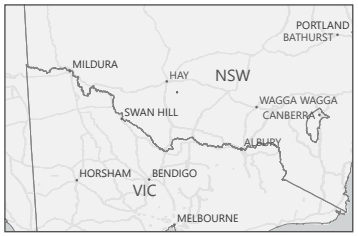
C:\Users\RachelMeibersom\UMWELT (AUSTRALIA) PTY. LTD\22110 - 03 S86VF R04 - Amended BDAR\02_Projects\22110_R34_AmendedBDAR_Ch5_v2.aprx - 22110_R34_0512_ThreatenedFlora_DiurisTricolor

FIGURE 5.12.4

Threatened Flora Surveys
Diuris tricolor

Legend

- Stage 1 (South) Development Footprint
- Road
- Watercourse
- Survey Area



0 20 40

Meters

Scale 1:2,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

C:\Users\RachelMeiberg\on\UMWELT (AUSTRALIA) PTY. LTD\22110 - 03 S86VF R44 - Amended BDAR\02_Projects\22110_R34_AmendedBDAR_Ch5_v2.aprx - 22110_R34_0512_ThreatenedFlora_DiurisTricolor

5.3.4.10 Red Darling Pea (*Swainsona plagiotropis*)

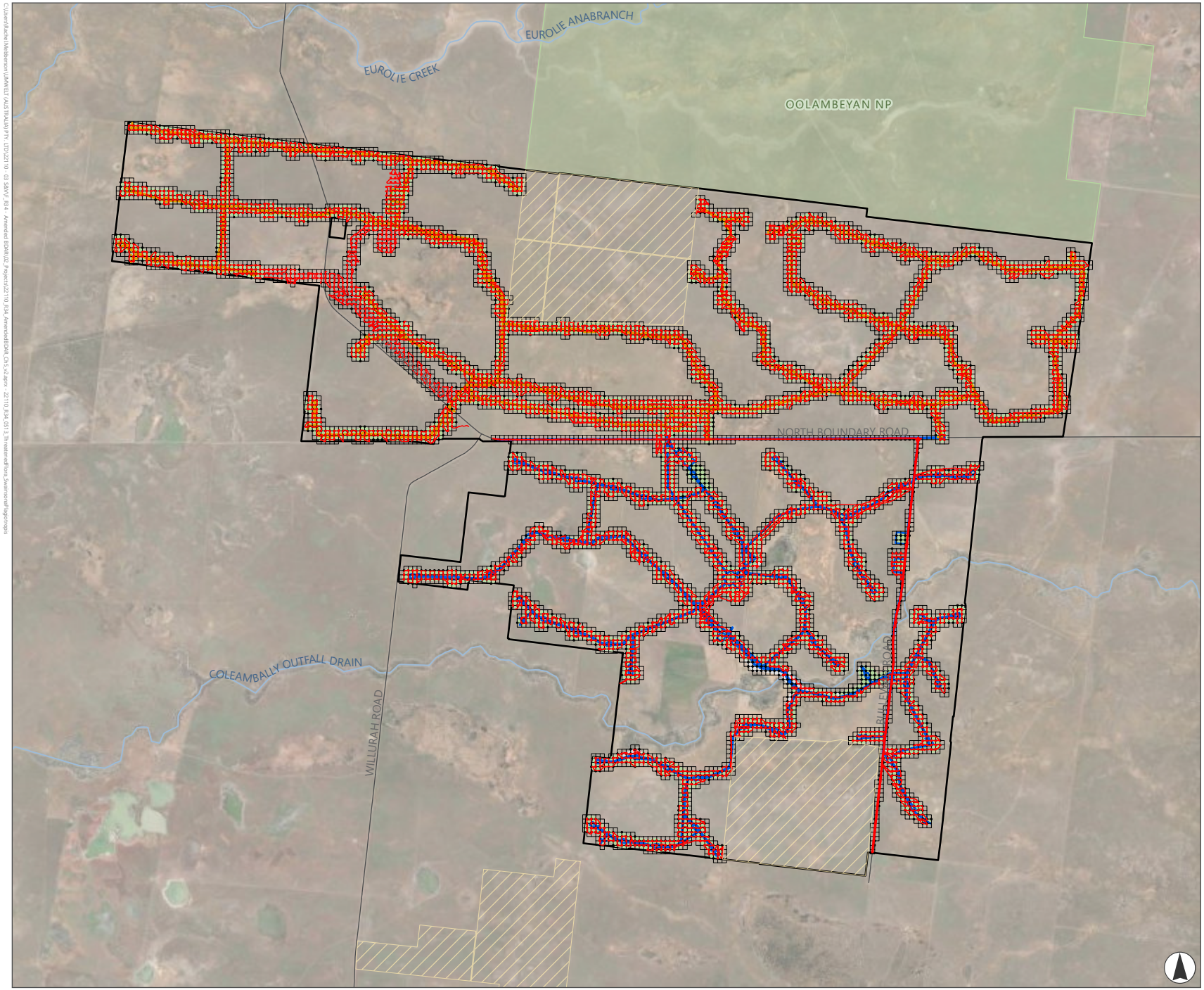
Table 5.18 Detailed Description of Surveys – Red Darling Pea (*Swainsona plagiotropis*)

Survey details – Red Darling Pea (*Swainsona plagiotropis*)	
Habitat Description	Grows on flat grassland and in heavy red soil, often on roadsides and especially in table drains. Soils are derived from quaternary sediments and are usually red-brown clay-loams. The species is absent from black low-lying soils. Recorded from roadsides, rail reserves, stock routes and areas of lightly grazed unimproved pasture comprising *Rytidosperma, Enteropogon acicularis* and *Austrostipa* grassland communities. Associated species include *Austrostipa aristiglumis, Austrostipa nodosa, Austrostipa setacea, Homopholis proluta, Chloris truncata, Austrodanthonia caespitosa, Austrostipa duttoniana, Enteropogon acicularis, Hordeum spp., Lolium rigidum, Rhodanthe corymbiflora, Calotis scabiosifolia, Microseris lanceolata* and *Chrysocephalum apiculatum*. *Swainsona plagiotropis* appears to be an indicator species of *Enteropogon* and *Austrostipa* grasslands, communities which are poorly known and almost extinct. Other significant plants found in these grassland communities include *Sclerolaena napiformis, Swainsona murrayana, Swainsona sericea, Brachyscome chrysoglossa*, *Leptorhynchos panaetioides* and *Maireana excavata.* Populations are variable in size, ranging from a handful of individuals to many thousands. The species is often prolific in good seasons and abundances vary from locally rare to abundant. Collections from the NSW north-western plains were from a population of 100+ plants scattered over 2 ha. Some form of disturbance (for example, light grazing at appropriate times, occasional soil disturbance or periodic fire) appears to be necessary to reduce competition and enhance seedling growth of *Swainsona plagiotropis* within grassy swards.
Associated PCTs/VZs	PCTs: 26, 44, 46 VZs: 5, 6, 9, 10
Habitat or Geographical Constraints	Geographical constraint – Hay Plain Occurs in the upper Murray River valley in the south-western plains of NSW and into Victoria. Most NSW records are from the Jerilderie area, with possible collections from the Louth-Bourke area and a disjunct record in the north-western plains from Buttabone Stud Park 35 km north west of Warren. Also rare in Victoria, restricted to a few sites in the central north, mostly between Bendigo and the Murray River south of Echuca.
Survey Requirement	The suitable habitat identified on site for this species was found to be 3,424.42 ha. Therefore, this species was subject to a two-phase grid-based systematic approach. A grid of 100 m^2 was overlayed over a topographic map of the Subject Land, with a 40 m diameter circle nested within the intersection of each x and y gridline. Surveyors used this grid overlay to target systematic surveys within circles and along grid lines between circles. 10 m wide transects were walked within each grid circle. Parallel field traverses have been carried out within small patches of suitable habitat, such as habitat in the offsite disturbance areas located within Stage 1 – site-based assessment area.
Species-specific Survey Requirements	N/A
Survey Period	September

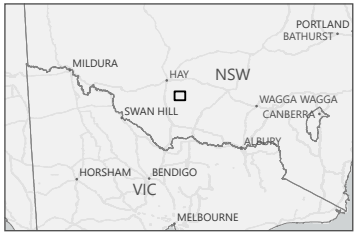
Survey details – Red Darling Pea (*Swainsona plagiotropis*)	
Survey Group	SG2
Surveys Completed	Stage 1 of the two-phased staged approach was carried out across the Stage 1 – Linear and Stage 2 – Linear assessment areas. Parallel field traverses were carried out within offsite disturbance areas. Approximately 1,260 hours of survey has been completed for SG2. A total of 1,226.79 km of transects were walked. Transect width was 10 m wide. Surveys were carried out between 4 and 23 September 2023 and 17 September 2024.
Weather Conditions	Weather conditions during the survey period for Survey Group 2 were favourable for identifying *Swainsona plagiotropis*. Daily weather conditions for Survey Group 2 are presented in **Appendix H**.
Comments/Additional Information/Justification of approach	This species was not observed during surveys and this species has been **assessed as not present.**

FIGURE 5.13.1

Threatened Flora Surveys
Swainsona plagiotropis



Legend
- Project Boundary
- Subject Land
- Stage 1 (South) Development Footprint
- Stage 2 (North) Development Footprint
- Conservation Agreement Area
- NPWS Reserves
- Road
- Watercourse
- Survey Area
- Survey Grid
- Threatened Species Transect



0 1,000 2,000

Meters

Scale 1:122,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

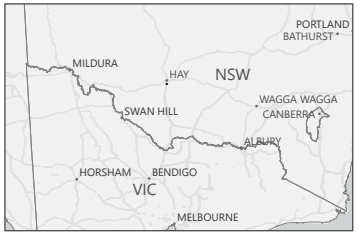
Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

FIGURE 5.13.2

Threatened Flora Surveys
Swainsona plagiotropis

Legend

- Stage 1 (South) Development Footprint
- Road
- Survey Area
- Threatened Species Transect



0 20 40

Meters

Scale 1:2,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

C:\Users\RachelMeiberg\UMWELT (AUSTRALIA) PTY. LTD\22110 - 03 S8(V)F R04 - Amended BDAR\02_Projects\22110_R34_AmendedBDAR_Ch5_v2.aprx - 22110_R34_051_ThreatenedFlora_SwainsonaPlagiotropis

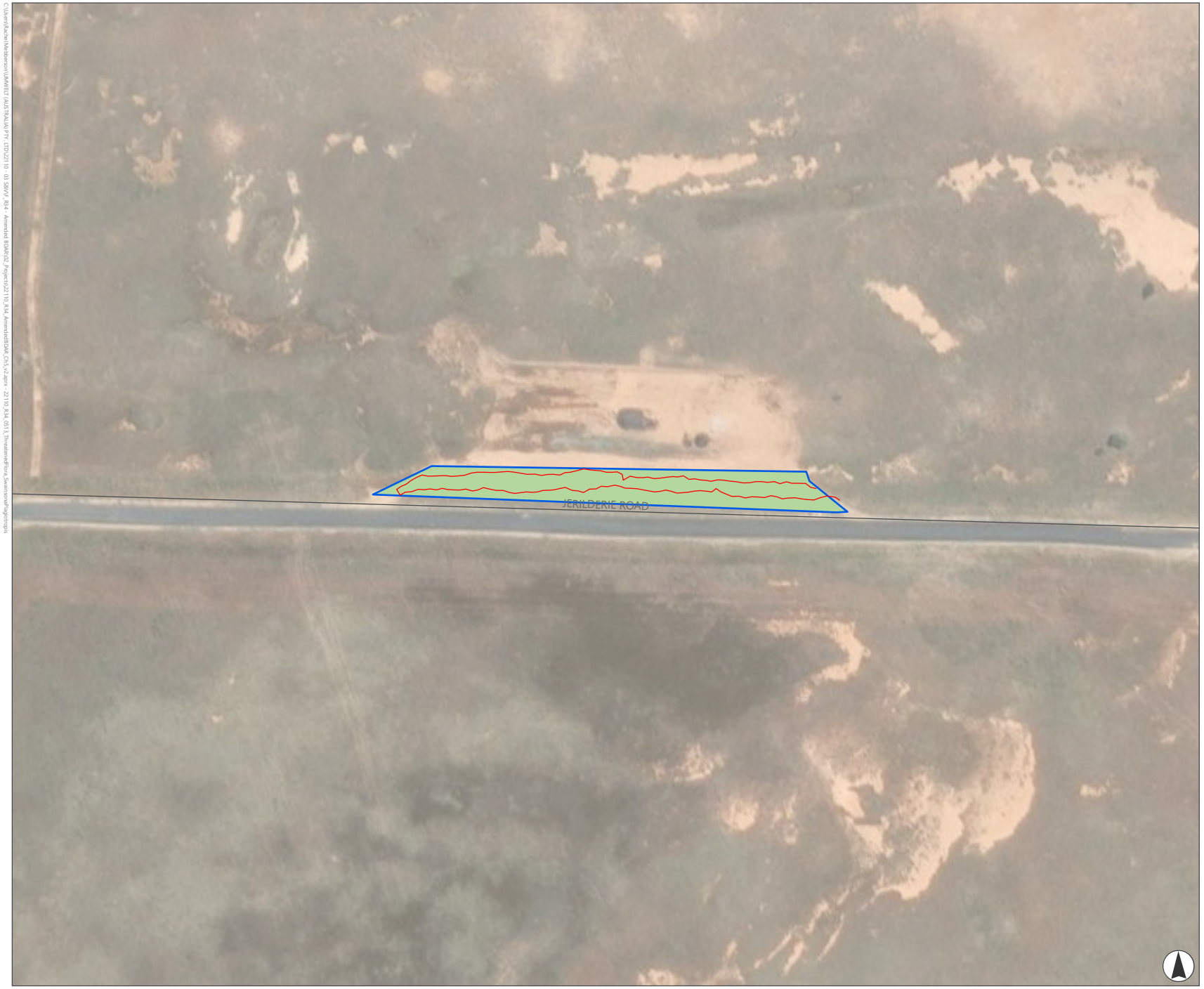
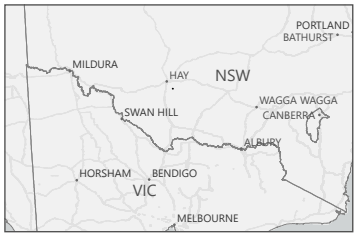


FIGURE 5.13.3

Threatened Flora Surveys
Swainsona plagiotropis

Legend

- Stage 1 (South) Development Footprint
- Road
- Survey Area
- Threatened Species Transect



0 20 40

Meters

Scale 1:2,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

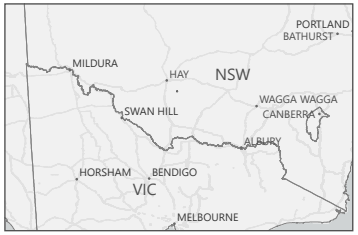
C:\Users\RachelMeiberg\on\UMWELT (AUSTRALIA) PTY. LTD\2210 - 03 SWVF R04 - Amended BDAR\02_Projects\2210_R34_AmendedBDAR_Ch5_v2.aprx - 2210_R34_051_ThreatenedFlora_SwainsonaPlagiotropis

FIGURE 5.13.4

Threatened Flora Surveys
Swainsona plagiotropis

Legend

- Stage 1 (South) Development Footprint
- Road
- Watercourse
- Survey Area
- Threatened Species Transect



0 20 40

Meters

Scale 1:2,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

5.3.4.11 Silky Swainson-pea (*Swainsona sericea*)

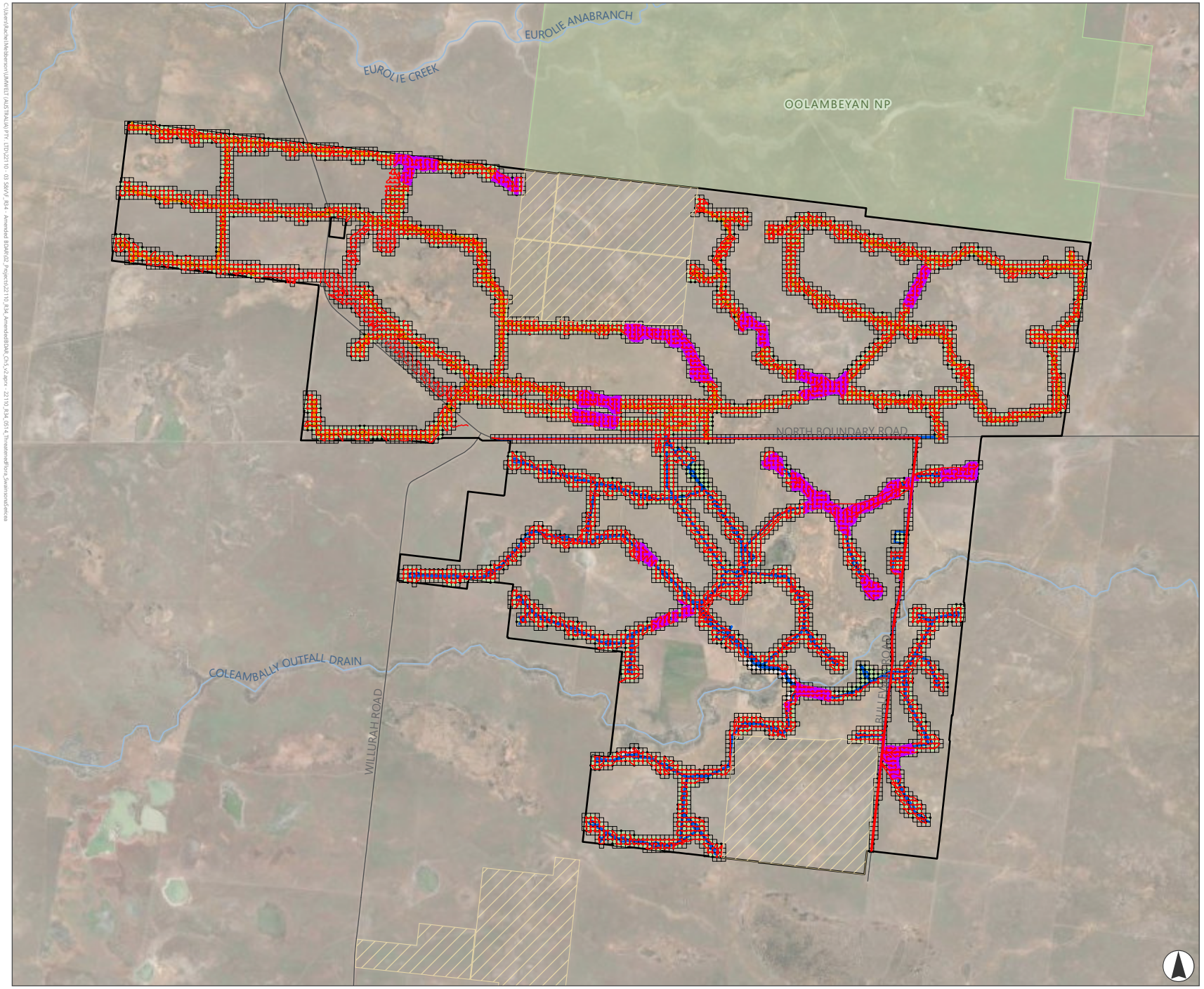
Table 5.19 Detailed Description of Surveys – Silky Swainson-pea (*Swainsona sericea*)

Survey details – Silky Swainson-pea (*Swainsona sericea*)	
Habitat Description	Found in Natural Temperate Grassland and Snow Gum Woodland on the Monaro. Found in Box-Gum Woodland in the Southern Tablelands and South West Slopes. Sometimes found in association with cypress-pines Callitris spp. Habitat on plains unknown.
Associated PCTs/VZs	PCTs: 26, 28, 44, 46 VZs: 5, 6, 7, 8, 9, 10
Habitat or Geographical Constraints	Silky Swainson-pea has been recorded from the Northern Tablelands to the Southern Tablelands and further inland on the slopes and plains. There is one isolated record from the far north-west of NSW. Its stronghold is on the Monaro. Also found in South Australia, Victoria and Queensland
Survey Requirement	The suitable habitat identified on site for this species was found to be 3,309.17 ha. Therefore, this species was subject to a two-phase grid-based systematic approach. Initially, a grid of 100 m^2 was overlayed over a topographic map of the Subject Land, with a 40 m diameter circle nested within the intersection of each x and y gridline. Surveyors used this grid overlay to target systematic surveys within circles and along grid lines between circles. 10 m wide transects were walked within each grid circle. Following the identification of the species during the Stage 1 of the two-phased grid-based approach, the Stage 2 of phased approach was carried out. A fine-scale grid of 10 m^2 was overlayed over a topographic map of the Subject Land, with a 4 m diameter circle nested within the intersection of each x and y gridline. Surveyors initially used this grid to inform systematic surveys, however, this approach was deemed impractical given the inherent accuracy of the GPS in mobile devices (3–4 m at best) when compared to size of the grid circles. Given the grids circles were spaced at 10 m widths, and consistent with the parallel field traverse approach for 'forbs' as detailed within Section 4.1 of DPIE 2020, surveyors carried out targeted surveys consisting of 10 m wide parallel field traverses. Given the grids circles are spaced at 10 m widths, parallel field traverses at 10 m-wide were considered to provide to adequate coverage Parallel field traverses have been carried out within small patches of suitable habitat, such as habitat in the offsite disturbance areas located within Stage 1 – site-based assessment area.
Species-specific Survey Requirements	Survey months differ based on location. Survey Oct–Nov on Monaro. Survey Sep–Oct in the Riverina.
Survey Period	September–October
Survey Group	SG2
Surveys Completed	Stage 1 of the two-phased staged approach was carried out across the Stage 1 – Linear and Stage 2 – Linear assessment areas. Parallel field traverses were carried out within offsite disturbance areas. Approximately 1,260 hours of survey has been completed for SG2. A total of 1,227.77 km of transects were walked. Transect width was 10 m wide. Stage 2 of the two-phase staged approach was carried out as parallel field traverses across the Stage 1 – Linear and Stage 2 – Linear assessment areas, within 500 m of records found during Stage 1. Targeted surveys have been carried out as part of the Projects RtS. Approximately 400 hours of survey has been completed for Stage 2 surveys. A total of 684.80 km of transects were walked. Transect width was 10 m wide.

Survey details – Silky Swainson-pea (*Swainsona sericea*)	
	Surveys were carried out between: • 4–23 September 2023 • 17–20 September 2024 • 30 September–3 October 2024 • 15–19 October 2024 • 29–31 October 2024.
Weather Conditions	Weather conditions during the survey period for Survey Group 2 were favourable for identifying *Swainsona sericea.* Daily weather conditions for Survey Group 2 are presented in **Appendix H**.
Comments/Additional Information/ Justification of approach	This species has been **assessed as present**. This species was observed during targeted surveys, as well as in periods outside of its survey window. Confirmation of species identification from the Royal Botanic Gardens is provided in **Appendix L**.

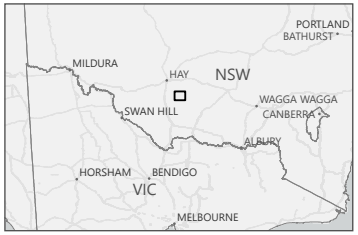
FIGURE 5.14.1

Threatened Flora Surveys
Swainsona sericea



Legend

- Project Boundary
- Subject Land
- Stage 1 (South) Development Footprint
- Stage 2 (North) Development Footprint
- Conservation Agreement Area
- NPWS Reserves
- Road
- Watercourse
- Survey Area
- Survey Grid
- Threatened Species Transect (Stage 1 Surveys)
- Threatened Species Transect (Stage 2 Surveys)



0 1,000 2,000

Meters

Scale 1:122,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

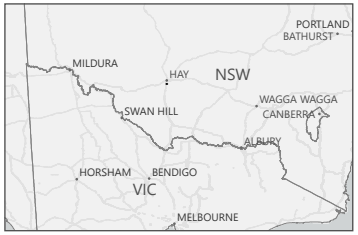
Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

FIGURE 5.14.2

Threatened Flora Surveys
Swainsona sericea

Legend

- Stage 1 (South) Development Footprint
- Road
- Survey Area
- Threatened Species Transect (Stage 1 Surveys)



0 20 40

Meters

Scale 1:2,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

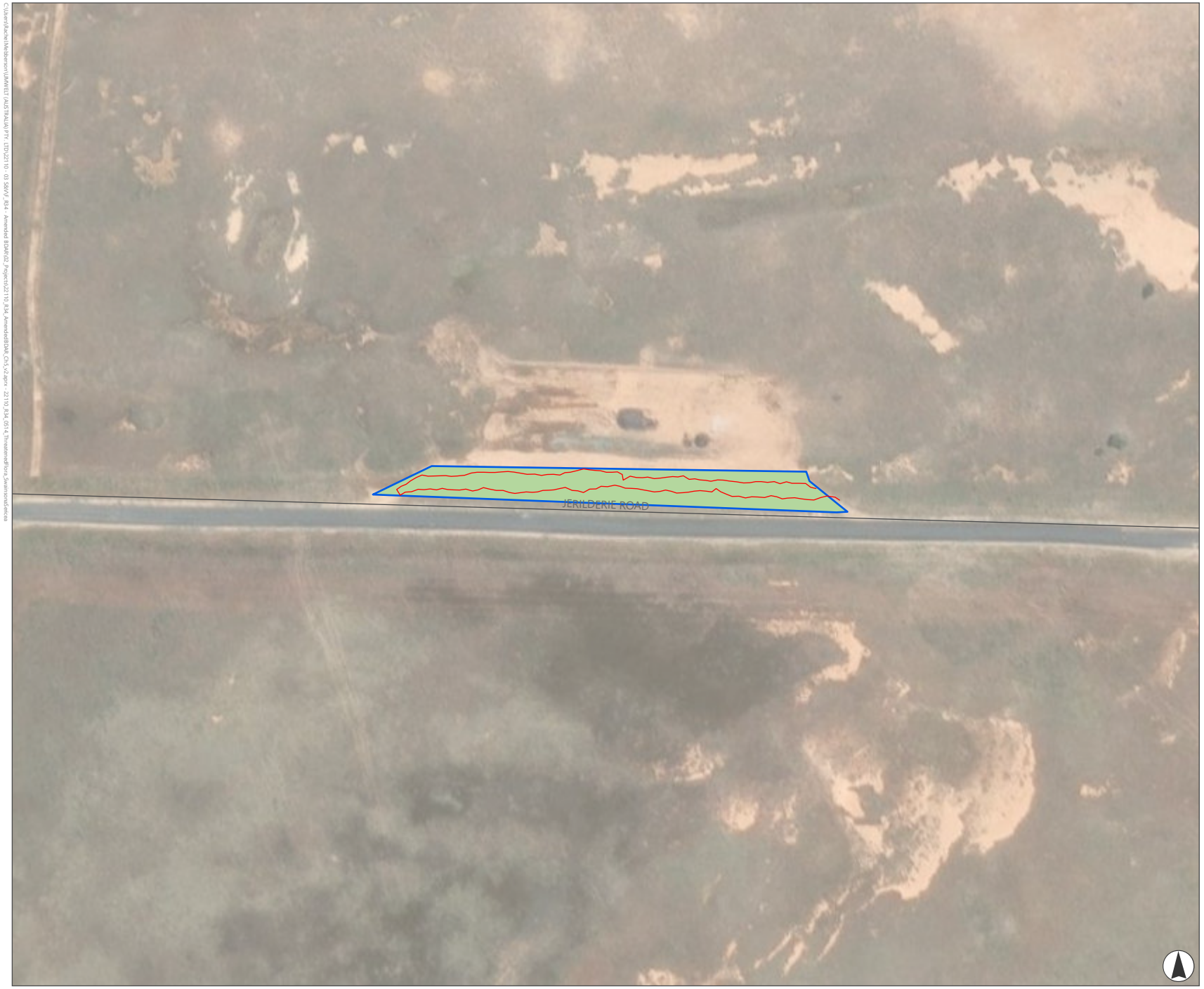
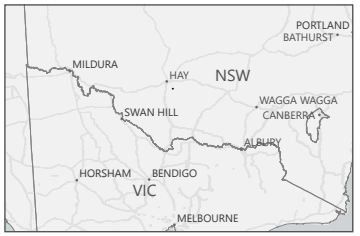


FIGURE 5.14.3

Threatened Flora Surveys
Swainsona sericea

Legend

- Stage 1 (South) Development Footprint
- Road
- Survey Area
- Threatened Species Transect (Stage 1 Surveys)



0 20 40

Meters

Scale 1:2,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

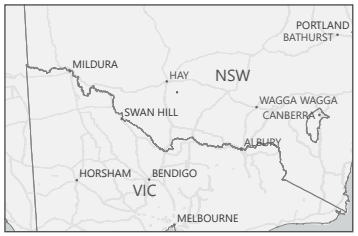
C:\Users\RachelMeiberg\on\UMWELT (AUSTRALIA) PTY. LTD\2210 - 03 SWVF R04 - Amended BDAR\02_Projects\2210_R34_AmendedBDAR_Ch5_v2.aprx - 2210_R34_0514_ThreatenedFlora_SwainsonaSericea

FIGURE 5.14.4

Threatened Flora Surveys
Swainsona sericea

Legend

- Stage 1 (South) Development Footprint
- Road
- Watercourse
- Survey Area
- Threatened Species Transect (Stage 1 Surveys)



0 20 40

Meters

Scale 1:2,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

C:\Users\RachelMeiberan\UMWELT (AUSTRALIA) PTY. LTD\2210 - 03 SWVF R04 - Amended BDAR\02_Projects\22110_R34_AmendedBDAR_Ch5_v2.aprx - 22110_R34_0514_ThreatenedFlora_SwainsonaSericea

5.3.4.12 Slender Darling Pea (*Swainsona murrayana*)

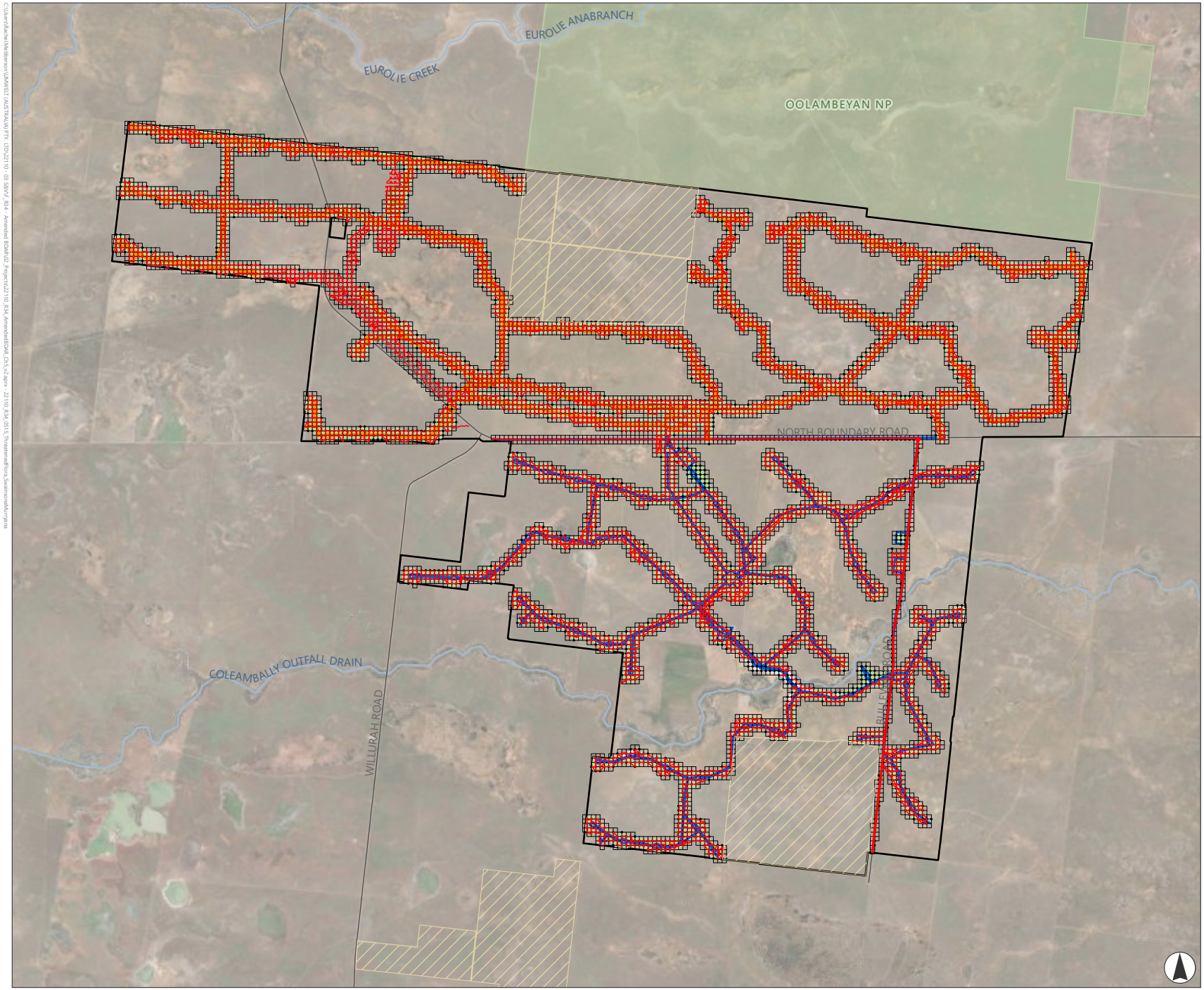
Table 5.20 Detailed Description of Surveys – Slender Darling Pea (*Swainsona murrayana*)

Survey details – Slender Darling Pea (*Swainsona murrayana*)	
Habitat Description	The species has been collected from clay-based soils, ranging from grey, red and brown cracking clays to red-brown earths and loams. 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 *Maireana* spp. Plants have been found in remnant native grasslands or grassy woodlands that have been intermittently grazed or cultivated. The species may require some disturbance and has been known to occur in paddocks that have been moderately grazed or occasionally cultivated.
Associated PCTs/VZs	PCTs: 26, 28, 44, 46, 164 VZs: 5, 6, 7, 8, 9, 10, 12
Habitat or Geographical Constraints	Found throughout NSW, it has been recorded in the Jerilderie and Deniliquin areas of the southern riverine plain, the Hay plain as far north as Willandra National Park, near Broken Hill and in various localities between Dubbo and Moree.
Survey Requirement	The suitable habitat identified on site for this species was found to be 4,205.08 ha. Therefore, this species was subject to a two-phase grid-based systematic approach. A grid of 100 m^2 was overlayed over a topographic map of the Subject Land, with a 40 m diameter circle nested within the intersection of each x and y gridline. Surveyors used this grid overlay to target systematic surveys within circles and along grid lines between circles. 10 m wide transects were walked within each grid circle. Parallel field traverses have been carried out within small patches of suitable habitat, such as habitat in the offsite disturbance areas located within Stage 1 – site-based assessment area. Given the relative abundance of individuals and suitable habitat present across the Subject Land, Stage 2 surveys were not carried out for *Swainsona murryana*.
Species-specific Survey Requirements	N/A
Survey Period	September
Survey Group	SG2
Surveys Completed	Stage 1 of the two-phased staged approach was carried out across the Stage 1 – Linear and Stage 2 – Linear assessment areas. Parallel field traverses were carried out within offsite disturbance areas. Approximately 1,360 hours of survey has been completed for SG2. A total of 1,227.77 km of transects were walked. Transect width was 10 m wide. Surveys were carried out between: • 4–23 September 2023 • 17–20 September 2024 • 30 September 2024.
Weather Conditions	Weather conditions during the survey period for Survey Group 2 were favourable for identifying *Swainsona murrayana.* Daily weather conditions for Survey Group 2 are presented in **Appendix H**.
Comments/Additional Information/Justification of approach	This species has been **assessed as present**. This species was observed in abundance within and outside its recommended survey window.

Survey details – Slender Darling Pea (*Swainsona murrayana*)	
	The species is associated with PCT 28 and PCT 164 within Stage 1 – Site-based assessment area. These PCTs were surveyed in 2023 (PCT 164) and 2024 (PCT 28) and the species was not recorded as being present within these areas. These areas do not form part of the species polygon. Confirmation of species identification from the Royal Botanic Gardens herbarium is provided in **Appendix L**.

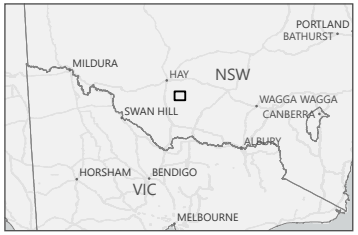
FIGURE 5.15.1

Threatened Flora Surveys
Swainsona murryana



Legend

- Project Boundary
- Subject Land
- Stage 1 (South) Development Footprint
- Stage 2 (North) Development Footprint
- Conservation Agreement Area
- NPWS Reserves
- Road
- Watercourse
- Survey Area
- Survey Grid
- Threatened Species Transect



0 1,000 2,000

Meters

Scale 1:122,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

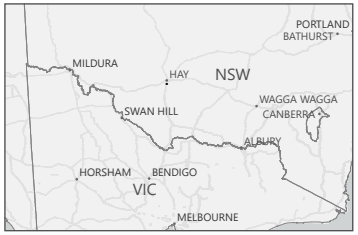
Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

FIGURE 5.15.2

Threatened Flora Surveys
Swainsona murryana

Legend

- Stage 1 (South) Development Footprint
- Road
- Survey Area
- Threatened Species Transect



0 20 40

Meters

Scale 1:2,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

C:\Users\RachelMeiberan\UMWELT (AUSTRALIA) PTY. LTD\22110 - 03 S86VF R44 - Amended BDAR\02_Projects\22110_R34_AmendedBDAR_Ch5_v2.aprx - 22110_R34_0515_ThreatenedFlora_SwainsonaMurryana

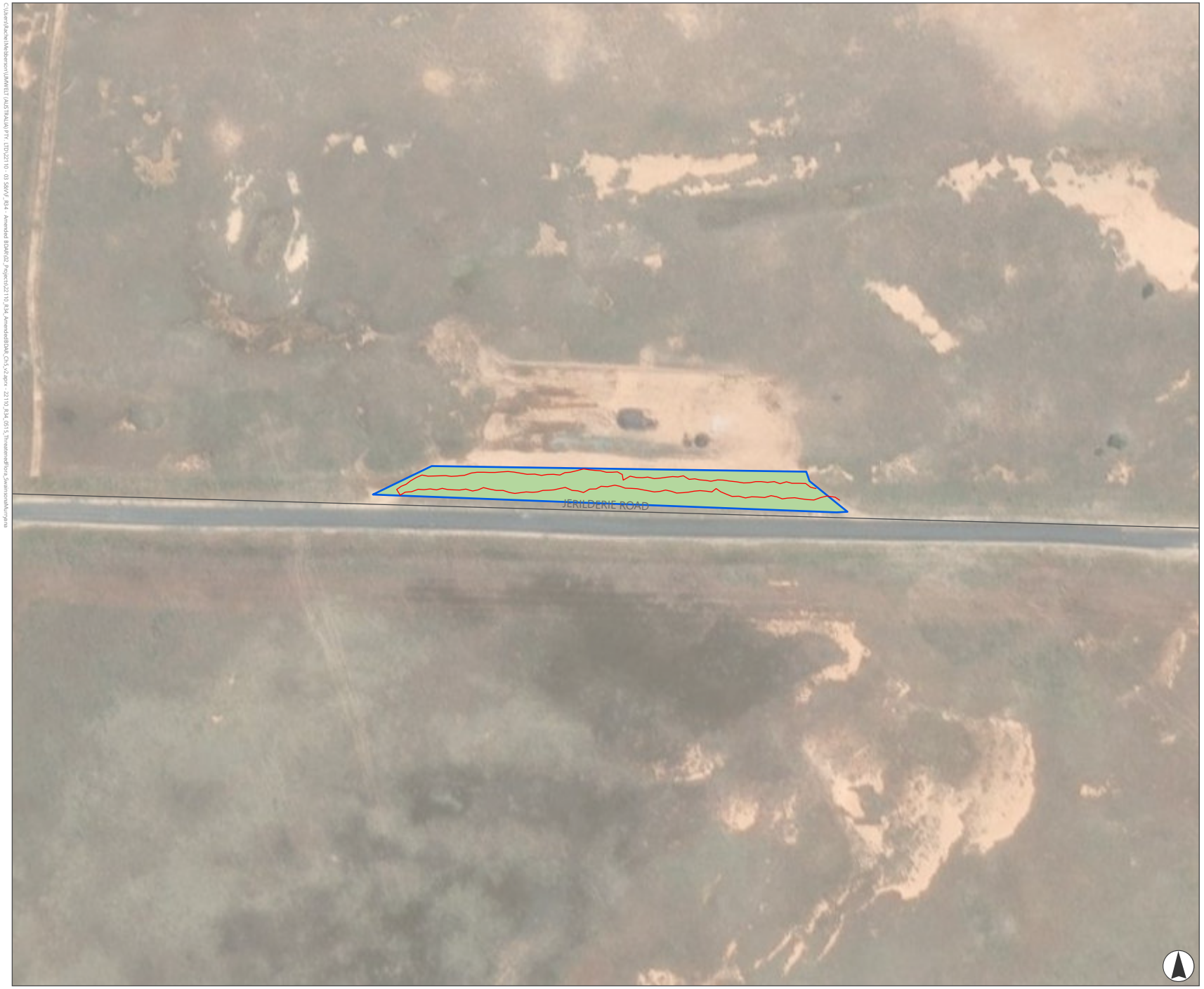
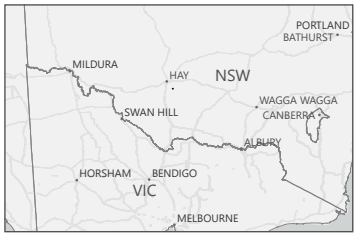


FIGURE 5.15.3

Threatened Flora Surveys
Swainsona murryana

Legend

- Stage 1 (South) Development Footprint
- Road
- Survey Area
- Threatened Species Transect



0 20 40

Meters

Scale 1:2,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

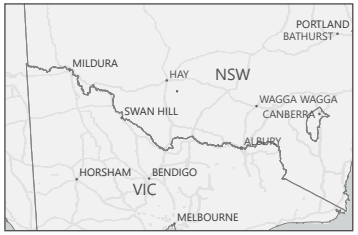
Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

FIGURE 5.15.4

Threatened Flora Surveys
Swainsona murryana

Legend

- Stage 1 (South) Development Footprint
- Road
- Watercourse
- Survey Area
- Threatened Species Transect



0 20 40

Meters

Scale 1:2,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

C:\Users\RachelMeiberg\on\UMWELT (AUSTRALIA) PTY. LTD\22110 - 03 SWVF R04 - Amended BDAR\02_Projects\22110_R34_AmendedBDAR_Ch5_v2.aprx - 22110_R34_0515_ThreatenedFlora_SwainsonaMurryana

5.3.4.13 Small Scurf-pea (*Cullen parvum*)

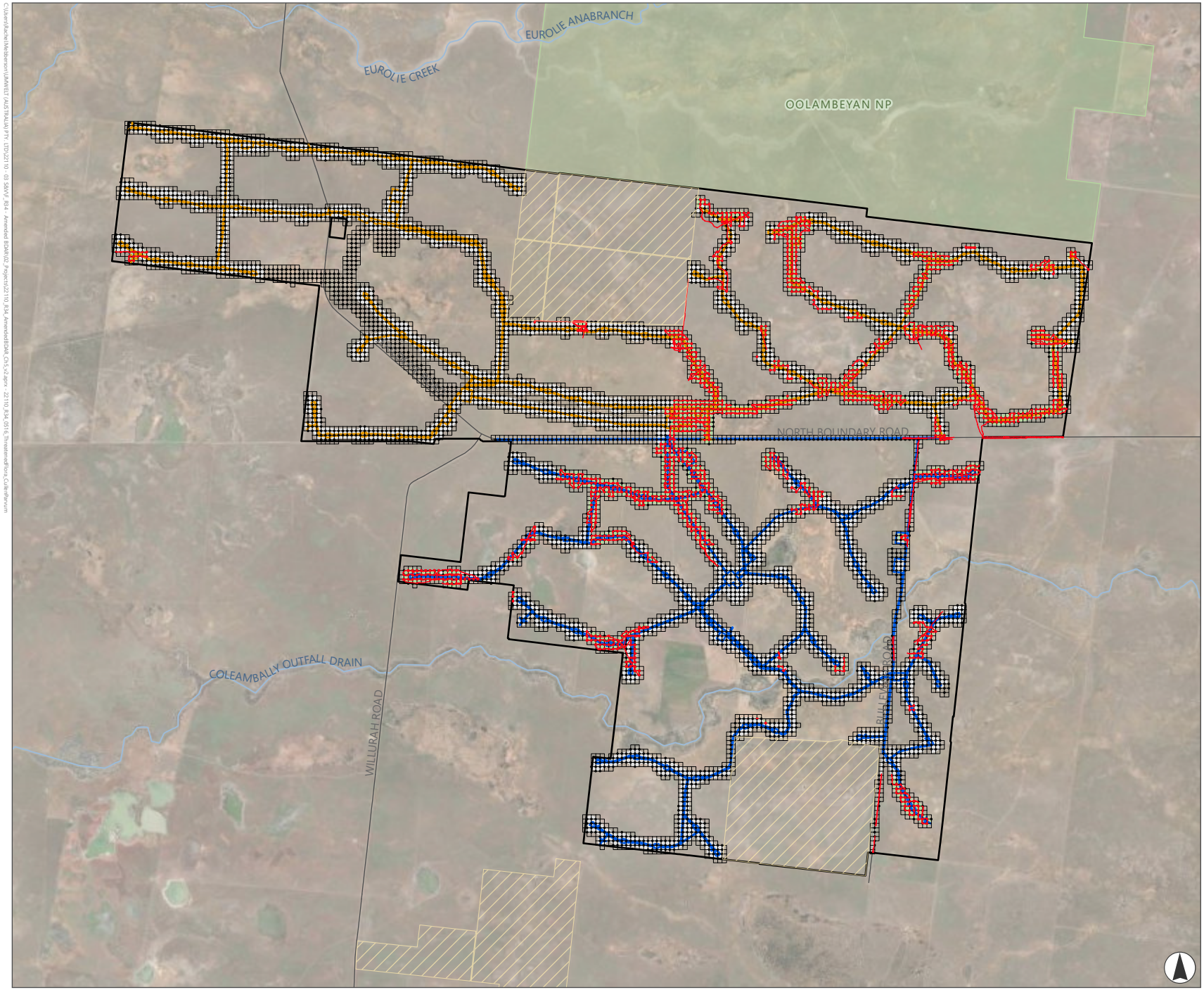
Table 5.21 Detailed Description of Surveys – Small Scurf-pea (*Cullen parvum*)

Survey details – Small Scurf-pea (*Cullen parvum*)	
Habitat Description	In known populations in Victoria and NSW, plants are found in grassland, *Eucalyptus camaldulensis* Woodland or Box-Gum Woodland, sometimes on grazed land and usually on table drains or adjacent to drainage lines or watercourses, in areas with rainfall of between 450 and 700 mm.
Associated PCTs/VZs	PCT: 44 VZ: 9
Habitat or Geographical Constraints	Geographic constraint – Hay Plains and to East The Small Scurf-pea is known in NSW from only two herbarium collections; one from Wagga Wagga in 1884 and the other from Jindera (near Albury) in 1967. A small population was recently reported from near Jerilderie (although it has not been relocated). In recent years, two populations have been recorded in travelling stock reserves south-west of Wagga Wagga, and a population reputedly exists on a roadside near Galong. Another population has recently been discovered on private land near Young. Large populations have been recorded in grassy gaps in the Red Gum Woodlands of Barmah State Park, just across the border in Victoria. Extensive suitable habitat probably occurs across the border in NSW.
Survey Requirement	The suitable habitat identified on site for this species was found to be 1,120.44 ha. Therefore, this species was subject to a two-phase grid-based systematic approach. A grid of 100 m^2 was overlayed over a topographic map of the Subject Land, with a 40 m diameter circle nested within the intersection of each x and y gridline. Surveyors used this grid overlay to target systematic surveys within circles and along grid lines between circles. 10 m wide transects were walked within each grid circle. Parallel field traverses have been carried out within small patches of suitable habitat, such as habitat in the offsite disturbance areas located within Stage 1 – site-based assessment area.
Species-specific Survey Requirements	Use flowers or fruit to locate and identify.
Survey Period	December–January
Survey Group	SG4
Surveys Completed	Stage 1 of the two-phased staged approach has been completed across half of the suitable habitat present within the Subject Land within Stage 1 – Linear and Stage 2 – Linear assessment areas. Inclement weather (heavy rain impeding access, and extreme heat) prevented surveys from being completed across the entire extent of suitable habitat. The remaining suitable habitat present was assessed via Stage 1 of the two-phased Stage 1 survey approach during the survey period of December 2024 – January 2025. Parallel field traverses were carried out within offsite disturbance areas. A total of 780 hours of survey has been completed for Survey Group 4. A total of 403.37 km of transects were walked. Surveys were carried out between: • 11–16 December 2023 • 14–19 January 2024 • 17–19 December 2024 • 12–14 January 2025.

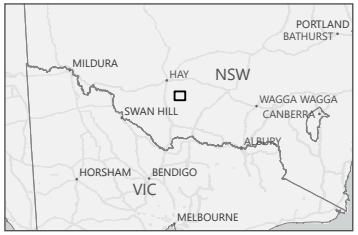
Survey details – Small Scurf-pea (*Cullen parvum*)	
Weather Conditions	Weather conditions during the survey period for Survey Group 4 were favourable for the growth and flowering of *Cullen parvum*, although the effects of rain and heat impeded access and completion of the surveys within the survey window during summer 2023/2024. Daily weather conditions for Survey Group 4 are presented in **Appendix H.**
Comments/Additional Information/Justification of approach	This species was not observed during surveys and this species has been **assessed as not present** in areas of the Subject Land within which surveys were carried out.

FIGURE 5.16.1

Threatened Flora Surveys
Cullen parvum



Legend
- Project Boundary
- Subject Land
- Stage 1 (South) Development Footprint
- Stage 2 (North) Development Footprint
- Conservation Agreement Area
- NPWS Reserves
- Road
- Watercourse
- Survey Area
- Survey Grid
- Threatened Species Transect



0 1,000 2,000

Meters

Scale 1:122,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

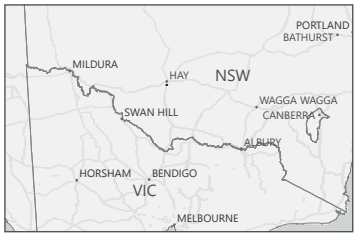
Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

FIGURE 5.16.2

Threatened Flora Surveys
Cullen parvum

Legend

- Stage 1 (South) Development Footprint
- Road



0 20 40

Meters

Scale 1:2,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

C:\Users\RachelMeiberan\UMWELT (AUSTRALIA) PTY. LTD\22110 - 03 S6IVF R4 - Amended BDAR\02_Projects\22110_R34_AmendedBDAR_Ch5.v2.aprx - 22110_R34_0516_ThreatenedFlora_CullenParvum

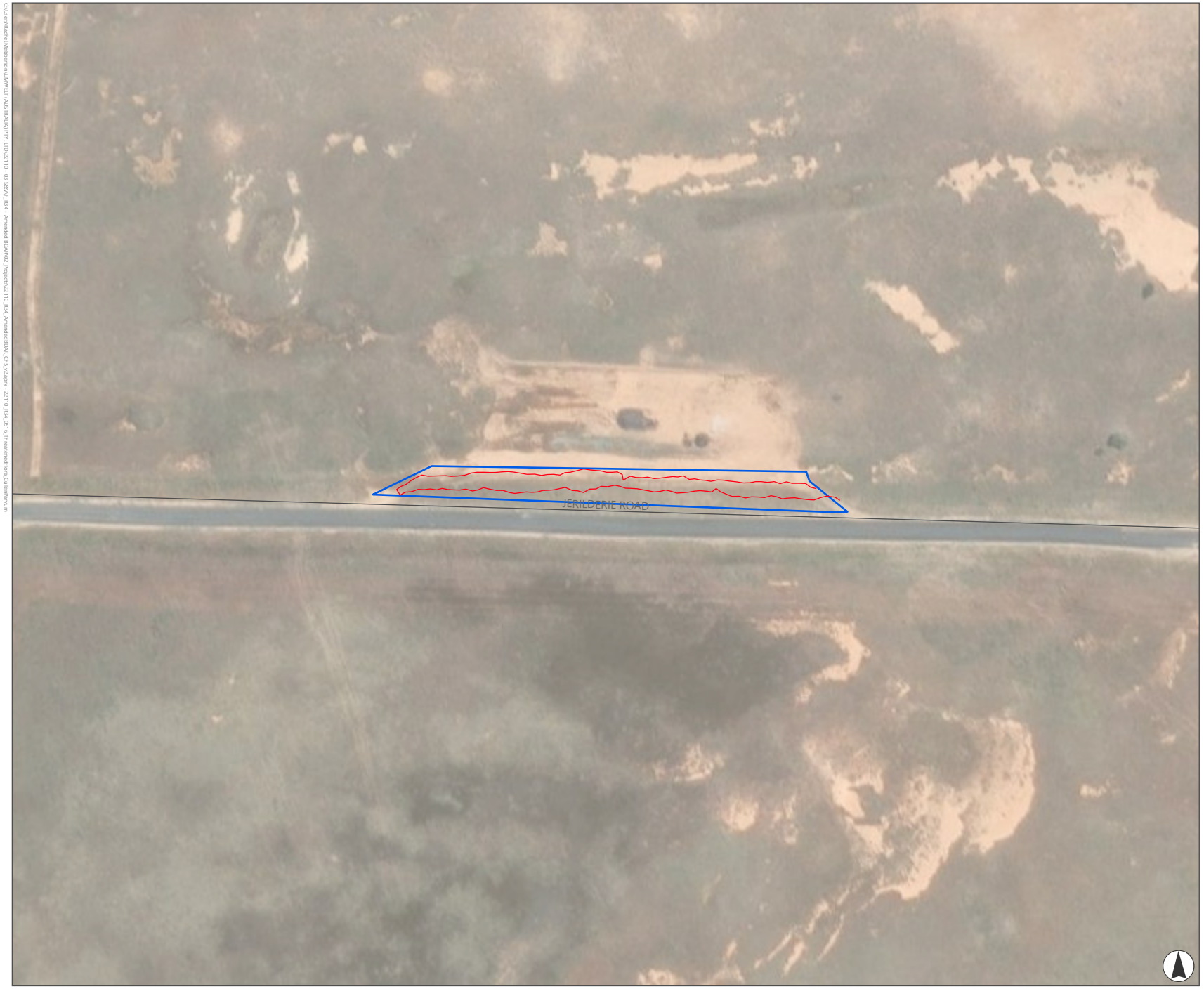
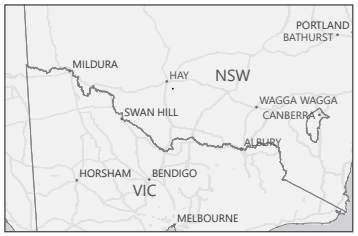


FIGURE 5.16.3

Threatened Flora Surveys
Cullen parvum

Legend

- Stage 1 (South) Development Footprint
- Road
- Threatened Species Transect



0 20 40

Meters

Scale 1:2,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

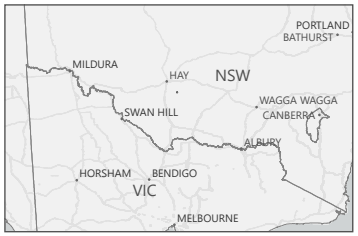
Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

FIGURE 5.16.4

Threatened Flora Surveys
Cullen parvum

Legend

- Stage 1 (South) Development Footprint
- Road
- Watercourse
- Threatened Species Transect



0 20 40

Meters

Scale 1:2,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

5.3.4.14 Spike-rush (*Eleocharis obicis*)

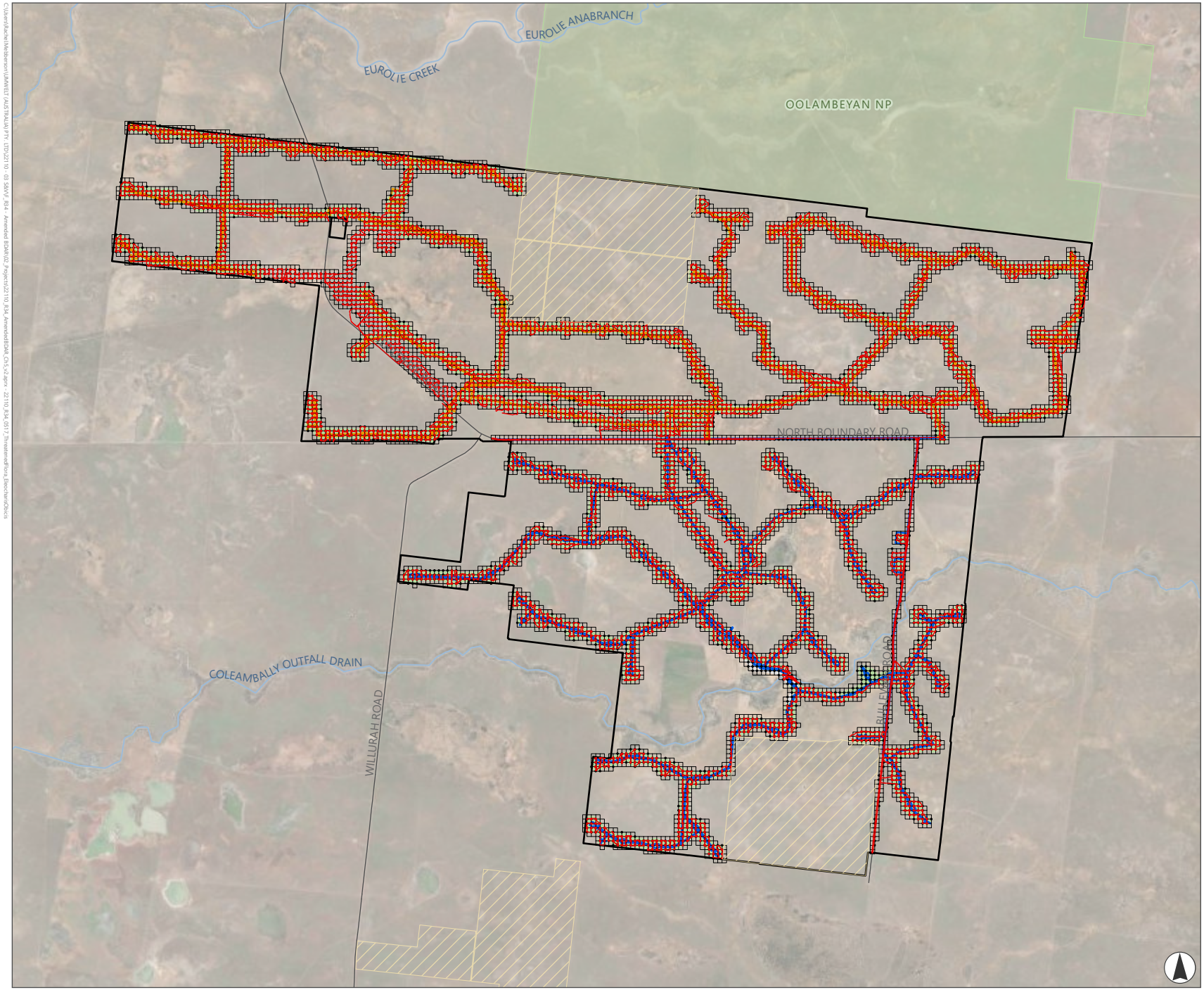
Table 5.22 Detailed Description of Surveys – Spike-rush (*Eleocharis obicis*)

Survey details – Spike-rush (*Eleocharis obicis*)	
Habitat Description	Grows in ephemerally wet situations such as roadside mitre drains and depressions, usually in low-lying grasslands. Sites include depressions with heavy clay soils on the Lachlan River floodplain, with *Eragrostis australasica*, *Atriplex vesicaria* and *Atriplex nummularia* shrublands, low-lying claypans near an irrigation channel, and a shallow open ditch on a low ridge with *Eucalyptus populnea* in red sandy soil over clay. Found to be locally frequent to abundant in western NSW populations.
Associated PCTs/VZs	PCTs: 10, 13, 17, 160, 164 VZs: 1, 2, 3, 4, 10, 11, 12, 13
Habitat or Geographical Constraints	Habitat constraint - Periodically waterlogged sites (including table drains and farm dams) Found near Condobolin and Hay, as well as being known from an old collection from the Barrier Range near Broken Hill. The later collection was made on the Lachlan River floodplain at Micabil, near Condobolin.
Survey Requirement	The suitable habitat identified on site for this species was found to be 364.70 ha. Therefore, this species was subject to a two-phase grid-based systematic approach. A grid of 100 m2 was overlayed over a topographic map of the Subject Land, with a 40 m diameter circle nested within the intersection of each x and y gridline. Surveyors used this grid overlay to target systematic surveys within circles and along gridlines between circles. 10 m wide transects were walked within each grid circle. Parallel field traverses have been carried out within small patches of suitable habitat, such as habitat in the offsite disturbance areas located within Stage 1 – site-based assessment area.
Species-specific Survey Requirements	Ephemeral, and requires good soaking rains to emerge, primarily in spring. Survey after soaking rains.
Survey Period	October–November
Survey Group	SG3
Surveys Completed	Stage 1 of the two-phased staged approach was carried out across the Stage 1 – Linear and Stage 2 – Linear assessment areas. Parallel field traverses were carried out within offsite disturbance areas. Approximately 1,510 hours of survey has been completed for SG3. A total of 1,202.98 km of transects were walked. Transect width was 10 m wide. Surveys were carried out between: • 16–25 October 2023 • 30 October–8 November 2023 • 13–29 November 2023 • 17 September 2024 • 30–31 October 2024.

Survey details – Spike-rush (*Eleocharis obicis*)	
Weather Conditions	Weather conditions during the survey period for Survey Group 3 were favourable for identifying *Eleocharis obicis* with substantial rainfall across the locality during a significant La Niña weather event between 2021 and early 2023. The Subject Land was completely inundated with water during December 2022, and was subject above average rainfall over six months of 2023, including June and October. The Subject Land was completely inundated with water during December 2022, and was subject above average rainfall over six months of 2023, including June and October. A total of 52.2 mm of rain fell in October which included a large rainfall event at the beginning of the month just as field surveys were commencing. Evidence of inundation and drying soils during surveys is provided in **Photo 5.4** and **Photo 5.5** in **Table 5.11** above. Daily weather conditions for Survey Group 3 are presented in **Appendix H.**
Comments/Additional Information/Justification of approach	This species was not observed during targeted surveys during 2023 and 2024; however the species was incidentally recorded in two locations (in a swale beside an access track and in a shallow depression) during late December 2024 following a late November rainfall event. As such, species has been assessed **as present**. Confirmation of species identification from Royal Botanic Gardens was received in January 2025 and is provided in **Appendix L**. Stage 2 surveys were not carried out for *Eleocharis obicis* because the species was incidentally outside its survey season.

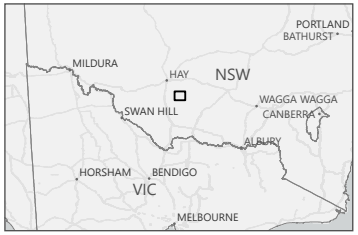
FIGURE 5.17.1

Threatened Flora Surveys
Eleocharis obicis



Legend

- Project Boundary
- Subject Land
- Stage 1 (South) Development Footprint
- Stage 2 (North) Development Footprint
- Conservation Agreement Area
- NPWS Reserves
- Road
- Watercourse
- Survey Area
- Survey Grid
- Threatened Species Transect



0 1,000 2,000

Meters

Scale 1:122,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

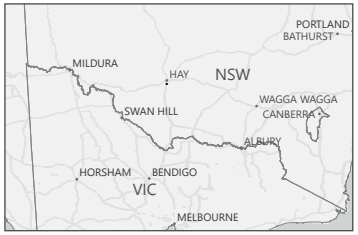
Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

FIGURE 5.17.2

Threatened Flora Surveys
Eleocharis obicis

Legend

- Stage 1 (South) Development Footprint
- Road
- Survey Area
- Threatened Species Transect



0 20 40

Meters

Scale 1:2,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

C:\Users\RachelMeiberan\UMWELT (AUSTRALIA) PTY. LTD\2210 - 03 SWJV_R34 - Amended BDAR\02_Projects\2210_R34_AmendedBDAR_Ch5_v2.aprx - 2210_R34_051_7ThreatenedFlora_EleocharisObicis

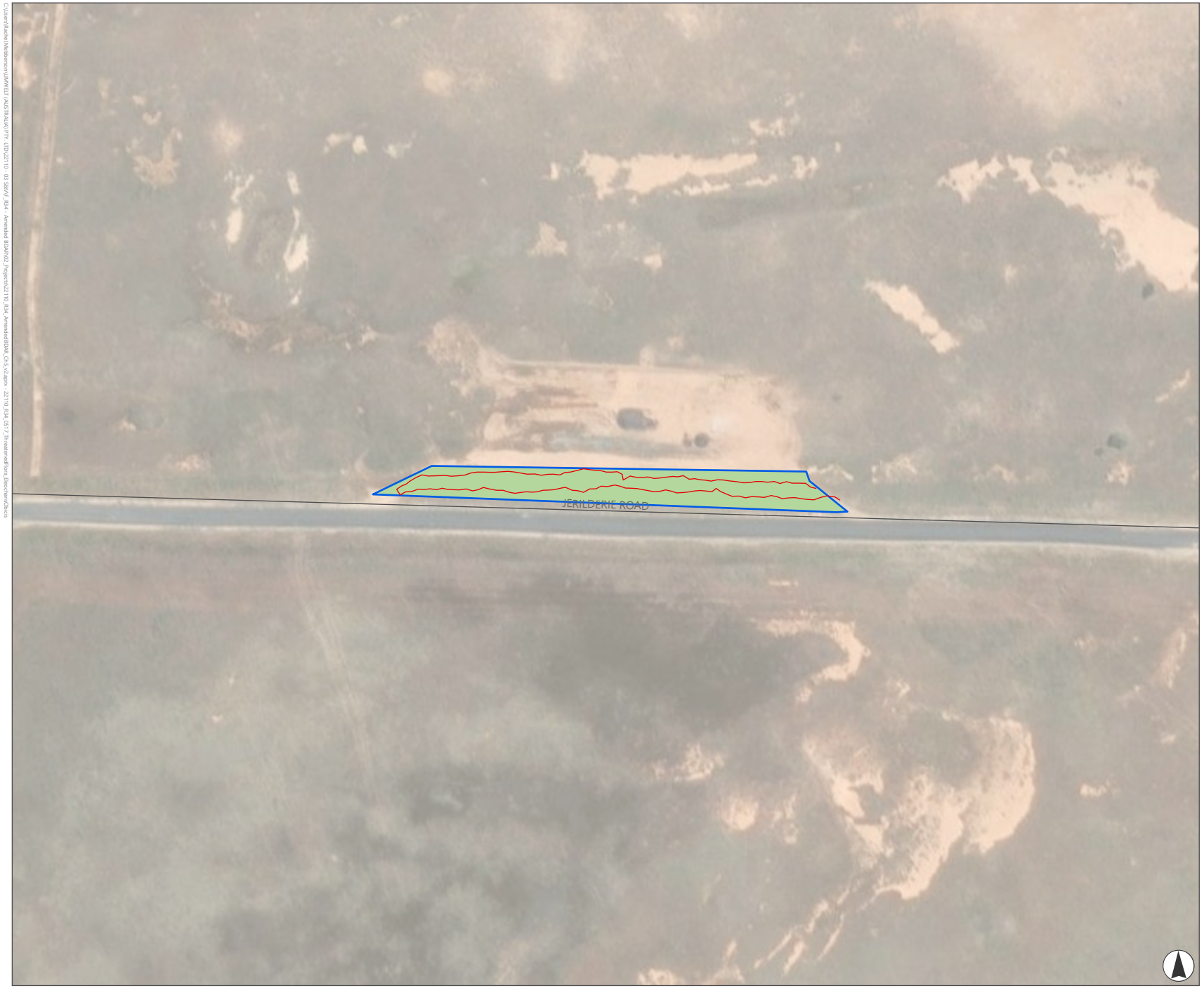
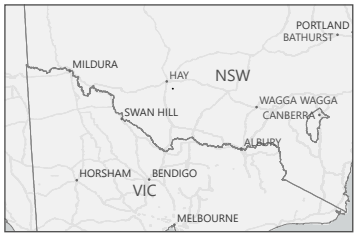


FIGURE 5.17.3

Threatened Flora Surveys
Eleocharis obicis

Legend

- Stage 1 (South) Development Footprint
- Road
- Survey Area
- Threatened Species Transect



0 20 40

Meters

Scale 1:2,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

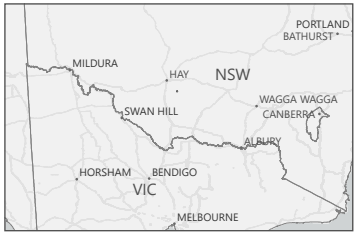
C:\Users\RachelMeibersom\UMWELT (AUSTRALIA) PTY. LTD\2210 - 03 SWVF R44 - Amended BDAR\02_Projects\2210_R34_AmendedBDAR_Ch5_v2.aprx - 2210_R34_0517_ThreatenedFlora_EleocharisObicis

FIGURE 5.17.4

Threatened Flora Surveys
Eleocharis obicis

Legend

- Stage 1 (South) Development Footprint
- Road
- Watercourse
- Survey Area
- Threatened Species Transect



0 20 40

Meters

Scale 1:2,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

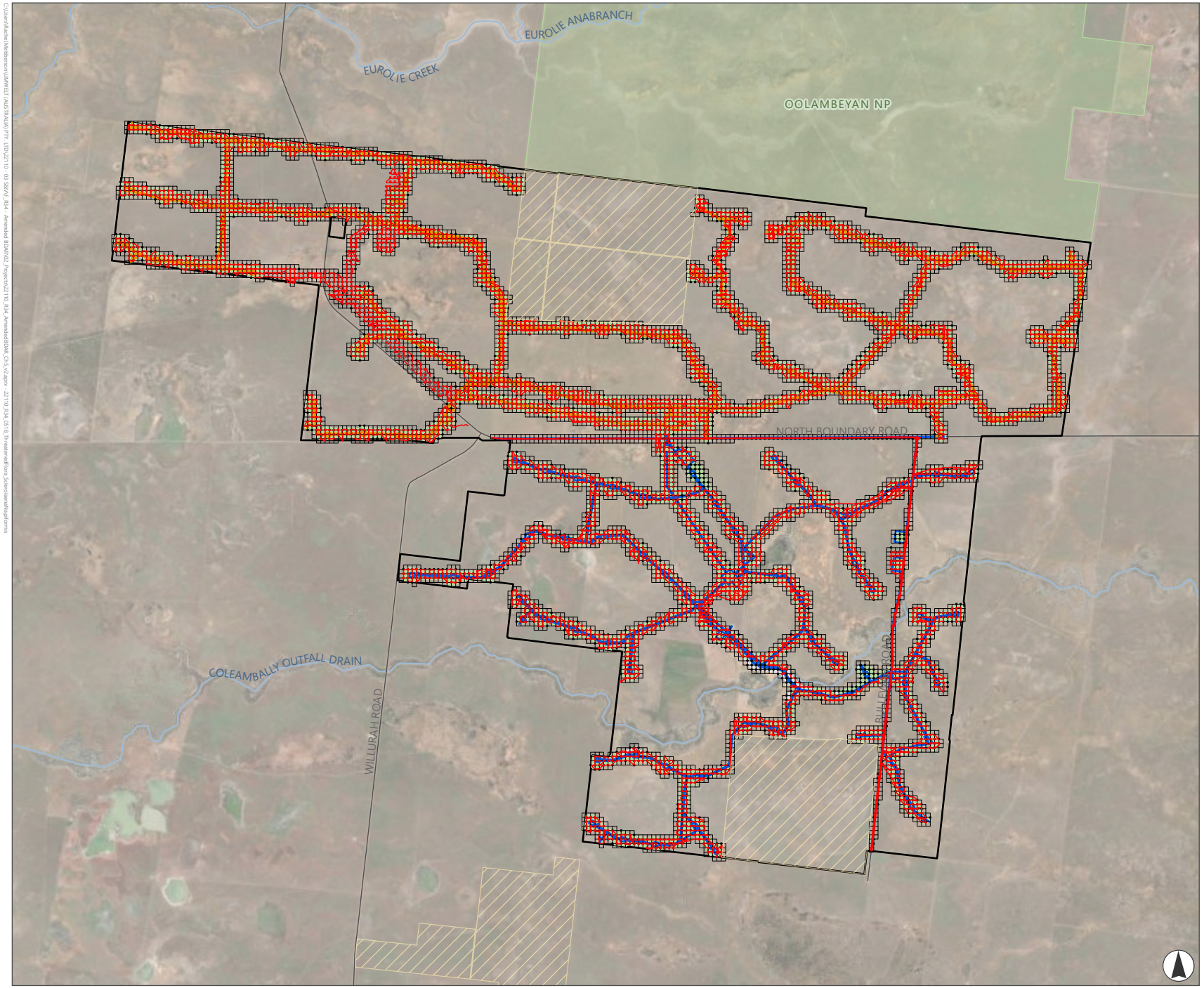
5.3.4.15 Turnip Copperburr (*Sclerolaena napiformis*)

Table 5.23 Detailed Description of Surveys – Turnip Copperburr (*Sclerolaena napiformis*)

Survey details – Turnip Copperburr (*Sclerolaena napiformis*)	
Habitat Description	Confined to remnant grassland habitats on clay-loam soils. Grows on level plains in tussock grassland of *Austrostipa nodosa* and *Chloris truncata*, in grey cracking clay to red-brown loamy clay. Sites are roadside travelling stock routes and reserves subject to sheep grazing. Grows in areas with intermittent light grazing. Based on past land use, this regime may promote the growth of the species, or at least not be detrimental to it. Associated species include *Rytidosperma duttonianum, Enteropogon acicularis, Austrostipa nodosa, Chloris truncata, Lolium rigidum, Swainsona murrayana, Swainsona plagiotropis, Swainsona procumbens, Rhodanthe corymbiflora, Calotis scabiosifolia, Microseris lanceolata, Acacia pendula* and various chenopods.
Associated PCTs/VZs	PCTs: 26, 44, 46 VZs: 5, 6, 9, 10
Habitat or Geographical Constraints	Geographic constraint – Hay Plain Known from only a few small populations in remnant grassland in the southern Riverina of NSW and north-central Victoria. NSW populations are confined to the area between Jerilderie and Moama on travelling stock routes and road reserves.
Survey Requirement	The suitable habitat identified on site for this species was found to be 3,424.42 ha. Therefore, this species was subject to a two-phase grid-based systematic approach. A grid of 100 m2 was overlayed over a topographic map of the Subject Land, with a 40 m diameter circle nested within the intersection of each x and y gridline. Surveyors used this grid overlay to target systematic surveys within circles and along grid lines between circles. 10 m wide transects were walked within each grid circle. Parallel field traverses have been carried out within small patches of suitable habitat, such as habitat in the offsite disturbance areas located within Stage 1 – site-based assessment area.
Species-specific Survey Requirements	N/A
Survey Period	September–December
Survey Group	SG2
Surveys Completed	Stage 1 of the two-phased staged approach was carried out across the Stage 1 – Linear and Stage 2 – Linear assessment areas. Parallel field traverses were carried out within offsite disturbance area on the corner of Cobb Highway and Jerilderie Road. Approximately 1,260 hours of survey has been completed for SG2. A total of 1,227.77 km of transects were walked. Transect width was 10 m wide. Surveys were carried out between: • 4 - 23 September 2023 • 17 September 2024 • 30–31 October 2024.
Weather Conditions	Weather conditions during the survey period for Survey Group 2 were favourable for identifying *Sclerolaena napiformis.* Daily weather conditions for Survey Group 2 are presented in **Appendix H**.
Comments/Additional Information/Justification of approach	This species was not observed during surveys and this species has been **assessed as not present.**

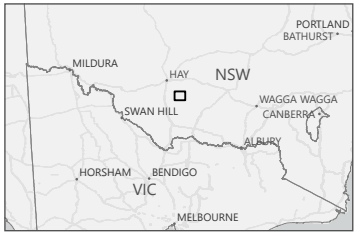
FIGURE 5.18.1

Threatened Flora Surveys
Sclerolaena napiformis



Legend

- Project Boundary
- Subject Land
- Stage 1 (South) Development Footprint
- Stage 2 (North) Development Footprint
- Conservation Agreement Area
- NPWS Reserves
- Road
- Watercourse
- Survey Area
- Survey Grid
- Threatened Species Transect



0 1,000 2,000

Meters

Scale 1:122,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

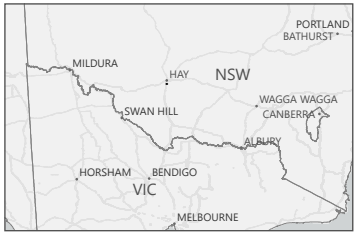
Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

FIGURE 5.18.2

Threatened Flora Surveys
Sclerolaena napiformis

Legend

- Stage 1 (South) Development Footprint
- Road
- Survey Area
- Threatened Species Transect



0 20 40

Meters

Scale 1:2,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

C:\Users\RachelMeiberan\UMWELT (AUSTRALIA) PTY. LTD\22110 - 03 S86VF R44 - Amended BDAR\02_Projects\22110_R34_AmendedBDAR_Ch5_v2.aprx - 22110_R34_0518_ThreatenedFlora_Sclerolaenahapiformis

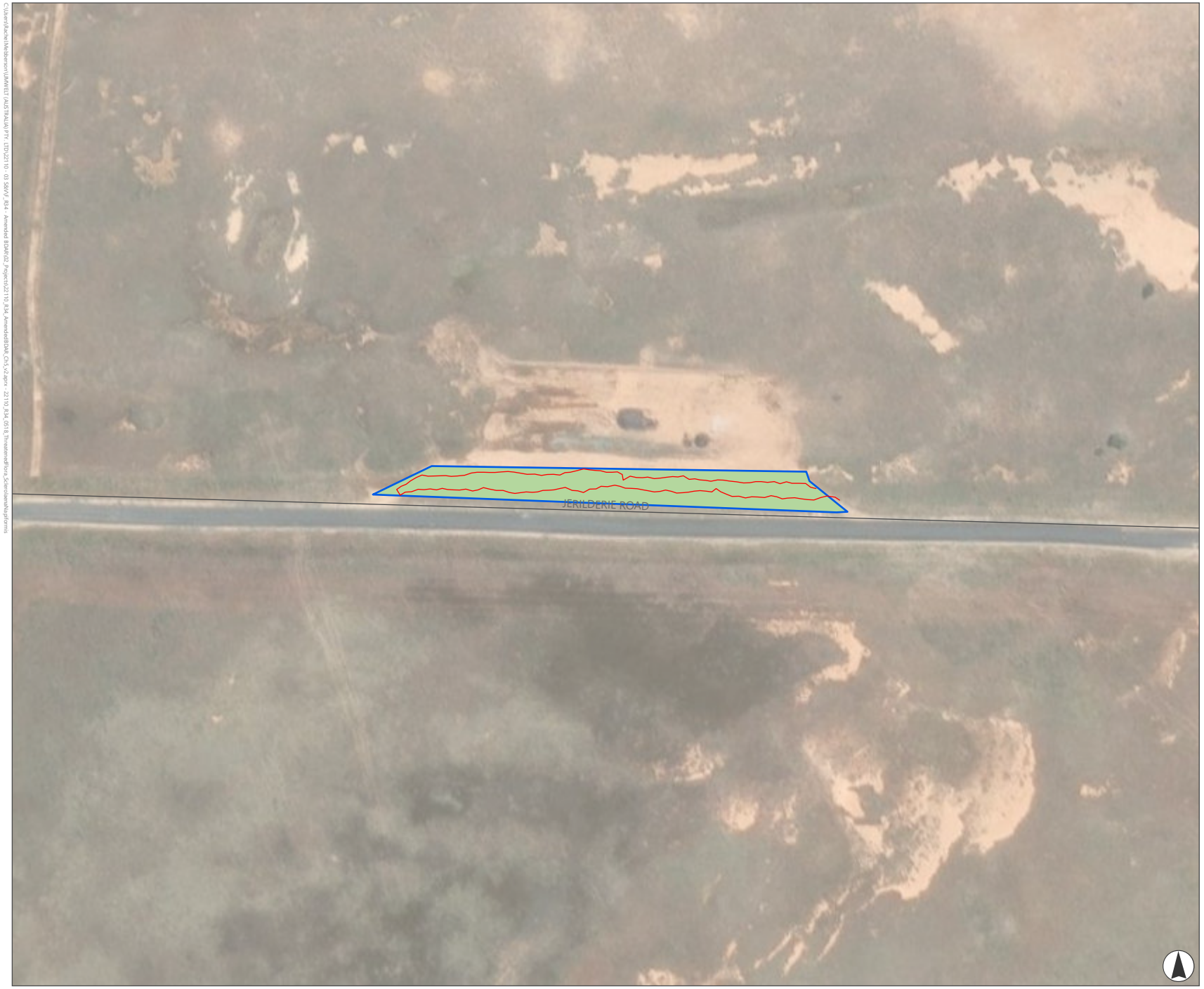
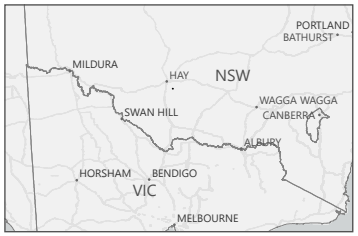


FIGURE 5.18.3

Threatened Flora Surveys
Sclerolaena napiformis

Legend

- Stage 1 (South) Development Footprint
- Road
- Survey Area
- Threatened Species Transect



0 20 40

Meters

Scale 1:2,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

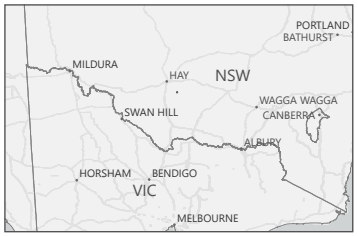
C:\Users\RachelMeibergen\UMWELT (AUSTRALIA) PTY. LTD\22110 - 03 SWVF R04 - Amended BDAR\02_Projects\22110_R34_AmendedBDAR_Ch5_v2.aprx - 22110_R34_0518_ThreatenedFlora_Sclerolaenahapiformis

FIGURE 5.18.4

Threatened Flora Surveys
Sclerolaena napiformis

Legend

- Stage 1 (South) Development Footprint
- Road
- Watercourse
- Survey Area
- Threatened Species Transect



0 20 40

Meters

Scale 1:2,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

5.3.4.16 Winged Peppercress (*Lepidium monoplocoides*)

Table 5.24 Detailed Description of Surveys – Winged Peppercress (*Lepidium monoplocoides*)

Survey details – Winged Peppercress (*Lepidium monoplocoides*)	
Habitat Description	Occurs on seasonally moist to waterlogged sites, on heavy fertile soils, with a mean annual rainfall of around 300–500 mm. Predominant vegetation is usually an open woodland dominated by *Allocasuarina luehmannii* and/or eucalypts, particularly *Eucalyptus largiflorens* or *Eucalyptus populnea*. The field layer of the surrounding woodland is dominated by tussock grasses. Recorded in a wetland-grassland community comprising *Eragrostis australasicus*, *Agrostis avenacea, Rytidosperma duttonianum, Homopholis proluta, Myriophyllum crispatum, Utricularia dichotoma* and *Pycnosorus globosus*, on waterlogged grey-brown clay. Also recorded from a *Maireana pyramidata* shrubland. The species is highly dependent on seasonal conditions. Occurs in periodically flooded and waterlogged habitats and does not tolerate grazing disturbance. The number of plants at each site varies greatly with seasonal conditions, but sites tend to be small in area with local concentrations of the plant. Has been recorded as uncommon to locally common with hundreds of plants at sites.
Associated PCTs/VZs	PCTs: 13, 24, 26, 46, 160 VZs: 2, 4, 5, 6, 10, 11
Habitat or Geographical Constraints	Widespread in the semi-arid western plains regions of NSW. Collected from widely scattered localities, with large numbers of historical records but few recent collections. There is a single collection from Broken Hill and only two collections since 1915, the most recent being 1950. Also previously recorded from Bourke, Cobar, Urana, Lake Cargelligo, Balranald, Wanganella and Deniliquin. Recorded more recently from the Hay Plain, south-eastern Riverina, and from near Pooncarie.
Survey Requirement	The suitable habitat identified on site for this species was found to be 2,332.88 ha. Therefore, this species was subject to a two-phase grid-based systematic approach. Initially, a grid of 100 m^2 was overlayed over a topographic map of the Subject Land, with a 40 m diameter circle nested within the intersection of each x and y gridline. Surveyors used this grid overlay to target systematic surveys within circles and along grid lines between circles. 10 m wide transects were walked within each grid circle. Following the identification of the species during the Stage 1 of the two-phased grid-based approach, the Stage 2 of phased approach was carried out. A fine-scale grid of 10 m^2 was overlayed over a topographic map of the Subject Land, with a 4 m diameter circle nested within the intersection of each x and y gridline. Surveyors initially used this grid to inform systematic surveys, however, this approach was deemed impractical given the inherent accuracy of the GPS in mobile devices (3–4 m at best) when compared to size of the grid circles. Given the grids circles were spaced at 10 m widths, and consistent with the parallel field traverse approach for 'forbs' as detailed within Section 4.1 of DPIE 2020, surveyors carried out targeted surveys consisting of 10 m-wide parallel field traverses. Given the grids circles are spaced at 10 m widths, parallel field traverses at 10 m-wide were considered to provide to adequate coverage Parallel field traverses have been carried out within small patches of suitable habitat, such as habitat in the offsite disturbance areas located within Stage 1 – site-based assessment area.
Species-specific Survey Requirements	Use seed-heads to identify. Survey about 1–2 months after significant rain. Plants emerge about 1 month after rain and only persist for a few months. Ephemeral nature of plant may mean that it may not be visible or identifiable during dry periods even during the approved months of survey.

Survey details – Winged Peppercress (*Lepidium monoplocoides*)	
Survey Period	September–December
Survey Group	SG3
Surveys Completed	Stage 1 of the two-phase staged approach was carried out across the Stage 1 – Linear and Stage 2 – Linear assessment areas. Parallel field traverses were carried out within offsite disturbance areas. Approximately 1,510 hours of survey has been completed for SG3. A total of 1,202.98 km of transects were walked. Transect width was 10 m wide. Stage 2 of the two-phase staged approach was carried out as parallel field traverses across the Stage 1 – Lineas and Stage 2 – Linear assessment areas, within 500 m of records found during Stage 1. Approximately 860 hours of survey has been completed for *Lepidium monoplocoides* Stage 2. A total of 684.80 km of transects were walked. Transect width was 10 m wide. Surveys were carried out between: • 16–25 October 2023 • 30 October–8 November 2023 • 13–29 November 2023 • 17–20 September 2024 • 30 September–3 October 2024 • 15–19 October 2024 • 29 October–2 November 2024 • 26–30 November 2024.
Weather Conditions	Weather conditions during the survey period for Survey Group 3 were favourable for identifying *Lepidium monoplocoides.* Daily weather conditions for Survey Group 3 are presented in **Appendix H**.
Comments/Additional Information/Justification of approach	This species was recorded during surveys therefore has been **assessed as present.** Confirmation of species identification from the Royal Botanic Gardens herbarium is provided in **Appendix L**.

Survey details – Winged Peppercress (*Lepidium monoplocoides*)	

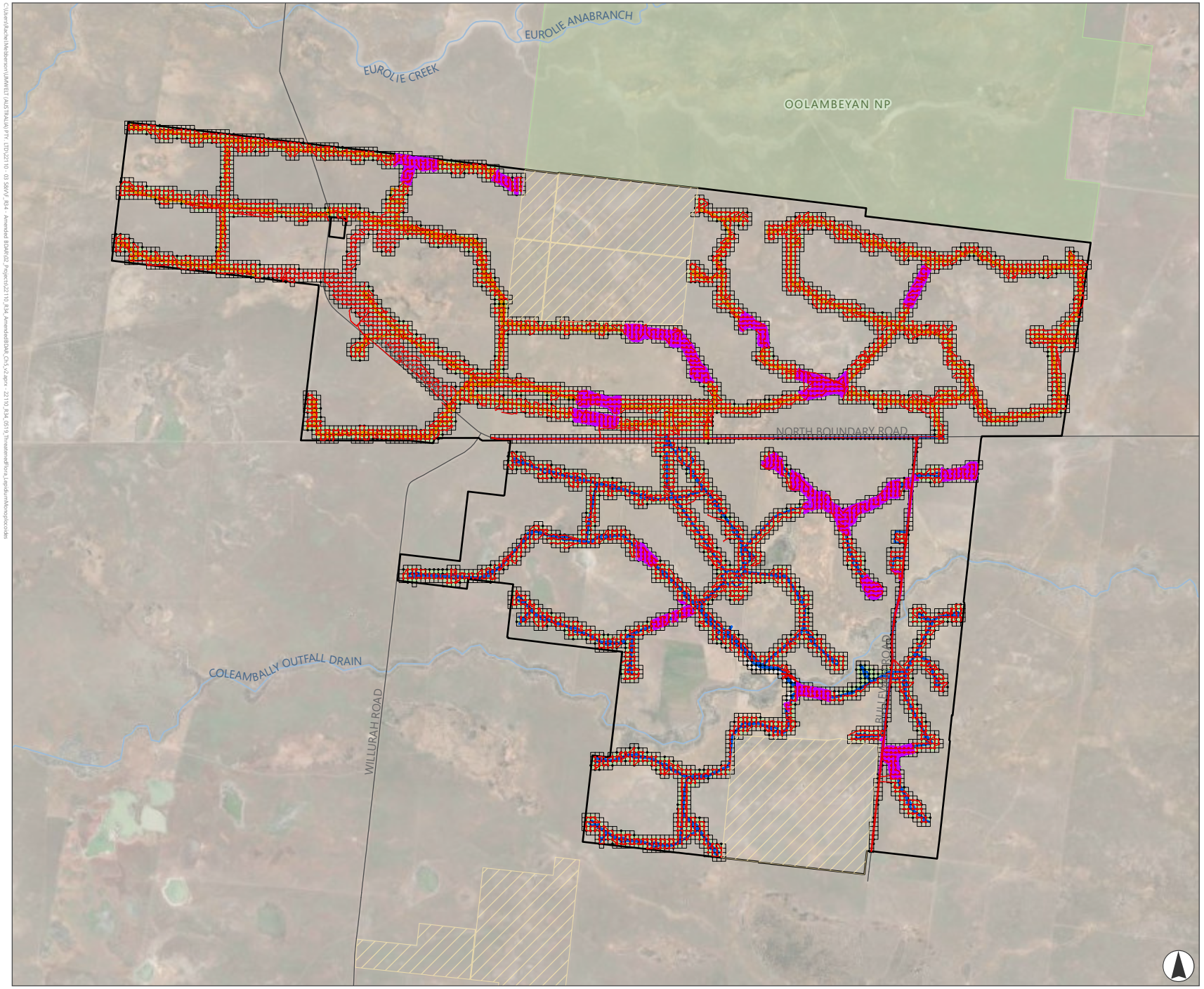
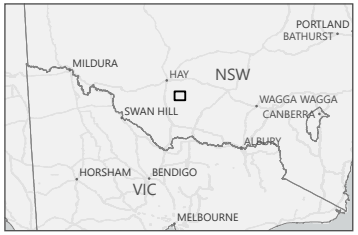


FIGURE 5.19.1

Threatened Flora Surveys
Lepidium monoplocoides

Legend

- Project Boundary
- Subject Land
- Stage 1 (South) Development Footprint
- Stage 2 (North) Development Footprint
- Conservation Agreement Area
- NPWS Reserves
- Road
- Watercourse
- Survey Area
- Survey Grid
- Threatened Species Transect (Stage 1 Surveys)
- Threatened Species Transect (Stage 2 Surveys)



0 1,000 2,000

Meters

Scale 1:122,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

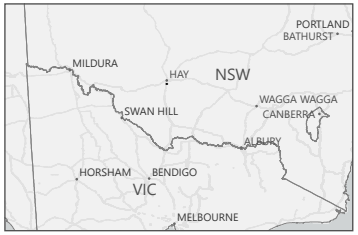
Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

FIGURE 5.19.2

Threatened Flora Surveys
Lepidium monoplocoides

Legend

- Stage 1 (South) Development Footprint
- Road
- Survey Area
- Threatened Species Transect (Stage 1 Surveys)



0 20 40

Meters

Scale 1:2,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

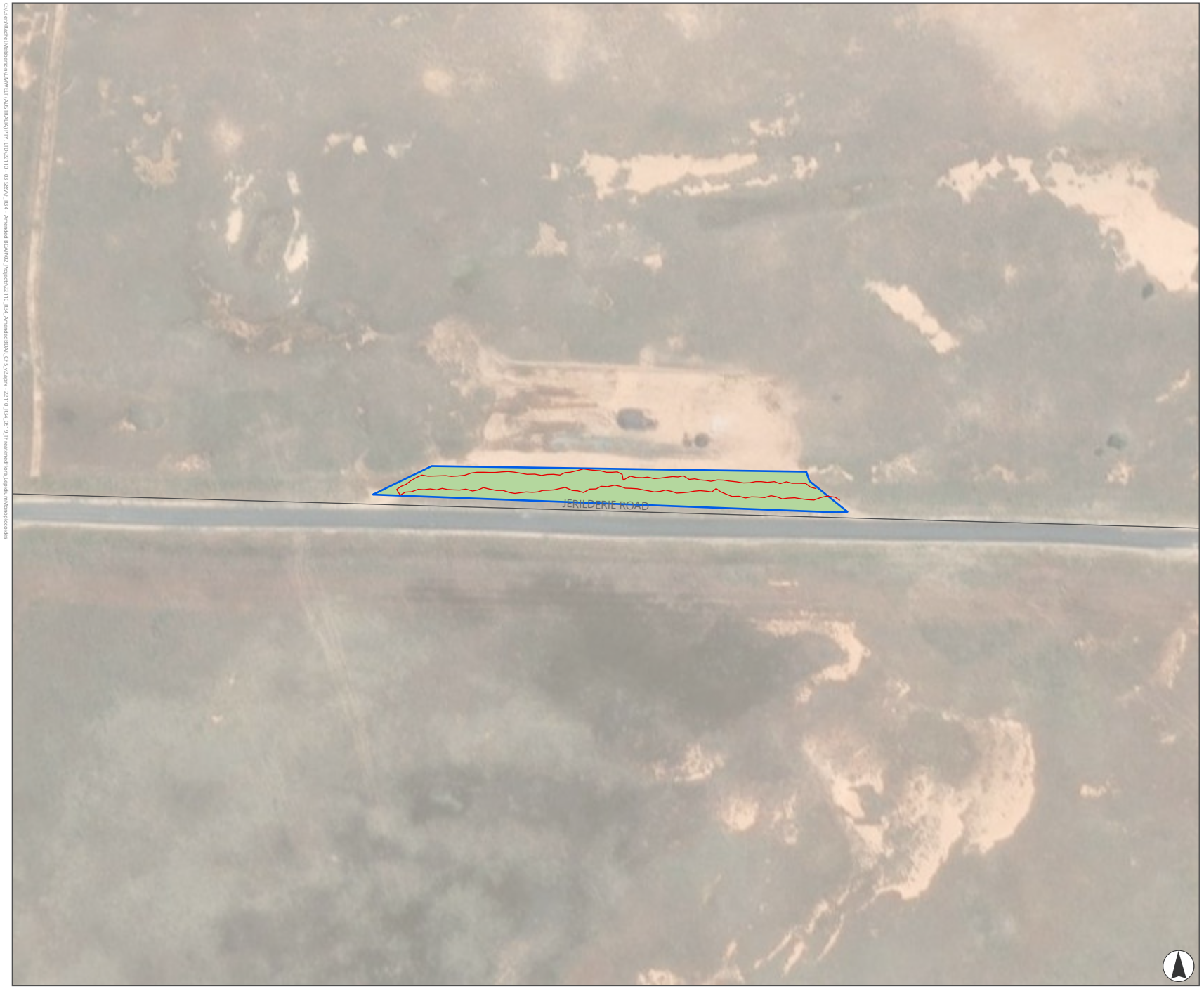
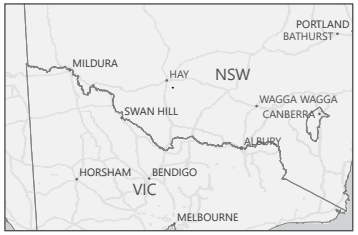


FIGURE 5.19.3

Threatened Flora Surveys
Lepidium monoplocoides

Legend

- Stage 1 (South) Development Footprint
- Road
- Survey Area
- Threatened Species Transect (Stage 1 Surveys)



0 20 40

Meters

Scale 1:2,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

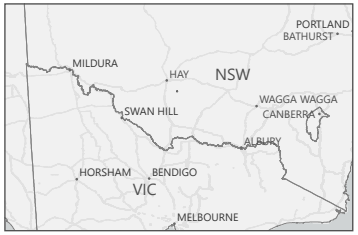
Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

FIGURE 5.19.4

Threatened Flora Surveys
Lepidium monoplocoides

Legend

- Stage 1 (South) Development Footprint
- Road
- Watercourse
- Survey Area
- Threatened Species Transect (Stage 1 Surveys)



0 20 40

Meters

Scale 1:2,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

C:\Users\RachelMeberson\UMWELT (AUSTRALIA) PTY. LTD\2210 - 03 S86VF R04 - Amended BDAR\02_Projects\22110_R34_AmendedBDAR_Ch5_v2.aprx - 22110_R34_0519_ThreatenedFlora_LepidiumMonoplocoides

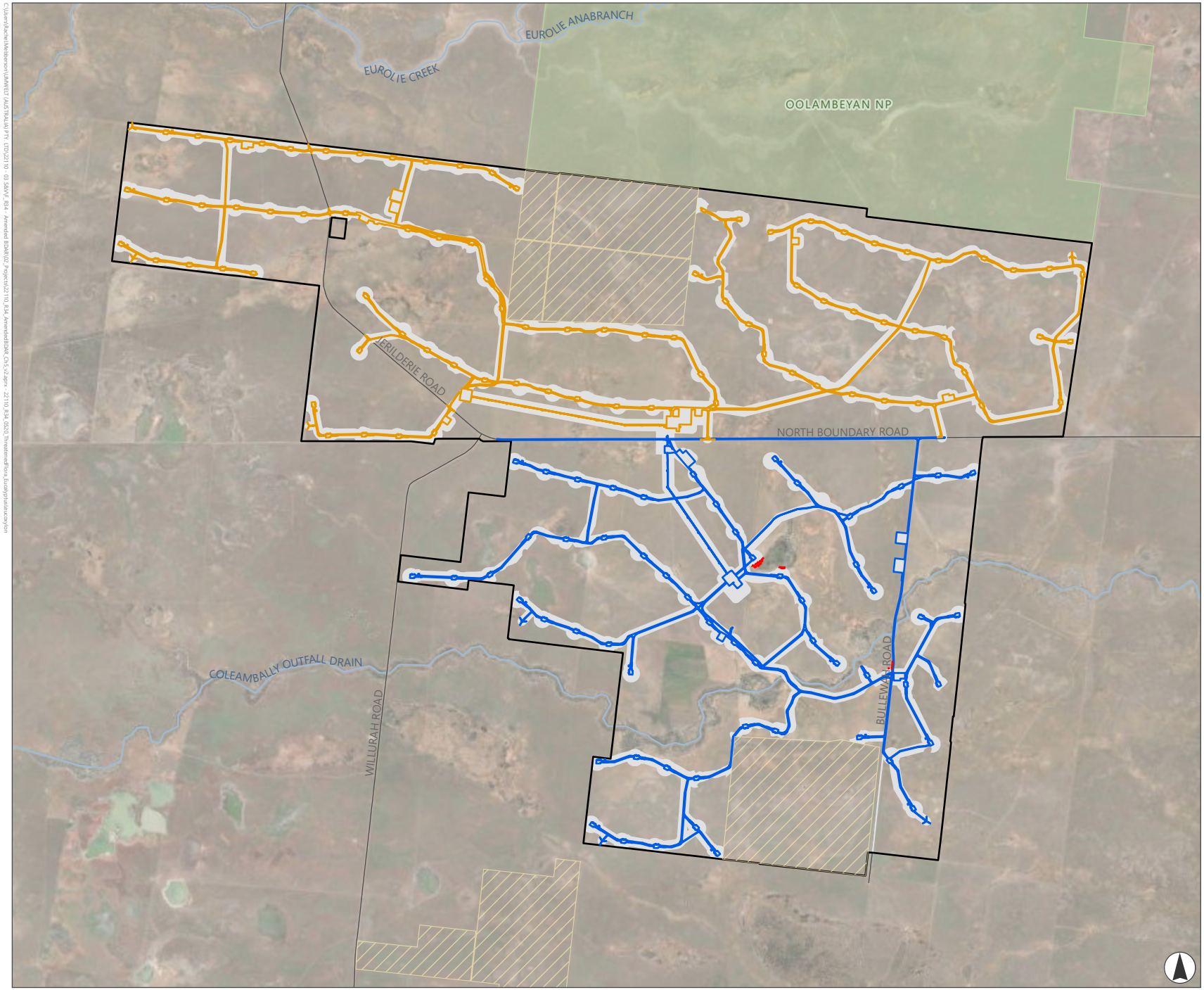
5.3.4.17 Yellow Gum (*Eucalyptus leucoxylon* subsp. *pruinosa*)

Table 5.25 Detailed Description of Surveys – Yellow Gum (*Eucalyptus leucoxylon subsp. pruinosa*)

Survey details - Yellow Gum (*Eucalyptus leucoxylon subsp. pruinosa*)	
Habitat Description	*Eucalyptus leucoxylon* subsp. *pruinosa* is a tree species which, in NSW, occurs at the bases of sandy rises and on loamy clay flats on the floodplains of the Murray River and its tributaries in the Riverina Bioregion.
Associated PCTs/VZs	PCT: 13 VZ: 2
Habitat or Geographical Constraints	Restricted to several small areas between Barham and Euston. This species is not known from any protected area within NSW, though some remnants occur within State Forests along the Murray River, particularly within Campbells Island and Euston State Forests.
Survey Requirement	Parallel field traverse. For a tree in dense vegetation the recommended maximum distance between field traverses is 20 m. In open vegetation this distance is 40 m.
Species-specific Survey Requirements	N/A
Survey Period	All year
Survey Group	SG6
Surveys Completed	Parallel field traverses were carried out within associated PCTs mapped within Subject Land. Parallel field traverses were caried out at width of 15–20 m wide, pending on the width of the habitat polygon. A total of 4 hours of survey has been completed for survey group 6. A total of 4.19 km of transect were walked. No targeted surveys have been carried out across the Stage 1 – Site-based assessment area, although no PCTs associated with species are present within this area.
Weather Conditions	Weather conditions during the survey period for Survey Group 6 were favourable for identifying *Eucalyptus leucoxylon* subsp. *pruinosa*.
Comments/Additional Information/Justification of approach	This species was not observed during surveys and this species has been **assessed as not present.**

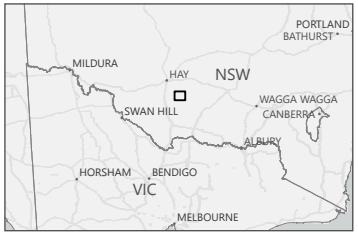
FIGURE 5.20.1

Threatened Flora Surveys
Eucalyptus leucoxylon subsp. pruinosa



Legend

- Project Boundary
- Subject Land
- Stage 1 (South) Development Footprint
- Stage 2 (North) Development Footprint
- Conservation Agreement Area
- NPWS Reserves
- Road
- Watercourse
- Survey Area
- Threatened Species Transect



0 1,000 2,000

Meters

Scale 1:122,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

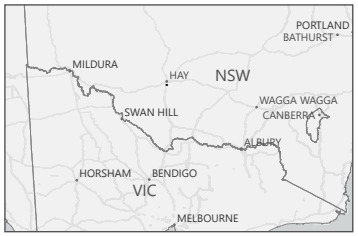
Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

FIGURE 5.20.2

Threatened Flora Surveys *Eucalyptus leucoxylon subsp. pruinosa*

Legend

- Stage 1 (South) Development Footprint
- Road



0 20 40

Meters

Scale 1:2,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

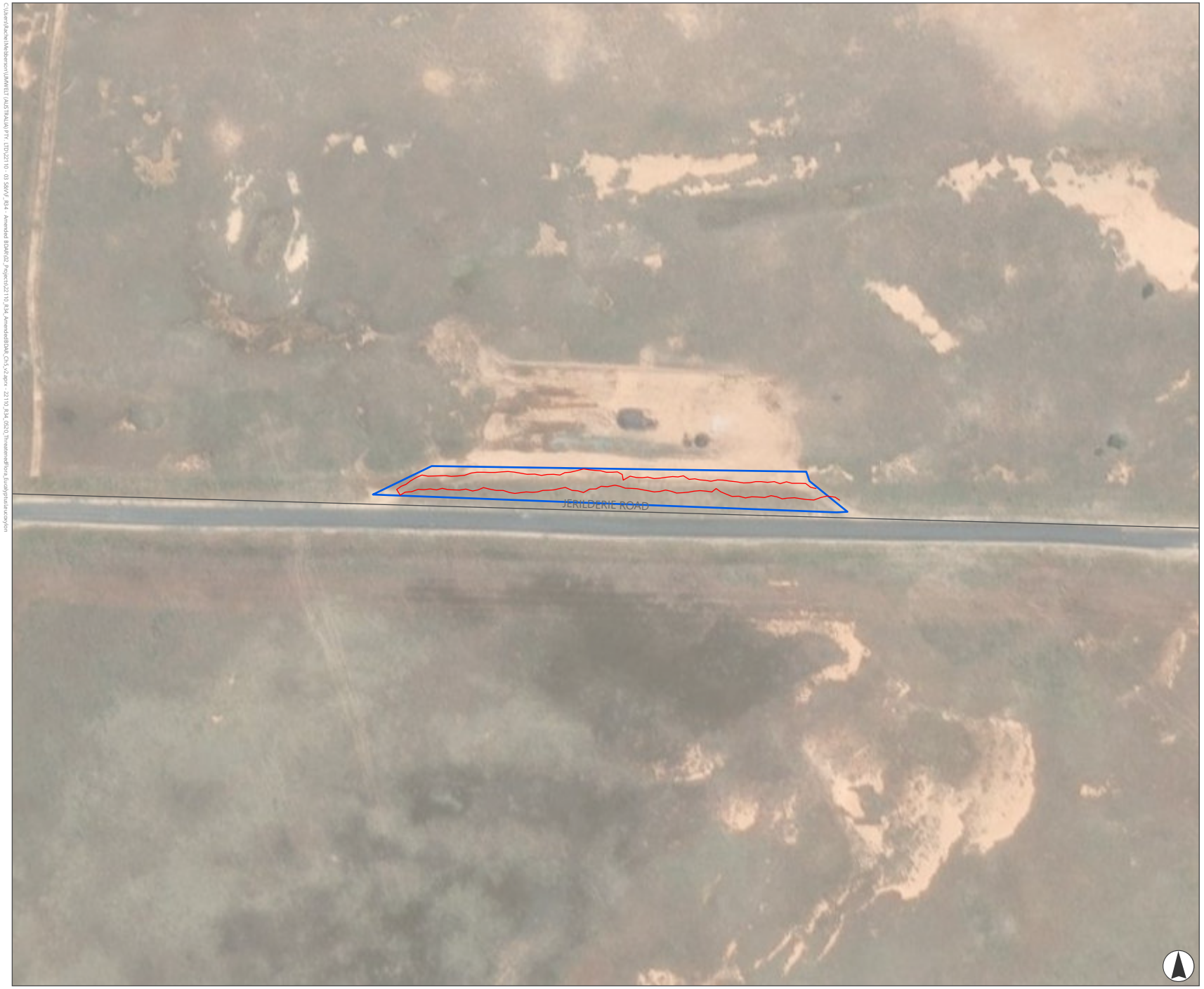
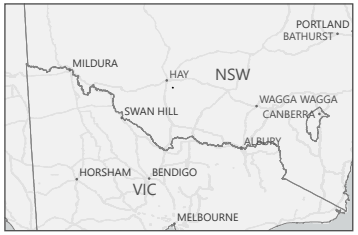


FIGURE 5.20.3

Threatened Flora Surveys
Eucalyptus leucoxylon subsp. pruinosa

Legend

- Stage 1 (South) Development Footprint
- Road
- Threatened Species Transect



0 20 40

Meters

Scale 1:2,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

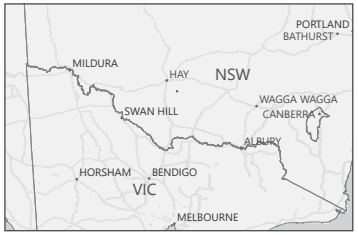
Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

FIGURE 5.20.4

Threatened Flora Surveys
Eucalyptus leucoxylon subsp. pruinosa

Legend

- Stage 1 (South) Development Footprint
- Road
- Watercourse
- Threatened Species Transect



0 20 40

Meters

Scale 1:2,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

5.3.5 Threatened Fauna Surveys

Targeted surveys were carried out for all 14 candidate fauna species as outlined in **Table 5.26** between March 2022 and March 2025. An assessment of habitat suitability for all potential candidate fauna species credit species is detailed within **Table 5.4**. Targeted fauna surveys have been carried out in accordance with the following survey guidelines, where relevant, or details within the TBDC:

- Threatened reptiles biodiversity assessment method survey guide (DPE, 2022).
- Koala *Phascolarctos cinereus* biodiversity assessment method survey guide (DPE, 2022).
- Species credit threatened bats and their habitats NSW guide for biodiversity assessment method (OEH, 2018).
- Species credit threatened bats and their habitats NSW guide for biodiversity assessment method (DPIE, 2021).
- NSW survey guide for threatened frogs (DPIE, 2020).
- Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities (2004 Working Draft) (DEC, 2004).
- Threatened species survey and assessment guidelines: field survey methods for fauna. Amphibians (2009) (DECC, 2009).
- Survey guidelines for Australia's threatened bats: Guidelines for detecting bats listed as threatened under the EPBC Act. (DEWHA, 2010a).
- Survey guidelines for Australia's threatened birds (DEWHA, 2010b).
- Survey Guidelines for Australia's threatened frogs (DEWHA, 2011a).
- Survey guidelines for Australia’s threatened mammals (DSEWPaC, 2011b).
- Survey guidelines for Australia’s threatened reptiles (DSEWPaC, 2011c).

A summary of candidate threatened fauna species, their survey requirements and survey effort are provided in Table 5.26. Detailed survey information for each species surveyed is then provided in **Section 5.3.5.1** to **Section 5.3.5.14**.

Where acoustic recording were used as a survey method the recordings were processed using Kaleidoscope Pro (Wildlife Acoustics), with a filter of 200–5000 Hz applied to the data to screen detections outside target species’ vocal range. Bait files of large forest owls and koala vocalisations were inserted into the data [clearly labelled as “sample”] to force any field detections into appropriate clusters of recordings during Kaleidoscope Pro software processing of the field data. Every cluster that included at least one bait vocalization recording underwent auditory and/or visual analysis using Kaleidoscope Pro. This process involved comparing the recordings and spectrograms with those of known vocalisations from the species of interest. Bait files were taken from ‘Nightlife of Australia: South-Eastern Forests’ by Ed McNabb (2005), and spectrograms from the ‘Handbook of Australian, New Zealand and Antarctic Birds’ (Marchant & Higgins, 1999), as well as spectrograms generated in Kaleidoscope Pro from the acoustic bait files.

The location of threatened fauna surveys carried out within the Subject Land during surveys is shown on **Figure 5.23**.

Table 5.26 Summary of Targeted Surveys Carried Out for Candidate Threatened Fauna Species

Species Name	Common Name	EPBC Act	BC Act	SAII	Minimum Survey Requirements	Survey Methodology Utilised	Seasonal Survey Requirements	Survey Date	Survey Effort
Birds									
Ardeotis australis	Australian Bustard	E	-	N	No specific survey guidance for this species provided within DEC (2004) or TBDC.	Dry habitat search – flushing via walking through suitable habitat. These surveys were carried out concurrently with threatened flora transects.	All year	Surveys were undertaken 104 days between July 2023 and January 2025 with the majority between August and November 2023. Additional transects were carried out between September 2024 and January 2025.	5,479.14 km flushing transects walked across the Subject Land.
Burhinus grallarius	Bush Stone-curlew	E	-	N	Dry habitat searches via flushing by walking through suitable habitat is a suitable survey method as detailed within Table 5.7 of *Threatened Biodiversity Survey and Assessment: Guidelines for developments and activities* (working Draft) (DEC 2004). Table 5.7 in DEC (2004) also lists call playback and spotlighting by foot or vehicle in first gear as suitable survey methods for this species. It is noted that DEC (2004) states that call playback should be carried out during breeding season (July to January). Furthermore, the TBDC states that it is unclear how well the species responds to call playback. Consultation with CPHR confirmed additional survey and assessment was required for this species utilizing call playback and these surveys could be completed outside of breeding season. Please refer to Section 5.3.5.2 for further details. Note that dominant vegetation across the Development Corridor is native grassland, thus habitat constraints for the species (Fallen/standing dead timber including logs) occurs infrequently.	Dry habitat search – flushing via walking through suitable habitat. It is proposed these surveys be carried out concurrently with threatened flora transects. Spotlighting by foot or via vehicle driven in first gear. Call playback of a 30 second broadcast, followed by 4.5-minute listening period. Across the site at locations in suitable habitat within the Subject Land. A total of 11 sites were surveyed across the Subject Land in 2025, spanning three nights (4–6/03/2025). Each survey site was repeated 2 times across the survey and was therefore surveyed a total of 30 minutes totaling 5.5 hours of survey effort. Eight (8) to nine (9) acoustic recorders deployed for a duration of 20 nights (8–18 August and 25 November–14 December 2023). Recorders were placed in associated PCTs targeted areas containing trees. Eight of the nine recorders acoustic recorders contained data. A total of 161 nights of recordings was completed.	All year	Dry habitat surveys were undertaken over 104 days between July 2023 and January 2025 with the majority between August and November 2023. Nocturnal vehicle spotlighting was carried out between 5–13 and 19–26 November 2024, and 3–4 December, 2024. Call playback surveys were undertaken between 4 and 6 March 2025. Acoustic call detection: 8–18 August 2023 25 November–14 December 2023.	5,479.14 km flushing transects walked across the Subject Land. Undertaken at 24 sites over 19 nights by 2 ecologists for a total of 524.85 km. Each site was surveyed twice. Call playback across 11 survey locations for a 5-minute cycle. Each site was repeated twice equating to 30 minutes per site. Total effort equals 5.5 hours across the Subject Land. Nine (9) acoustic recorders deployed for 10 nights between 8 – 18 August 2023. An additional eight (8) acoustic recorders were deployed for up to 11 nights between 25 November and 14 December 2023. A total of 161 nights of recordings.
Haliaeetus leucogaster	White-bellied Sea-Eagle	V	-	N	Survey requirements not explicitly stated. Searches for stick nest were carried out during habitat assessment surveys. Opportunistic searches for large stick nests took place during all surveys in the correct survey period.	Seasonal bird and bat utilisation surveys carried out to detect presence of species within the Subject Land. At least one round of surveys was carried out between July and December when the species breeds.	All year	BBUS vantage survey dates: 23 – 29 March 2022 8–13 July 2022 19–24 September 2022 17–21 January 2023 22–26 May 2023 15–19 July 2023 23–26 September 2023 13–17 February 2024	Each of the 10 vantage point survey locations were surveyed for 1 hour 6 times per survey period (8 in total). This equates to 48 hours of survey per vantage point survey location. With ten vantage point locations this is a total of 480 hours survey.

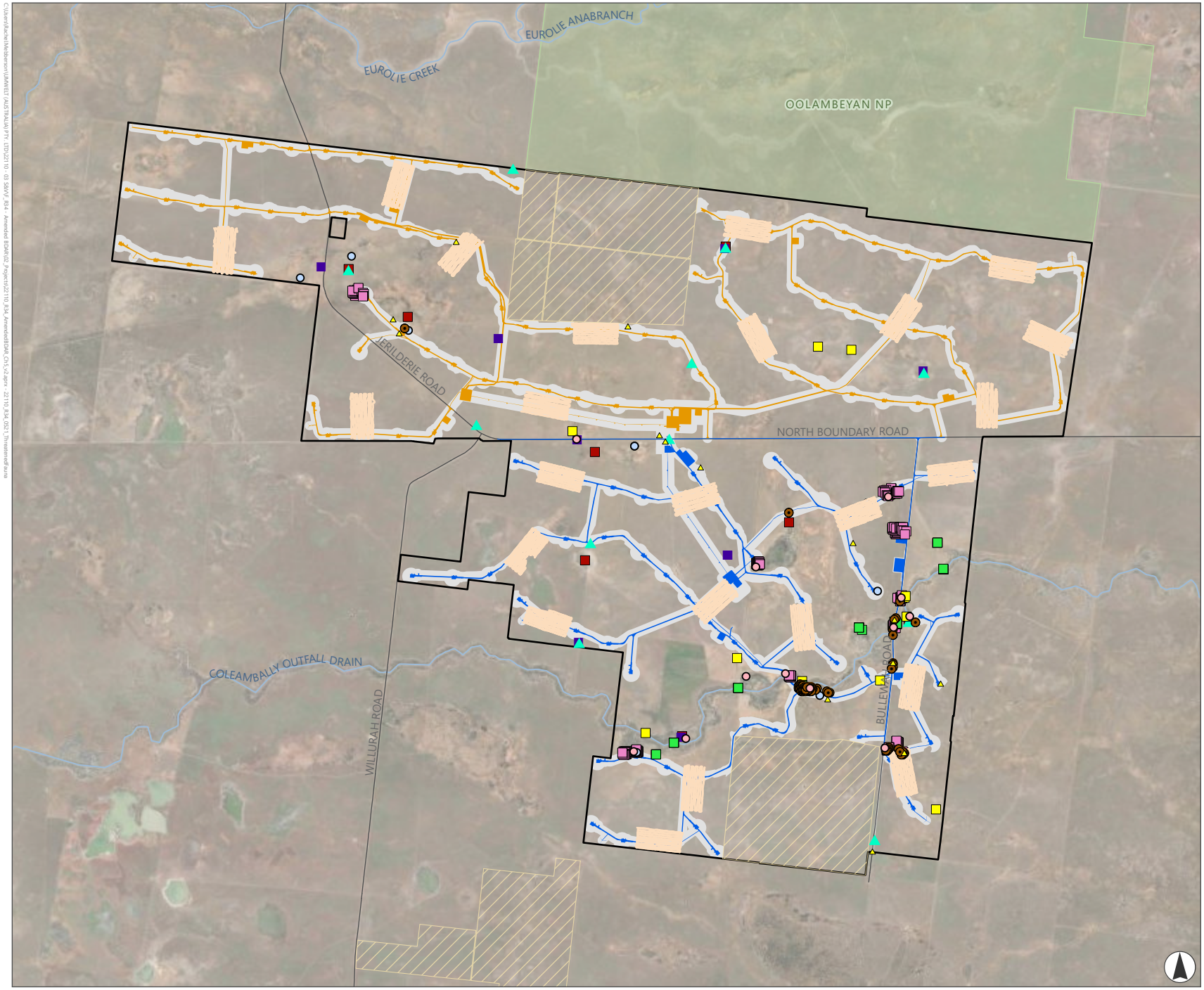
Species Name	Common Name	EPBC Act	BC Act	SAII	Minimum Survey Requirements	Survey Methodology Utilised	Seasonal Survey Requirements	Survey Date	Survey Effort
Hieraaetus morphnoides	Little Eagle	V	-	N	Survey requirements not explicitly stated. Band et al. (2007) recommend vantage point surveys. Searches for stick nest were carried out during habitat assessment surveys. Opportunistic searches for large stick nests took place during all surveys in the correct survey period.	Seasonal bird and bat utilisation surveys carried out to detect presence of species within the Subject Land. At least one round of surveys was carried out between August and October when the species breeds.	N/A	BBUS vantage survey dates: 23–29 March 2022 8–13 July 2022 19–24 September 2022 17–21 January 2023 22–26 May 2023 15–19 July 2023 23–26 September 2023 13–17 February 2024	Each of the ten (10) vantage point survey locations were surveyed for 1 hour 6 times per survey period (8 in total). This equates to 48 hours of survey per vantage point survey location. With ten vantage point locations this is a total of 480 hours survey.
Lophochroa leadbeateri	Pink Cockatoo	V	-	N	Survey requirements not explicitly stated. 20 min/2 ha area searches in accordance with *Survey guidelines for Australia's threatened birds* (DEWHA, 2010b) in areas containing suitable breeding habitat (hollows). Searches for hollows were carried out during habitat assessment surveys. Opportunistic searches for large stick nests took place during all surveys in the correct survey period.	Seasonal bird and bat utilisation surveys carried out to detect presence of species within the Subject Land. At least two rounds of surveys were carried out between September to December when the species breeds. 20 min/2 ha area searches at 12 survey locations, repeated four (4) times.	All year	BBUS vantage survey dates: 23–29 March 2022 8–13 July 2022 19–24 September 2022 17–21 January 2023 22–26 May 2023 15–19 July 2023 23–26 September 2023 13–17 February 2024 Area search dates: 30 September 2024 1–2 October 2024 1–2 November 2024	Each of the ten (10) vantage point survey locations were surveyed for 1 hour 6 times per survey period (8 in total). This equates to 48 hours of survey per vantage point survey location. With ten vantage point locations this is a total of 480 hours survey. Each of the 12 survey locations were surveyed for 20 min per survey and surveyed four (4) times. With 12 survey locations this is a total of 960 min / 40 hours)
Lophoictinia isura	Square-tailed Kite	V	-	N	Survey requirements not explicitly stated. Band et al. (2007) recommend vantage point surveys. Searches for stick nest were carried out during habitat assessment surveys. Opportunistic searches for large stick nests took place during all surveys in the correct survey period.	Seasonal bird and bat utilisation surveys carried out to detect presence of species within the Subject Land. At least one round of surveys was carried out between August and October when the species breeds.	All year	BBUS vantage survey dates: 23–29 March 2022 8–13 July 2022 19–24 September 2022 17–21 January 2023 22–26 May 2023 15–19 July 2023 23–26 September 2023 13–17 February 2024	Each of the ten (10) vantage point survey locations were surveyed for 1 hour 6 times per survey period (8 in total). This equates to 48 hours of survey per vantage point survey location. With ten vantage point locations this is a total of 480 hours survey.
Ninox connivens	Barking Owl	V	-	N	Acoustic recording at suitable density and duration, or call playback comprised of 15-minute broadcast and 15-minute listening sequence over 6 nights or until owl responds. Note that the surveys for Barking Owl were carried out prior to the species being a full species credit species on 14 March 2024. The TBDC was subsequently updated with survey requirements for this species.	Nine (9) acoustic recorders deployed for a duration of ten (10) nights in associated PCTs (approx. 21 ha), containing suitable hollow bearing trees.	May–December	8–18 August 2023	Nine (8) acoustic recorders deployed for 10 nights. Total recording time of all units was 841 minutes. Note: one acoustic recorder did not record.

Species Name	Common Name	EPBC Act	BC Act	SAII	Minimum Survey Requirements	Survey Methodology Utilised	Seasonal Survey Requirements	Survey Date	Survey Effort
Pedionomus torquatus	Plains-wanderer	E	CE	Y	As per Section 5.3(1)(c) of the BAM, no targeted surveys are required for species with important habitat mapping. Consultation with CPHR confirmed that no additional survey and assessment was required for this species, however, Commonwealth DCCEEW confirmed that in order to assess species under the EPBC Act, additional surveys in 'secondary' habitat for the species would be required. Spotlight from the vehicle travelling at 6–7 km/hr across grid-based survey areas comprised of 10–11 transects that are 1 km long and set 50 m apart. Each grid should be surveyed twice, 2–3 nights apart.	Important habitat mapping for the species occurs within the Project Boundary and adjacent to the Subject Land. The Project design has been changed to avoid areas of important habitat mapping for this species such that no important habitat is proposed to be impacted. Vehicle spotlighting transects were conducted across 24 grids where 10 x 1 km long transects were set 50 m apart. The spotlighting was completed by car travelling 6–7 km/hr with two spotters searching from the car covering 25 m outwards. Each grid site was surveyed twice, 2–3 nights apart from the initial survey.	September – November	5–13 and 19–26 November 2024 3–4 December 2024	**Spotlighting**: Undertaken at 24 sites over 19 nights by 2 people for a total of 524.85 km and 380 hours. Each site was surveyed twice.
Polytelis swainsonii	Superb Parrot	V	V	N	Survey requirements not explicitly stated. 20 min/2 ha area searches in accordance with Survey guidelines for Australia's threatened birds (DEWHA, 2010b) in areas containing suitable breeding habitat (hollows). Searches for hollows were carried out during habitat assessment surveys.	Seasonal bird and bat utilisation surveys carried out to detect presence of species within the Subject Land. At least two rounds of surveys were carried out between September to December when the species breeds. 20 min/2 ha area searches at 12 survey locations, repeated four (4) times.	N/A	BBUS vantage survey dates: 23–29 March 2022 8–13 July 2022 19–24 September 2022 17–21 January 2023 22–26 May 2023 15–19 July 2023 23–26 September 2023 13–17 February 2024 Area search dates: 30 September 2024 1–2 October 2024 1–2 November 2024	Each of the ten (10) vantage point survey locations were surveyed for 1 hour 6 times per survey period (8 in total). This equates to 48 hours of survey per vantage point survey location. With ten vantage point locations this is a total of 480 hours survey. Each of the 12 survey locations were surveyed for 20 min per survey and surveyed four (4) times. With 12 survey locations this is a total of 960 min (40 hours)
Tyto novaehollandiae	Masked Owl	V	-	N	Acoustic recording at suitable density and duration, or call playback comprised of 15-minute broadcast and 15-minute listening sequence over 6 nights or until owl responds. Note that the surveys for Masked Owl were carried out prior to the species being a full species credit species on 14 March 2024. The TBDC was subsequently updated with survey requirements for this species.	Nine (9) acoustic recorders deployed for a duration of ten (10) nights in associated PCTs (approx. 150 ha), containing suitable hollow bearing trees.	May–August	8–18 August 2023	Nine (9) acoustic recorders deployed for 10 nights. Total recording time of all units was 841 minutes. Note: one acoustic recorder did not record.
Amphibians									
Litoria raniformis	Southern Bell Frog	V	E	N	Aural-visual surveys. 500 m transect 480 minutes total, four repeats in absence of species.	Aural-visual surveys total 480 minutes per 500 m transect, repeated 4 times.	October - January	5–12 December 2023	Aural-visual surveys at all water bodies within the development corridor. This species was widely recorded. Repeat nights were only undertaken when the species was not recorded on the first night.

Species Name	Common Name	EPBC Act	BC Act	SAII	Minimum Survey Requirements	Survey Methodology Utilised	Seasonal Survey Requirements	Survey Date	Survey Effort
Reptiles									
Hemiaspis damelii	Grey Snake	E	E	N	Not stated. There are no survey guidelines for this species but survey advice from CPHR (received 23 November 2023) for Grey Snake is as follows: *nocturnal spotlighting on warm nights in spring-summer, adjacent to wetlands on cracking clay soils, particularly in river red gum/spike rush or lignum vegetation communities.*	Nocturnal spotlighting within suitable habitat.	October - February	5–12 December 2023	Passive meandering nocturnal searches at three (3) sites within designated PCT. Two ecologists conducted about 30-minute surveys, repeated over four nights. Equating to 405 minutes of survey per ecologist, a total of 810 minutes (13.5 hours).
Mammals									
Phascolarctos cinereus	Koala	E	E	N	Passive acoustic detection: 1 recording unit per 5 ha over 7 nights. Koala Spot Assessment Technique (SAT) based on 150 m spacing, for suitable habitat ≤50 ha.	Eight (8) acoustic recorders were deployed for a 9-night period (7 nights were required) within suitable habitat (approx. 23 ha). Koala Spot Assessment Technique (SAT) was utilised to assess the presence of koala scat within the prescribed area. Effort consistent with that specified within *Koala (Phascolarctos cinereus) Biodiversity Assessment Method Guideline* (DPE 2022).	All year (SAT) September–December (acoustic detection)	Acoustic recorders: 25 November 2023–14 November 2023 SAT Survey: 13 May 2024–16 May 2024	Eight (8) acoustic recorders were deployed for Koala detection for up to 11 nights. A total of 81 nights of recordings. Eleven (11) Koala SAT plots were selected using the *Koala (Phascolarctos cinereus) Biodiversity Assessment Method Guideline (DPE 2022).* The 11 plots were surveyed for scat, with each tree (larger than 10 cm DBH) surveyed for 2 person minutes and identified to species.
Myotis macropus	Southern Myotis	V	-	N	Department of Planning, Industry and Environment (2021) outline several detection methods including: • Passive acoustic detection. 16 hours over 4 nights. • Active acoustic detection with visual confirmation of foraging behaviour. 8 hours over 4 nights.	Effort consistent with that specified within *'Species credit' threatened bats and their habitats* (OEH 2018). Active acoustic detection was conducted using an Anabat Walkabout from Titley Scientific. Equipment used for visual detection were spotlights with a red filter along with a HIKMICRO Falcon FH35 thermal monocular.	October–March	Passive acoustic detection: 23–29 March 2022 17–23 January 2023 22–27 March 2023 31 October–7 November 2023 19–27 February 2024 Spotlighting/real-time acoustic detection: 20–27 February 2024.	<u>Passive acoustic detection</u> March 2022: 5 sites, 4–6 nights of data per site, 26 nights total data. January 2023: 4 sites, 6–7 nights per site, 27 nights total March 2023: 6 sites, 6–7 nights per site, 40 nights total data. October–November 2023: 6 sites, 7 nights per site, 42 nights total data. February 2024: 6 sites, 9–12 nights per site, 55 nights total data. <u>Spotlighting/active acoustic detection</u> Undertaken at 8 sites over 8 nights by 2 people for a total of 1,920 minutes. Each site was surveyed 4 times.

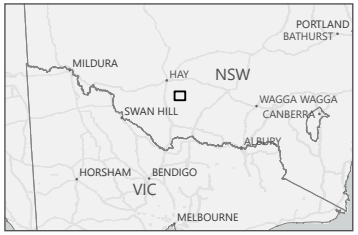
FIGURE 5.21.1

Threatened Fauna Surveys



Legend

- Project Boundary
- Subject Land
- Stage 1 (South) Development Footprint
- Stage 2 (North) Development Footprint
- Conservation Agreement Area
- NPWS Reserves
- Road
- Watercourse
- Pink Cockatoo and Superb Parrot Survey Location
- Koala Acoustic Survey Location
- BBUS Vantage Points
- Anabat Survey Location
- Southern Myotis Survey Location
- Southern Bell Frog Survey Location
- KSAT Surveys Location
- Owl Survey Location
- Stick Nest Locations
- Hollow Bearing Trees
- Plains Wanderer Transects



0 1,000 2,000

Meters

Scale 1:122,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

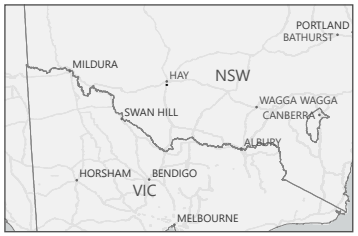
Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

FIGURE 5.21.2

Threatened Fauna Surveys

Legend

- Stage 1 (South) Development Footprint
- Road



0 20 40

Meters

Scale 1:2,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

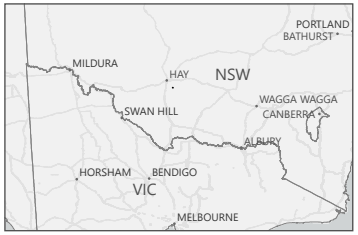
C:\Users\RachelMeiberg\UMWELT (AUSTRALIA) PTY. LTD\2210 - 03 SWVF R4 - Amended BDAR\02_Projects\2210_R34_AmendedBDAR_Ch5.v2.aprx - 2210_R34_052_ThreatenedFauna

FIGURE 5.21.3

Threatened Fauna Surveys

Legend

- Stage 1 (South) Development Footprint
- Road



0 20 40

Meters

Scale 1:2,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

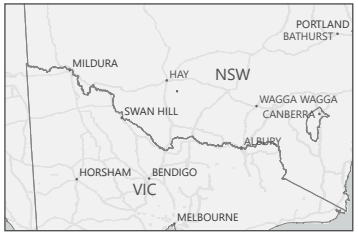
Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

FIGURE 5.21.4

Threatened Fauna Surveys

Legend

- Stage 1 (South) Development Footprint
- Road
- Watercourse



0 20 40

Meters

Scale 1:2,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

5.3.5.1 Australian Bustard (*Ardeotis australis*)

Table 5.27 Detailed Description of Surveys – Australian Bustard

Survey details – Australian Bustard (*Ardeotis australis*)	
Credit Type	Species credit species
Habitat Description	Mainly inhabits tussock and hummock grasslands, though prefers tussock grasses to hummock grasses; also occurs in low shrublands and low open grassy woodlands; occasionally seen in pastoral and cropping country, golf courses and near dams. Breeds on bare ground on low sandy ridges or stony rises in ecotones between grassland and protective shrubland cover; roosts on ground among shrubs and long grasses or under trees.
Associated PCTs/VZs	PCTs: 24, PCT 26, PCT 28, PCT 44, PCT 46, PCT 160, PCT 164 VZs: 4,5,6,7,8,9,10,11,12
Habitat or Geographical Constraints	N/A
Survey Requirement	No specific survey guidance for this species provided within DEC (2004) or TBDC.
Survey Period	All year
Surveys Completed	Flushing via walking through suitable habitat. These surveys were carried out concurrently with threatened flora transects. A total of 5,479.14 km of threatened flora transects were completed within the development corridor.
Weather Conditions	Surveys were undertaken over 104 days between October 2023 and January 2025 (with the majority between August and November 2023) and between September 2024 and January 2025. Refer to **Appendix H** for weather during this period.
Comments/Additional Information/Justification of approach	The Australian Bustard has become rare within the southern part of its range and it is now considered a vagrant to the Riverina. There is a 2005 record of two individuals within Oolambeyan National Park, just to the north of the Subject Land. It is possible that the Australian Bustard may occur in the Subject Land occasionally. The species was **not recorded** during surveys.

5.3.5.2 Bush stone-curlew (*Burhinus grallarius*)

Table 5.28 Detailed Description of Surveys – Bush stone-curlew

Survey details – Bush stone-curlew (*Burhinus grallarius*)	
Credit Type	Species
Habitat Description	Inhabits open forests and woodlands with a sparse grassy groundlayer and fallen timber. Largely nocturnal, being especially active on moonlit nights. Nest on the ground in a scrape or small bare patch.
Associated PCTs/VZs	PCTs: 13, 26, 28, VZs: 2, 5, 6, 7, 8
Habitat or Geographical Constraints	Fallen/standing dead timber including logs

Survey details – Bush stone-curlew (*Burhinus grallarius*)	
Survey Requirement	Dry habitat searches via flushing by walking through suitable habitat is a suitable survey method as detailed within Table 5.7 of Threatened Biodiversity Survey and Assessment: Guidelines for developments and activities (working Draft) (DEC 2004). Surveys can also be conducted by playing Bush-stone curlew calls for 30 seconds, followed by 4.5 minutes of silence. This 5-minute cycle should be repeated up to three times so there is a maximum of 15 minutes of survey at each point. The same 30 seconds of calls should be used throughout the survey. If a bird responds to the taped call, approximately 10 minutes should then be spent listening for other Bush-stone curlew responses. Survey points should be approximately 2–4 km apart. TBDC states that it is unclear how well the species responds to call playback. Spotlighting by foot or vehicle in first gear as suitable survey methods for this species as detailed within DEC (2004).
Survey Period	All year
Surveys Completed	Flushing via walking through suitable habitat. These surveys were carried out concurrently with threatened flora transects. A total of 5,479.14 km of threatened flora transects were completed within the development corridor. Spotlighting surveys were conducted across November to December of 2024 across twenty-four grids comprised of 10 x 1 km transects set 50 m apart. The spotlighting was completed by car travelling 6–7 km/hr with two spotters searching from the car covering 25 m outwards. Each grid site was surveyed twice, 2–3 night apart from the initial survey. The surveys were undertaken over 19 survey nights by 2 ecologists for a total of 524.85 km. Call playback of a 30 second broadcast, followed by 4.5-minute listening period. Across the site at locations in suitable habitat within the Subject Land. A total of 11 sites were surveyed across the Subject Land in 2025, spanning three nights (4–6 March 2025). Each survey site was repeated 2 times across the survey and was therefore surveyed a total of 30 minutes totalling 5.5 hours of survey effort across the Subject Land. Eight (8) to nine (9) acoustic recorders (Titley Chorus programmed to record stereo acoustic) were deployed for a duration of 20 nights (8–18 August and 25 November–14 December 2023). Recorders were placed in associated PCTs targeted areas containing trees. Eight of the nine recorders acoustic recorders contained data. A total of 161 nights of recordings was completed.
Weather Conditions	Dry habitat surveys were undertaken over 104 days between July 2023 and January 2025 (with the majority between August and November 2023). Spotlighting surveys were completed over 19 days between November 2024 and December 2024. Call playback surveys were completed between the 4 and 6 March 2025. Acoustic call detection occurred between August 2023 and December 2023. Refer to **Appendix H** for weather during this period.
Comments/Additional Information/Justification of approach	The dominant vegetation across the Development Corridor is native grassland, thus habitat constraints for the species (Fallen/standing dead timber including logs) occurs infrequently. The species was **not recorded** during surveys.

5.3.5.3 White-bellied Sea-eagle (*Haliaeetus leucogaster*)

Table 5.29 Detailed Description of Surveys – White-bellied Sea-eagle

Survey details – White-bellied Sea-eagle (*Haliaeetus leucogaster*)	
Credit Type	Dual credit species with breeding habitat assessed for species credits and foraging habitat assessed for ecosystem credits.
Habitat Description	Habitats are characterised by the presence of large areas of open water including larger rivers, swamps, lakes, and the sea. Occurs at sites near the sea or sea-shore, such as around bays and inlets, beaches, reefs, lagoons, estuaries and mangroves; and at, or in the vicinity of freshwater swamps, lakes, reservoirs, billabongs and saltmarsh. Terrestrial habitats include coastal dunes, tidal flats, grassland, heathland, woodland, and forest (including rainforest). Breeding habitat consists of mature tall open forest, open forest, tall woodland, and swamp sclerophyll forest close to foraging habitat. Nest trees are typically large emergent eucalypts and often have emergent dead branches or large dead trees nearby which are used as 'guard roosts'. Nests are large structures built from sticks and lined with leaves or grass.
Associated PCTs/VZs	PCTs: 10, 13, 17, 24, 26, 28, 44, 46, 160, 164 VZs: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
Habitat or Geographical Constraints	Living or dead mature trees within suitable vegetation within 1 km of rivers, lakes, large dams or creeks, wetlands and coastlines.
Survey Requirement	Survey requirements not explicitly stated. Due to the similarities in nest structure and use of the same nests by White-bellied Sea Eagles and Wedge-tailed Eagles, where a nest is observed without a bird present, searches for prey remains/feathers below the structure should be undertaken. The differing diets of both species and distinctive adult feathers, should provide evidence of nest use, however; where prey items/feathers are absent, repeat visits to the nest until a bird is observed should be undertaken. Where a breeding site has been identified in accordance with the BAM, the species polygon buffer should be established by one of two methods where the breeding site is within an urban or peri-urban area, a circular polygon with a 250 m radius from the breeding site is applied. Where the breeding site is 500 m or more from an urban or peri-urban area, a circular polygon with a 500 m radius from the breeding site is applied. The purpose of the buffers is to minimise disturbance/avoid clearing, for a development application, or to conserve and improve habitat, for a biodiversity stewardship agreement, within the area essential for breeding. This includes habitat suitable for feeding/grooming/lookout perches and fledgling requirements. It does not account for foraging habitat as the White-bellied Sea Eagle forages on water. The polygons are in accordance with published literature on nesting requirements of the species (Debus 2008; Debus et al. 2014; Dennis et al. 2011; O'Donnell & Debus 2012; Threatened Species Section 2006). DPIE is currently developing survey guidance for threatened bird species. In the interim, assessors must undertake a species survey using best practice methods that can be replicated for repeat surveys (as per the BAM threatened species survey requirements). Where a development proposal seeks to undertake works near an identified breeding site, a site-specific assessment of viewsheds (based on the concept by Camp et al. 1997) should be undertaken if the planned works are within the species' breeding period (June – January). A maximum viewshed buffer with a 1000 m radius should be applied from the breeding site, and where the buffer encompasses the proposed works, they should not proceed until post breeding period.

Survey details – White-bellied Sea-eagle (*Haliaeetus leucogaster*)	
Survey Period	Bird utilisation (vantage point) surveys can be conducted all year. July–December (breeding)
Surveys Completed	Bird utilisation surveys were undertaken seasonally from March 2022 to February 2024 in order to identify presence of the species within the Project Area. Each of the 10 vantage point survey locations were surveyed for 1 hour 6 times per survey period (8 in total). This equates to 48 hours of survey per vantage point survey location. Four of the eight survey periods occurred within the breeding period. With ten vantage point locations this is a total of 480 hours survey. Searches for stick nests were undertaken during the habitat assessment survey and opportunistically during all other surveys. Location of the stick nests in relation to BBUS survey vantage point locations is shown in **Figure 5.21**.
Weather Conditions	BBUS vantage survey dates: 23–29 March 2022 8–13 July 2022 (breeding) 19–24 September 2022 (breeding) 16–20 January 2023 21–25 March 2023 15–19 July 2023 (breeding) 23–26 September 2023 (breeding) 13–17 February 2024 Refer to **Appendix H** for weather during this period.
Comments/Additional Information/Justification of approach	The species was **not recorded** during surveys.

5.3.5.4 Little Eagle (*Hieraaetus morphnoides*)

Table 5.30 Detailed Description of Surveys – Little Eagle

Survey details – Little Eagle (*Hieraaetus morphnoides*)	
Credit Type	Dual credit species with breeding habitat (nests) assessed for species credits and foraging habitat assessed for ecosystem credits.
Habitat Description	Occupies open eucalypt forest, woodland or open woodland. Sheoak or Acacia woodlands and riparian woodlands of interior NSW are also used. Nests in tall living trees within a remnant patch, where pairs build a large stick nest in winter (Debus and Soderquist 2008). Breeding habitat is live (occasionally dead) large old trees within suitable vegetation and the presence of a male and female; or any adult with nesting material; or an individual on a large stick nest in the top half of the tree canopy; or pairs displaying (soaring, diving, engaging in chases, or a male observed calling in flight with a female begging from tree).
Associated PCTs/VZs	PCTs: 10, 13, 17, 24, 26, 28, 44, 46, 160, 164 VSs: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
Habitat or Geographical Constraints	Nest trees - live (occasionally dead) large old trees within vegetation. Paddock trees can provide important breeding habitat (there are examples of nest trees in ACT).

Survey details – Little Eagle (*Hieraaetus morphnoides*)	
Survey Requirement	NSW DCCEEW is currently developing survey guidance for threatened bird species. In the interim, assessors must undertake a species survey using best practice methods that can be replicated for repeat surveys (as per the BAM threatened species survey requirements). Survey requirements not explicitly stated. Seasonal bird utilisation (vantage point) surveys. Opportunistic searches for large stick nests during all surveys in the correct (breeding) survey period.
Survey Period	August–October (breeding). Bird utilisation surveys can be conducted all year.
Surveys Completed	Bird utilisation surveys were undertaken seasonally from March 2022 to February 2024 in order to identify the presence of the species within the Project Area. Each of the 10 vantage point survey locations were surveyed for 1 hour 6 times per survey period (8 in total). This equates to 48 hours of survey per vantage point survey location. Two of the eight survey periods occurred within the breeding period. With 10 vantage point locations this is a total of 480 hours survey. Searches for stick nests were undertaken during the habitat assessment survey and opportunistically during all other surveys. Location of the stick nests in relation to BBUS survey vantage point locations is shown in **Figure 5.21.**
Weather Conditions	BBUS vantage survey dates: 23–29 March 2022 8–13 July 2022 19–24 September 2022 (breeding) 17–21 January 2023 22–26 May 2023 15–19 July 2023 23–26 September 2023 (breeding) 13–17 February 2024 Refer to **Appendix H** for weather during this period.
Comments/Additional Information/Justification of approach	The species **was recorded** during surveys. Where possible, the design was updated to avoid impacts to stick nests as detailed within **Section 7.1**.

5.3.5.5 Pink Cockatoo (*Lophochroa leadbeateri*)

Table 5.31 Detailed Description of Surveys – Pink Cockatoo

Survey details – Pink Cockatoo (*Lophochroa leadbeateri*)	
Credit Type	Dual credit species with breeding habitat assessed for species credits and foraging habitat assessed for ecosystem credits.
Habitat Description	Inhabits a wide range of treed and treeless inland habitats, always within easy reach of water. Feeds mostly on the ground, especially on the seeds of native and exotic melons and on the seeds of species of saltbush, wattles and cypress pines. Nesting, in tree hollows, occurs throughout the second half of the year; nests are at least 1 km apart, with no more than one pair every 30 km^2.
Associated PCTs/VZs	PCTs: 10, 13, 26, 28 VZs: 1, 2, 5, 6, 7, 8

Survey details – Pink Cockatoo (*Lophochroa leadbeateri*)	
Habitat or Geographical Constraints	Hollow bearing trees – living or dead tree with hollows greater than 10 cm diameter.
Survey Requirement	Survey requirements not explicitly stated. Opportunistic searches suitable hollow bearing trees during all surveys in the correct survey period. Seasonal bird utilisation (vantage point) surveys. Assessors should look for signs of breeding on site as follows; (a) begging birds of any age or sex; or (b) lone individuals of the species identified during the breeding season (August to November); or (c) an occupied nest. Where signs of breeding on site are present, potential nest trees should be identified. Where potential nest trees are identified on site, monitor for this species during the breeding season (August to November) to confirm the presence of any actual nest trees on site. DPIE is currently developing survey guidance for threatened bird species. In the interim, assessors must undertake a species survey using best practice methods that can be replicated for repeat surveys (as per the BAM threatened species survey requirements). If actual nest trees are confirmed on site, then the species polygons are to be drawn around those actual nest trees (i.e. trees that birds of the species are known to have used for nesting). The species polygons should be circular in shape and must include a buffer radius of 200 m around each actual nest tree. The purpose of the buffer is to identify the essential area for breeding and minimise disturbance/avoid clearing for a development application, or conserve and improve habitat for a biodiversity stewardship agreement. The shape of the buffer can be modified where evidence provided in the Biodiversity Assessment Report indicates an alternative shape would better meet the species needs in the context of the assessment site. For example, extant vegetation is linear, and the nest tree is already located near the edge of the wooded area.
Survey Period	September–December (TBDC) August–November (breeding)
Surveys Completed	Bird utilisation surveys were undertaken seasonally from March 2022 to February 2024. Each of the 10 vantage point survey locations were surveyed for 1 hour x 6 times per survey period (8 in total). This equates to 48 hours of survey per vantage point survey location. Two of the eight survey periods occurred within the breeding period. With 10 vantage point locations this is a total of 480 hours survey. Searches for hollow bearing trees was undertaken during the habitat assessment survey and opportunistically during all other surveys. Area searches were carried out in accordance with Survey guidelines for Australia's threatened birds (DEWHA, 2010b) and were completed by 2 ecologists per survey, covering areas of tree cover to search for hollows and the presence of breeding Pink Cockatoo's. Surveys were comprised of 20 min/2 ha area searches at 12 survey locations, repeated four (4) times. Surveys were carried out over the following dates: • 30 September 2024 • 1–2 October 2024 • 1–2 November 2024.

Survey details – Pink Cockatoo (*Lophochroa leadbeateri*)	
Weather Conditions	BBUS vantage survey dates: 23–29 March 2022 8–13 July 2022 19–24 September 2022 (breeding) 17–21 January 2023 22–26 May 2023 15–19 July 2023 23–26 September 2023 (breeding) 13–17 February 2024 20-minute 2-hectare area search dates: 30 September 2024 1–2 October 2024 1–2 November 2024 Refer to **Appendix H** for weather during this period.
Comments/Additional Information/Justification of approach	The species was **not recorded** during surveys. Breeding habitat is present with hollow bearing trees with hollows greater than 10 cm diameter concentrated predominantly along Coleambally Outfall Drain. Several other patches of trees with suitable hollows occur sporadically in the development corridor.

5.3.5.6 Square-tailed Kite (*Lophoictinia isura*)

Table 5.32 Detailed Description of Surveys – Square-tailed Kite

Survey details – Square-tailed Kite (*Lophoictinia isura*)	
Credit Type	Dual credit species with breeding habitat (nests) assessed for species credits and foraging habitat assessed for ecosystem credits.
Habitat Description	Occupies open eucalypt forest, woodland or open woodland. Sheoak or Acacia woodlands and riparian woodlands of interior NSW are also used. Nests in tall living trees within a remnant patch, where pairs build a large stick nest in winter (NSW DPE 2023c).
Associated PCTs/VZs	PCTs: 10, PCT 13, PCT 26, PCT 28 VZs: 1, 2, 5, 6, 7, 8
Habitat or Geographical Constraints	Nest trees
Survey Requirement	NCS DCCEEW is currently developing survey guidance for threatened bird species. In the interim, assessors must undertake a species survey using best practice methods that can be replicated for repeat surveys (as per the BAM threatened species survey requirements) i.e. seasonal bird utilisation (vantage point) surveys. Kites will need be in attendance to confirm breeding sites. Breeding habitat is live large old trees within suitable vegetation and the presence of a male and female; or female with nesting material; or an individual on a large stick nest in the top half of the tree canopy.
Survey Period	September–January

Survey details – Square-tailed Kite (*Lophoictinia isura*)	
Surveys Completed	Bird utilisation surveys were undertaken seasonally from March 2022 to February 2024 in order to identify the presence of the species within the Project Area. Each of the 10 vantage point survey locations were surveyed for 1 hour x 6 times per survey period (eight in total). This equates to 48 hours of survey per vantage point survey location. Three of the eight survey periods occurred within the breeding period. With 10 vantage point locations this is a total of 480 hours survey. Searches for stick nests were undertaken during the habitat assessment survey and opportunistically during all other surveys. Location of the stick nests in relation to BBUS survey vantage point locations is shown in **Figure 5.21.**
Weather Conditions	BBUS vantage survey dates: 23–29 March 2022 8–13 July 2022 19–24 September 2022 (breeding) 17–21 January 2023 22–26 May 2023 15–19 July 2023 23–26 September 2023 (breeding) 13–17 February 2024 Refer to **Appendix H** for weather during this period.
Comments/Additional Information/Justification of approach	The species was **not recorded** during surveys.

5.3.5.7 Barking Owl (*Ninox connivens*)

Table 5.33 Detailed Description of Surveys – Barking Owl

Survey details – Barking Owl (*Ninox connivens*)	
Credit Type	Species credit species.
Habitat Description	Inhabits woodland and open forest, including fragmented remnants and partly cleared farmland. It is flexible in its habitat use, and hunting can extend in to closed forest and more open areas. Species is likely to breed and forage within very small patches of vegetation (< 5 ha), especially when the patch is riparian vegetation or where the small patch is within 400 m of another larger patch of vegetation. They are unlikely to nest in the hollows of a paddock tree if the tree is separated from a larger patch of vegetation by more than 400 m of cleared habitat (NSW DPE 2023c).
Associated PCTs/VZs	PCTs: 10, 13 VZs: 1, 2
Habitat or Geographical Constraints	Living or dead trees with hollows greater than 20 cm diameter and greater than 4 m above the ground. Patch: Species is likely to breed and forage within very small patches of vegetation (< 5 ha), especially when the patch is riparian vegetation or where the small patch is within 400 m of another larger patch of vegetation. They are unlikely to nest in the hollows of a paddock tree if the tree is separated from a larger patch of vegetation by more than 400 m of cleared habitat.

Survey details – Barking Owl (*Ninox connivens*)	
Survey Requirement	Acoustic recording (songmeters: e.g. BAR-LT, Audio Moth) can be undertaken year-round – evidence of the value of acoustic recording units for monitoring owls is emerging. The NSW DCCEEW seeks to build data to support developing a standardised survey effort (survey nights, replicates, and unit densities). Stewardship or development projects proposing to use acoustic recording for targeted Biodiversity Assessment Method (BAM) owl surveys must provide a draft survey approach for review and approval to DPE via BOS.helpdesk@environment.nsw.gov.au as an interim measure and to help contribute to the building of future guidance. The draft survey approach must include: 1. Type of recording unit. 2. A map showing density of recording unit distribution. 3. Justification for proposed recording unit density (including details of previous surveys published or otherwise, where the proposed recorder density has detected owls or birds with similar call volume and pitch)(note: less sensitive recorders like Audio Moths with a smaller recording radius of up to approximately 100 will need to be more densely distributed than other songmeters where recording radius may be up to 400 m), and the proposed time and recording period each day (e.g. "daily 3 hours before dawn and 3 hours after dusk"); 4. The proposed survey period and minimum total survey duration (e.g. "3 months from March to May 2024" or "90 days over three disjunct 30 day periods in April, July and October") and justification for this proposed approach (including details of previous surveys published or otherwise, when owls were detected using the proposed approach); 5. How the recordings will be analysed (e.g. what call recognisers are proposed to be applied). OR Call playback (can be undertaken during survey months listed above) – must be conducted at night (preferably around dawn and dusk) during calm (i.e. 0 beaufort scale, <1 km/hr) and dry weather (see Reference 1 in General Notes field) because responses may be erratic and quiet. Survey as follows: 1. Allow 10 minutes listening and observation time prior to broadcasting. If the target owl(s) is observed or call is heard during this period, call playback is not required. 2. Evenly distribute call playback stations within areas of up to 1000 ha of suitable habitat (as per the Threatened Biodiversity Database Collection (TBDC)) approximately 1000 m apart (I.e.1000 m x 1000 m grid or every 100 ha). This equates to 10 stations for 1000 ha of suitable habitat. 3. Broadcast pre-recorded calls (e.g. single male, single female, duet and for masked owl, screech and chatter) for no more than 15 seconds followed by at least 30 seconds of listening time. Listen for the response or appearance of the target owl(s) during the listening time. Watch/listen for an owl that may be circling overhead. 4. At each station repeat the broadcast and listening sequence for 15 minutes for each target owl, unless the target owl is detected before 15 minutes expires. Increase the volume from 20% of natural volume up to 200% of natural volume with each repeated broadcast.

Survey details – Barking Owl (*Ninox connivens*)	
	5. Search for owls drawn in by the broadcast within a 1 ha circular plot around each broadcast station (radius approximately 57 m) at the end of the 15-minute repeated broadcast and listening sequence. Look and listen for the target species using a spotlight for 15 minutes, unless the target owl is detected before 15 minutes expires. Watch/listen for an owl that may be circling overhead. 6. Record the direction of fly in and time to respond to playback of detected owls, to reduce multiple counts of the same owl at different sample stations. 7. If simultaneously surveying for multiple owl species (e.g. Masked Owl, Sooty Owl, Powerful Owl and Barking Owl), the playback sequence may include an escalating sequence of calls of these species punctuated with listening periods between each species' call. The Masked Owl calls should come at the end of the sequence so that if birds respond with a single shriek the response is not obscured by further playback (DSE,2011). 8. Repeatedly sample at each survey station with up to 15 minutes of broadcast calls and listening sequences (as above), until an owl responds, or for at least 6 nights. 9. When the area of suitable habitat is 100 ha or less locate the call playback station as centrally as possible within suitable habitat (as per the TBDC). For areas of suitable habitat greater than 1000 ha, place sampling stations at a density of approximately one every 1500 m (i.e. 1500 m x 1500 m grid or every 225 ha), distributed evenly to cover at least half of the area of suitable habitat.
Survey Period	All year (acoustic recording) January–August (call playback)
Surveys Completed	Nine (9) acoustic recorders (Titley Chorus programmed to record stereo acoustic) were deployed for a duration of 10 nights (8 – 18 August 2023). Recorders were placed in associated PCTs (approx. 21 ha) targeted areas containing trees and suitable hollow bearing trees. Eight of the nine recorders acoustic recorders contained data. The total recording time of all units was 841 minutes acoustic recordings (.wav files). The targeted surveys were carried out prior to Barking Owls becoming a species credit species and the survey guidance detailed above was released. The surveys carried out in August 2023 were consistent with the details provided within TBDC at the time. It is noted that the change in credit type and survey requirements for Barking Owl was not released with specific transitional arrangements.
Weather Conditions	Temperature was an average of 2.0°C to 17.5°C with 4.6 ml of rain recorded on 13 August.
Comments/Additional Information/Justification of approach	No Barking Owl calls were recorded during the acoustic recording period. One Barking Owl was heard calling during the nocturnal surveys targeting Southern Myotis on 25 February 2024. The call was estimated to be up to 2 km from the survey site along the Coleambally Outfall Drain. This record is outside the breeding period for the species. The Barking Owl is highly mobile and may sometimes occur in the woodland around the Coleambally Outfall Drain if it is able to also use other treed areas (e.g. along watercourses) in the landscape. Hollow-bearing trees are present in this habitat and may possibly be used for breeding. One of the eight acoustic recorders did not record any data. It is considered that this could be due to an error or fault in the device or SD card or due to a programming error.

5.3.5.8 Plains-wanderer (*Pedionomus torquatus*)

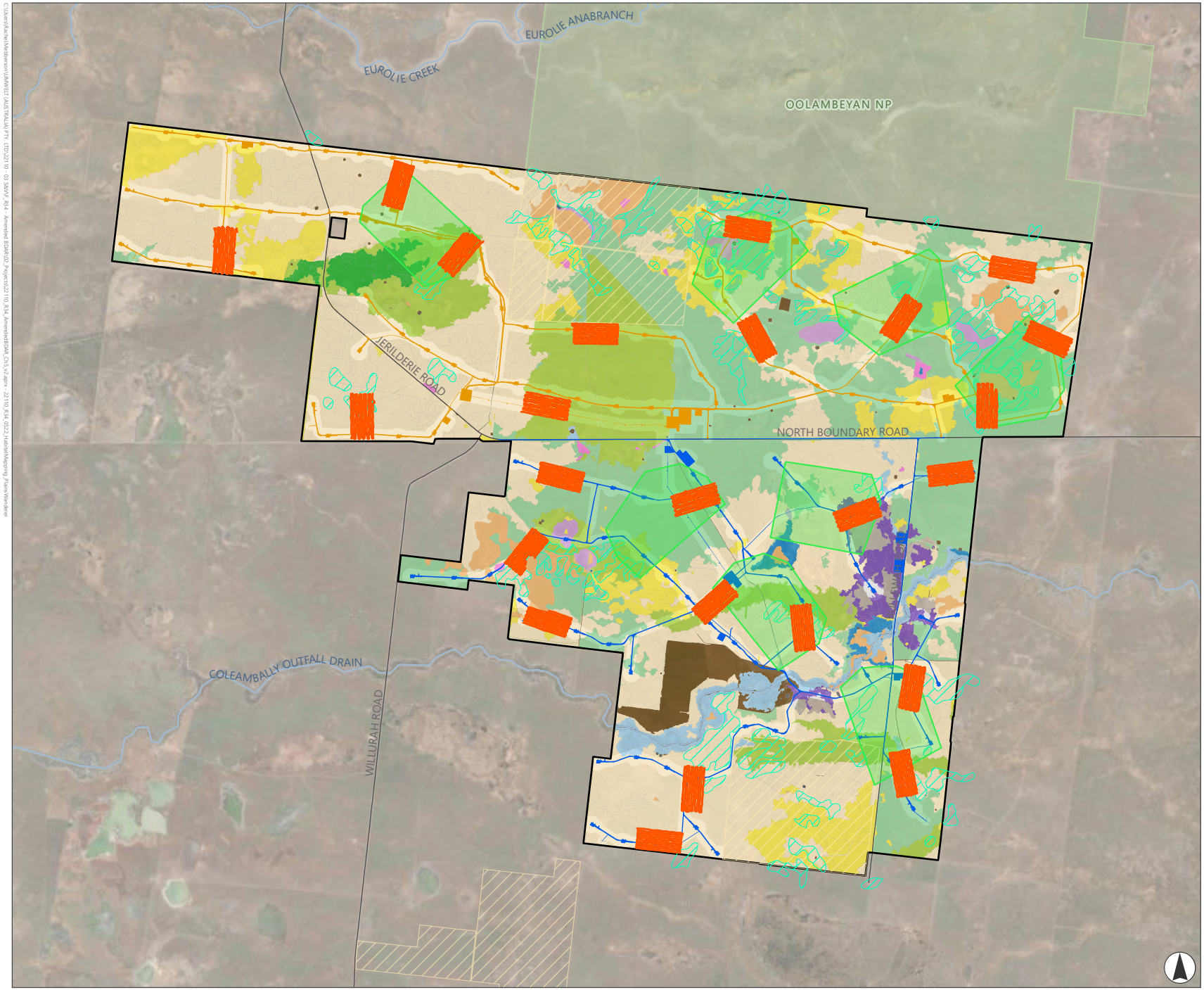
Table 5.34 Detailed Description of Surveys – Plains-wanderer

Survey details – Plains Wanderer (*Pedionomus torquatus*)	
Credit Type	Dual credit species with mapped Important Habitat assessed as species credit and other suitable habitat assessed as ecosystem credit,
Habitat Description	Plains-wanderers live in semi-arid, lowland native grasslands that typically occur on hard red-brown soils. These grasslands support a high diversity of plant species, including a number of state and nationally threatened species. Habitat structure appears to play a more important role than plant species composition. Preferred habitat of the Plains-wanderer typically comprises 50% bare ground, 10% fallen litter, and 40% herbs, forbs and grasses. Most of the grassland habitat of the Plains-wanderer is <5 cm high, but some vegetation up to a maximum of 30 cm is important for concealment, as long as grass tussocks are spaced 10–20 cm apart. During prolonged drought, the denudation of preferred habitats may force birds into marginal denser and taller grassland habitats that become temporarily suitable. The average home range of a single bird is about 12 ha. Breeding pairs have overlapping home ranges that total approximately 18 ha. The Plains-wanderer is a ground-dwelling grassland bird, which is cryptic and very difficult to observe during the day. Graziers have seen Plains-wanderers during the day when mustering sheep. The species can only be properly surveyed at night using spotlighting techniques.
Associated PCTs/VZs	PCTs: 44, 46 VZs: 9, 10
Habitat or Geographical Constraints	Important Habitat Map
Survey Requirement	As per Section 5.3(1)(c) of the BAM, no targeted surveys are required for species with important habitat mapping. Several studies (Baker-Gabb et al. 2016; Antos and Schultz 2020) used nocturnal vehicle-based spotlighting. Nugent et al. (2022a) combined spotlighting with the use of thermal scopes. Important habitat mapping for the species occurs within the Project Boundary and adjacent to the Development Corridor. The Project design has been changed since initial project layout to avoid areas of important habitat mapping for this species such that no important habitat is proposed to be impacted. To further refine the Development Footprint, surveys were conducted in Spring 2024 using methodology developed in consultation with Commonwealth DCCEEW which recommended spotlight from the vehicle travelling at 6–7 km/hr across grid-based survey areas comprised of 10–11 transects that are 1 km long and set 50 m apart. Each grid should be surveyed twice, 2–3 nights apart.
Survey Period	N/A
Surveys Completed	Surveys were conducted during November and early December 2024. Twenty-four grids comprised of 10 x 1 km long transect set 50 m apart, were placed across the Subject Land and adjacent Project Area, targeting areas important habitat mapping and associated PCTs where the structural composition preferred by the species was present. The spotlighting was completed by car travelling 6–7 km/hr with two spotters searching from the car covering 25 m outwards. Each grid site was surveyed twice, 2–3 nights after the initial survey. Surveys were carried out over 19 nights by 2 people for a total of 524.85 km was surveyed over a total of 380 hours.

Survey details – Plains Wanderer (*Pedionomus torquatus*)	
Detailed habitat mapping	Detailed mapping of plains-wanderer secondary habitat was carried out across the Subject Land utilising of 4-band high resolution imagery and LiDAR provided via satellite and drone. Significant delays in Civil Aviation Safety Authority (CASA) approval timeframes precluded the use of fixed-wing drone. Drone surveys were carried out over 5 days in December 2024 across portions of the Subject Land and adjacent Project Area. High resolution aerial imagery and LiDAR was systematically captured within nine 400 ha survey areas by drone as shown in **Figure 5.22**. The survey areas were selected based on the following attributes: • Proximity to mapped Important Habitat. • Plains-wanderer records obtained from BioNet Wildlife Atlas. • Location in relation to Plains-wanderer survey transects. • Associated PCTs mapped within the Subject Land. • Area of Subject Land that would intersect the survey areas. High resolution satellite imagery captured by Airbus was utilised outside of the drone survey areas. The process of image classification for the purpose of identifying areas of suitable habitat and ultimately generating a threatened species polygon is described in more detail in **Section 5.4.3.10**.
Weather Conditions	Survey dates: • 5–13 and 19–26 November 2024 • 3–4 December 2024. Refer to **Appendix H** for weather during this period.
Comments/Additional Information/Justification of approach	The species was **recorded** during field surveys for the Project. The species was recorded across areas of important habitat and new areas of associated PCTs. Individuals as well as evidence of breeding were recorded.

FIGURE 5.22.1

Plains-wanderer Habitat Mapping

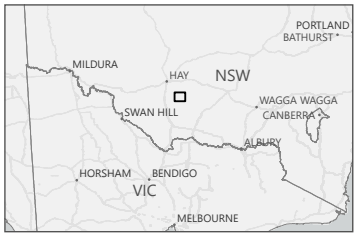


Legend

- Project Boundary
- Subject Land
- Stage 1 (South) Development Footprint
- Stage 2 (North) Development Footprint
- Conservation Agreement Area
- NPWS Reserves
- Road
- Watercourse
- Plains Wanderer Transects
- Plains Wanderer Important Habitat
- Drone Survey Area

Plant Community Type

- PCT 10 Moderate-Good
- PCT 13 Moderate-Good
- PCT 17 Moderate-Good
- PCT 24 Moderate-Good
- PCT 26 Derived Native Grassland
- PCT 28 Derived Native Grassland
- PCT 28 Moderate-Good
- PCT 44 Moderate-Good
- PCT 46 Moderate-Good
- PCT 160 Moderate-Good
- PCT 164 Moderate-Good
- PCT 216 Moderate-Good
- Non-native vegetation
- Water
- Infrastructure



0 1,000 2,000

Meters

Scale 1:122,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

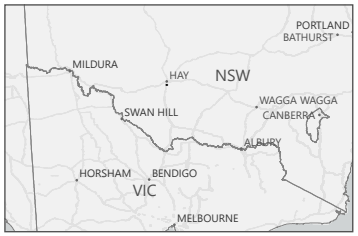
Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

FIGURE 5.22.2

Plains-wanderer Habitat Mapping

Legend

- Stage 1 (South) Development Footprint
- Road



0 20 40

Meters

Scale 1:2,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

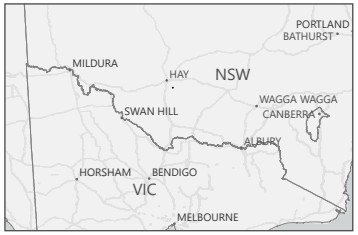
C:\Users\RachelMeiberg\on\UMWELT (AUSTRALIA) PTY. LTD\22110 - 03 SWVF R04 - Amended BDAR\02_Projects\22110_R34_AmendedBDAR_Ch5_v2.aprx - 22110_R34_052-HabitatMapping_PlainsWanderer

FIGURE 5.22.3

Plains-wanderer Habitat Mapping

Legend

- Stage 1 (South) Development Footprint
- Road



0 20 40

Meters

Scale 1:2,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

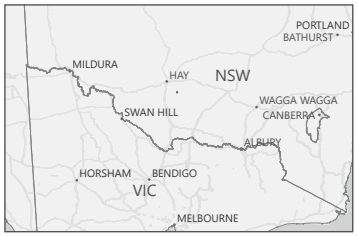
C:\Users\RachelMeiberg\UMWELT (AUSTRALIA) PTY. LTD\2210 - 03 SWVF R04 - Amended BDAR\02_Projects\2210_R34_AmendedBDAR_Ch5_v2.aprx - 2210_R34_052_HabitatMapping_PlainsWanderer

FIGURE 5.22.4

Plains-wanderer Habitat Mapping

Legend

- Stage 1 (South) Development Footprint
- Road
- Watercourse



0 20 40

Meters

Scale 1:2,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

C:\Users\RachelMeiberson\UMWELT (AUSTRALIA) PTY. LTD\2210 - 03 SWVF R44 - Amended BDAR\02_Projects\2210_R34_AmendedBDAR_Ch5_v2.aprx - 2210_R34_052_HabitatMapping_PlainsWanderer

5.3.5.9 Superb Parrot (*Polytelis swainsonii*)

Table 5.35 Detailed Description of Surveys – Superb Parrot

Survey details – Superb Parrot (*Polytelis swainsonii)*	
Credit Type	Dual credit species with breeding habitat assessed for species credits and foraging habitat assessed for ecosystem credits.
Habitat Description	Inhabit Box-Gum, Box-Cypress-pine and Boree woodlands and River Red Gum forest.
Associated PCTs/VZs	In the Riverina superb parrots nest in the hollows of large trees (dead or alive) mainly in tall riparian River Red Gum forest or woodland. On the South West Slopes and Southern Tablelands nest trees can be in open Box-Gum woodland or isolated living or dead paddock trees. Species known to be used are Blakely's Red Gum, Yellow Box, Apple Box and Red Box. In the Riverina superb parrots nest in the hollows of large trees (dead or alive) mainly in tall riparian River Red Gum forest or woodland. On the South West Slopes and Southern Tablelands nest trees can be in open Box-Gum woodland or isolated living or dead paddock trees. Species known to be used are Blakely's Red Gum, Yellow Box, Apple Box and Red Box. Superb Parrots nest in tree hollows with an entrance diameter of 6 cm or wider, and that are at least 3.5 m above the ground. Nest in small colonies, often with more than one nest in a single tree. Breed between September and January, with nesting typically from October to late December. May forage up to 10 km from nesting sites, primarily in grassy box woodland. Feed in trees and understorey shrubs and on the ground and their diet consists mainly of grass seeds and herbaceous plants. Also eaten are fruits, berries, nectar, buds, flowers, insects and grain.
Habitat or Geographical Constraints	Living or dead *Eucalyptus blakelyi*, *Eucalyptus melliodora*, *Eucalyptus albens*, *Eucalyptus camaldulensis*, *Eucalyptus microcarpa*, *Eucalyptus polyanthemos*, *Eucalyptus mannifera*, *Eucalyptus intertexta* with hollows greater than 5 cm diameter; greater than 4 m above ground or trees with a DBH of greater than 30 cm. Breeding habitat can be identified by the presence of habitat features and observed nest OR two or more birds seen on site.
Survey Requirement	NSW DCCEEW is currently developing survey guidance for threatened bird species. In the interim, assessors must undertake a species survey using best practice methods that can be replicated for repeat surveys (as per the BAM threatened species survey requirements) i.e. seasonal bird utilisation (vantage point) surveys. Opportunistic searches suitable hollow bearing trees during all surveys in the correct survey period.
Survey Period	September–November
Surveys Completed	Bird utilisation surveys were undertaken seasonally from March 2022 to February 2024. Each of the 10 vantage point survey locations were surveyed for 1 hour x 6 times per survey period (8 in total). This equates to 48 hours of survey per vantage point survey location. Two of the eight survey periods occurred within the breeding period. With ten vantage point locations this is a total of 480 hours survey. Searches for hollow bearing trees was undertaken during the habitat assessment survey and opportunistically during all other surveys. Area searches were carried out in accordance with *Survey guidelines for Australia's threatened birds* (DEWHA, 2010b) and were completed by 2 ecologists per survey, covering areas of tree cover to search for hollows and the presence of breeding Superb Parrot. Surveys were comprised of 20 min / 2 ha area searches undertaken at 12 survey locations, repeated four times. Surveys were carried out over the following dates:

Survey details – Superb Parrot (*Polytelis swainsonii)*	
	• 30 September 2024 • 1–2 October 2024 • 1–2 November 2024.
Weather Conditions	BBUS vantage survey dates: 23–29 March 2022 8–13 July 2022 19–24 September 2022 (breeding) 17–21 January 2023 22–26 May 2023 15–19 July 2023 23–26 September 2023 (breeding) 13–17 February 2024 20-minute 2-hectare area search dates: 30 September 2024 1–2 October 2024 1–2 November 2024 Refer to **Appendix H** for weather during this period.
Comments/Additional Information/Justification of approach	The species was **not recorded** during surveys. Breeding habitat present within the Subject Land. Numerous species records within 30 km. Mainly occurs in Eucalypt forests and woodland, especially in association with *Eucalyptus camaldulensis* and box eucalypts. It mostly feeds on the ground on a variety of native and introduced seeds (CoA 2021). The Superb Parrot often breeds in large *Eucalyptus camaldulensis* near water. Potential foraging and breeding habitat present in the Subject Land along the Coleambally Outfall Drain

5.3.5.10 Masked Owl (*Tyto novaehollandiae*)

Table 5.36 Detailed Description of Surveys – Masked Owl

Survey details – Masked Owl (*Tyto novaehollandiae*)	
Credit Type	Species credit species
Habitat Description	Lives in dry eucalypt forests and woodlands from sea level to 1100 m. A forest owl, but often hunts along the edges of forests, including roadsides. The typical diet consists of tree-dwelling and ground mammals, especially rats. Roosts and breeds in moist eucalypt forested gullies, using large tree hollows or sometimes caves for nesting. Roosts and breeds in moist eucalypt forested gullies, using large tree hollows or sometimes caves for nesting.
Associated PCTs/VZs	PCTs: 10, 13, 24, 26 VZs: 1, 2, 4, 5, 6
Habitat or Geographical Constraints	Living or dead trees with hollows greater than 20 cm diameter. Patch size selected is based on that fact that the species will use areas that are quite small, especially as foraging habitat but also as roosting habitat and occasionally as breeding habitat. In Tasmania and Victoria, Masked owls have been recording nesting in paddock trees. Dead stags are especially popular for roosting/breeding habitat and are a limited resource due to natural attrition.

Survey details – Masked Owl (*Tyto novaehollandiae*)	
Survey Requirement	Acoustic recording (songmeters: e.g. BAR-LT, Audio Moth) can be undertaken year-round – evidence of the value of acoustic recording units for monitoring owls is emerging. The NSW DCCEEW seeks to build data to support developing a standardised survey effort (survey nights, replicates, and unit densities). Stewardship or development projects proposing to use acoustic recording for targeted Biodiversity Assessment Method (BAM) owl surveys must provide a draft survey approach for review and approval to DPE via BOS.helpdesk@environment.nsw.gov.au as an interim measure and to help contribute to the building of future guidance. The draft survey approach must include: 1. Type of recording unit. 2. A map showing density of recording unit distribution. 3. Justification for proposed recording unit density (including details of previous surveys published or otherwise, where the proposed recorder density has detected owls or birds with similar call volume and pitch)(note: less sensitive recorders like Audio Moths with a smaller recording radius of up to approximately 100 m will need to be more densely distributed than other songmeters where recording radius may be up to 400 m), and the proposed time and recording period each day (e.g. "daily 3 hours before dawn and 3 hours after dusk"). 4. The proposed survey period and minimum total survey duration (e.g. "3 months from March to May 2024" or "90 days over three disjunct 30 day periods in April, July and October") and justification for this proposed approach (including details of previous surveys published or otherwise, when owls were detected using the proposed approach). 5. How the recordings will be analysed (e.g. what call recognisers are proposed to be applied). OR Call playback (can be undertaken during survey months listed above) – must be conducted at night (preferably around dawn and dusk) during calm (i.e. 0 beaufort scale, <1 km/hr) and dry weather (see Reference 1 in General Notes field) because responses may be erratic and quiet. Survey as follows: 1. Allow 10 minutes listening and observation time prior to broadcasting. If the target owl(s) is observed or call is heard during this period, call playback is not required. 2. Evenly distribute call playback stations within areas of up to 1000 ha of suitable habitat (as per the Threatened Biodiversity Database Collection (TBDC)) approximately 1000 m apart (I.e.1000 m x 1000 m grid or every 100 ha). This equates to 10 stations for 1000 ha of suitable habitat. 3. Broadcast pre-recorded calls (e.g. single male, single female, duet and for masked owl, screech and chatter) for no more than 15 seconds followed by at least 30 seconds of listening time. Listen for the response or appearance of the target owl(s) during the listening time. Watch/listen for an owl that may be circling overhead. 4. At each station repeat the broadcast and listening sequence for 15 minutes for each target owl, unless the target owl is detected before 15 minutes expires. Increase the volume from 20% of natural volume up to 200% of natural volume with each repeated broadcast.

Survey details – Masked Owl (*Tyto novaehollandiae*)	
	5. Search for owls drawn in by the broadcast within a 1 ha circular plot around each broadcast station (radius approximately 57 m) at the end of the 15-minute repeated broadcast and listening sequence. Look and listen for the target species using a spotlight for 15 minutes, unless the target owl is detected before 15 minutes expires. Watch/listen for an owl that may be circling overhead. 6. Record the direction of fly in and time to respond to playback of detected owls, to reduce multiple counts of the same owl at different sample stations. 7. If simultaneously surveying for multiple owl species (e.g. Masked Owl, Sooty Owl, Powerful Owl and Barking Owl), the playback sequence may include an escalating sequence of calls of these species punctuated with listening periods between each species' call. The Masked Owl calls should come at the end of the sequence so that if birds respond with a single shriek the response is not obscured by further playback (DSE,2011). 8. Repeatedly sample at each survey station with up to 15 minutes of broadcast calls and listening sequences (as above), until an owl responds, or for at least 6 nights. When the area of suitable habitat is 100 ha or less locate the call playback station as centrally as possible within suitable habitat (as per the TBDC). For areas of suitable habitat greater than 1000 ha, place sampling stations at a density of approximately one every 1500 m (i.e. 1500 m x 1500 m grid or every 225 ha), distributed evenly to cover at least half of the area of suitable habitat.
Survey Period	All year (acoustic recording) January to August (call playback)
Surveys Completed	Nine (9) acoustic recorders (Titley Chorus programmed to record stereo acoustic) were deployed for a duration of ten (10) nights (8 – 18 August 2023). Recorders were placed in associated PCTs (approx. 21 ha) targeted areas containing trees and suitable hollow bearing trees. Eight of the nine recorders acoustic recorders contained data. The total recording time of all units was 841 minutes acoustic recordings (.wav files). The targeted surveys were carried out prior to Masked Owl becoming a species credit species and the survey guidance detailed above was released. The surveys carried out in August 2023 were consistent with the details provided within TBDC at the time. It is noted that the change in credit type and survey requirements for Masked Owl was not released with specific transitional arrangements.
Weather Conditions	Temperature was an average of 2.0°C to 17.5°C with 4.6 ml of rain recorded on 13 August.
Comments/Additional Information/Justification of approach	The species was **not recorded** during surveys. One of the eight acoustic recorders did not record any data. It is considered that this could be due to an error or fault in the device or SD card or due to a programming error. There is a lack of sufficiently extensive, connected Eucalypt forest or woodland in the Subject Land to support the Masked Owl's large home-ranges and there are no species' records within 30 km of the Subject Land, however, the locale is within its known distribution range. The Masked Owl is highly mobile and may sometimes occur in the woodland around the Coleambally Outfall Drain if it is able to also use other treed areas (e.g. along watercourses) in the landscape. Hollow-bearing trees are present in this habitat and may possibly be used for breeding.

5.3.5.11 Southern Bell Frog (*Litoria raniformis*)

Table 5.37 Detailed Description of Surveys – Southern Bell Frog

Survey details – Southern Bell Frog (*Litoria raniformis*)	
Credit Type	Species
Habitat Description	Southern Bell Frog is 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. The species has been known to breed anytime from early spring through to late summer/early autumn (Sept to April) following a 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. Tadpoles require standing water for at least 4 months for development and metamorphosis to occur but can take up to 12 months to develop. Prey includes a variety of invertebrates as well as other small frogs, including young of their own species. Prey includes a variety of invertebrates as well as other small frogs, including young of their own species.
Associated PCTs/VZs	PCTs: 10, 13, 17, 24 VZs: 1, 2, 3, 4
Habitat or Geographical Constraints	N/A
Survey Requirement	• Aural-visual surveys total 480 minutes per 500 m transect, repeated 4 times. Or • Acoustic recorder (after flooding rains) total 154 recorder days per 500 m transect, 1 x 14 days. • Tadpole search total 10 minutes per 50 m^2 of surface water, repeated once or twice (can be used to replace up to two of the aural-visual surveys (DPIE 2020).
Survey Period	October–January
Surveys Completed	Targeted nocturnal aural-visual surveys for this species were undertaken on the following dates: 05/12/2023: (17:30–03:30) 10.5 hours x 2 people – Full traverse of the irrigation channel, call playback and quiet listening for calling. Aural visual surveys. Team recorded positive call playback and observed several individuals in the water and on the banks of the channel along the length of the Subject Land. 06/12/2023: (18:00–2:30) 8.5 hours x 2 people – Full traverse of the irrigation channel, call playback and quiet listening for calling. Aural visual surveys. Team recorded positive call playback and observed several individuals in the water and on the banks of the channel along the length of the Subject Land. 07/12/2023: (18:00–1:30) 7.5 hours x 2 people – habitat assessment and pond/dam surveys, call playback, quiet listening, aural visual surveys confirming presence or absence. Repeat surveys for ponds/dams where individuals were not identified. 08/12/2023: Surveys abandoned completely due to fire onsite. 09/12/2023: (20:00–0:00) 4 hours x 2 people – habitat assessment and pond/dam surveys, call playback, quiet listening, aural visual surveys confirming presence or absence. Repeat surveys for ponds/dams where individuals were not identified. 10/12/2023: (20:15–22:30) 2.25 hours x 2 people – Surveys abandoned prematurely due to intense storms.

Survey details – Southern Bell Frog (*Litoria raniformis*)	
	11/12/2023: (19:30–1:30) 6 hours x 2 people – habitat assessment and pond/dam surveys, call playback, quiet listening, aural visual surveys confirming presence or absence. Repeat surveys for ponds/dams where individuals were not identified. 12/12/2023: (18:30–23:45) 5.25 hours x 2 people – habitat assessment and pond/dam surveys, call playback, quiet listening, aural visual surveys confirming presence or absence. Repeat surveys for ponds/dams where individuals were not identified.
Weather Conditions	Temperature was an average of 20.7°C to 40.3 °C with 7.6 ml of rain on 11 December. There was 9.4 ml of rain recorded in the 7 days prior to survey.
Comments/Additional Information/Justification of approach	Southern Bell Frog was extensively recorded in the Subject Land between 5 and 12 December 2023. Initial survey focus was the main irrigation channel, however due to an abundance of individuals of the target species, the field team were then able to assess each body of water on site for presence or absence. Individuals were found at almost all water bearing dams or ponds. Breeding associated behaviour such as calling and amplexus was observed in the Coleambally Outfall Drain and most farm dams.

5.3.5.12 Grey Snake (*Hemiaspis damelii)*

Table 5.38 Detailed Description of Surveys – Grey Snake

Survey details – Grey Snake (*Hemiaspis damelii*)	
Credit Type	Species
Habitat Description	Floodplains and ephemeral wetlands associated with heavy clay soils are key habitat features for the Grey Snake. In NSW, the Grey Snake's habitat includes the margins of ephemeral wetlands within *Eucalyptus camaldulensis* and *Eucalyptus largiflorens* vegetation communities and *Duma florulenta* swamps. The species shelters in soil cracks, rocks, logs, flood debris, and abandoned burrows within these habitats.

Survey details – Grey Snake (*Hemiaspis damelii*)	
	The Grey Snake has not been sighted in dry phase wetlands, suggesting its detectability and activity patterns may be related to wetland inundation regimes and suitable weather conditions. Grey Snakes are viviparous, giving birth to 4–16 live young. The species is crepuscular to nocturnal, where they are active for 1–2 hours after dusk. The diet of the Grey Snake is primarily composed of ground-dwelling frogs. However, tree frogs and, rarely, skinks also form part of the species' diet. Cracks in clay soils are used in the species' hunting strategy, where it travels along cracks searching for ground-dwelling frogs, which are often found between these cracks.
Associated PCTs/VZs	PCTs: 13, 17 24, 46, 160 VZ: 2, 3, 4, 10, 11
Habitat or Geographical Constraints	Nil
Survey Requirement	No species-specific guidelines for NSW or Commonwealth. There are no survey guidelines for this species but survey advice from CPHR (received 23 November 2024) for is as follows: *Nocturnal spotlighting on warm nights in spring-summer, adjacent to wetlands on cracking clay soils, particularly in river red gum/spike rush or lignum vegetation communities.* Additionally, the species is crepuscular, known to be exclusively active for one or two hours after sunset (Michael et. al., 2020). Survey periods should fall within this window.
Survey Period	October–February
Surveys Completed	Passive meandering nocturnal searches at three sites within designated PCT where suitable survey habitat for the species was present. Each of the three locations was surveyed four times. Surveys completed include: 05/12/2023: (20:30–22:00) 1.5 hours x 2 people – Nocturnal meandering 20-minute surveys throughout three pre-determined polygons within designated PCTs located along the irrigation channel. Team searched cracks in the ground, terrestrial and arboreal habitats. No Grey Snakes were detected throughout the surveys. 06/12/2023: (21:15–23:00) 1.75 hours x 2 people – Repeat nocturnal meandering 20 minute surveys throughout three pre-determined polygons within designated PCTs located along the irrigation channel. Team searched cracks in the ground, terrestrial and arboreal habitats. No Grey Snakes were detected throughout the surveys. 11/12/2023: (20:45–22:30) 1.75 hours x 2 people – Repeat nocturnal meandering 20 minute surveys throughout three pre-determined polygons within designated PCTs located along the irrigation channel. Team searched cracks in the ground, terrestrial and arboreal habitats. No Grey Snakes were detected throughout the surveys. 12/12/2023: (21:30–23:15) 1.75 hours x 2 people - Repeat nocturnal meandering 20 minute surveys throughout three pre-determined polygons within designated PCTs located along the irrigation channel. Team searched cracks in the ground, terrestrial and arboreal habitats. No Grey Snakes were detected throughout the surveys. Grey Snake surveys were undertaken for a total of 13.5 person hours (810 minutes).

Survey details – Grey Snake (*Hemiaspis damelii*)	
Weather Conditions	Weather conditions during the Grey Snake survey period were considered to be suitable for detection of the species. Surveys were conducted within two hours of sunset, while temperatures were within the range of 20–35°C, temperatures associated with a 20–50% chance of detection (Michael, *et. al.*, 2023).
Comments/Additional Information/Justification of approach	River Red Gum/Black Box woodland and associated wetlands along the Coleambally Outfall Drain. Forages mainly on ground-dwelling frogs and may occur elsewhere in the Subject Land where frogs are abundant. **Note on detectability**: During field surveys, ecologists found several Curl Snakes (*Suta suta*) on each night of survey within each of the three survey locations, indicating suitable weather conditions for detecting snake species. Ground frogs known to be Grey Snake prey species such as Spotted Marsh Frog (*Limnodynastes tasmaniensis*) and Ornate Burrowing Frog (*Platypectrum ornatum*) were active and abundant amongst the survey sites.

5.3.5.13 Koala (*Phascolarctos cinereus*)

Table 5.39 Detailed Description of Surveys – Koala

Survey details – Koala (*Phascolarctos cinereus)*	
Credit Type	Full species credit.
Habitat Description	Inhabits eucalypt woodlands and forests where it feeds on the foliage. It feeds on at least 70 eucalypt species and 30 non-eucalypt species, but in any one area will select a limited number of preferred browse tree species. Spends most of its time in trees, but descends to the ground to disperse or move throughout its home range which vary between 2 ha to > 100 ha (NSW DPE 2023c).
Associated PCTs/VZs	PCTs: 10, 13, 17, 24, 26, 28, 160 VZs: 1, 2, 3, 4, 5, 6, 7, 8, 11 Note: due to the lack of trees in several associated PCTs the following PCTs only were considered to have suitable habitat (koala use trees) present: • PCT 10 Moderate-Good (19.96 ha) • PCT 13 Moderate-Good (2.45 ha) • PCT 28 Moderate-Good (0.85 ha).
Habitat or Geographical Constraints	Presence of koala use trees – refer to Survey Comments field in TBDC
Survey Requirement	Koala (*Phascolarctos cinereus*): Biodiversity Assessment Method survey guide (DPE 2022) outlines the minimum survey effort to detect koala presence on the Subject Land requires the total effort for two standard survey methods to be met. A scat detection method, which may indicate past occupancy, must be paired with a non-scat detection method as follows: 1. Spot Assessment Technique (SAT) or detection dogs. 2. Spotlighting or passive acoustic or drones. The two survey methods may be undertaken in any order, or concurrently where the timing requirements of each method can be met. The other survey method, in addition to SAT, chosen for this projects survey was passive acoustic recorders.

Survey details – Koala (*Phascolarctos cinereus)*	
	The Koala Spot Assessment Technique (K-SAT) requires selecting survey locations based on a 250 m spacing grid in suitable habitat. Grid intersections in suitable habitat represent site where the K-SAT protocol must be undertaken. K-SAT protocol requires a centre tree to be located closest to the grid intersection. Moving outwards from the centre tree a further twenty-nine (29) nearest trees of any species will be surveyed. The survey consists of a radial search for koala scat beneath each of the thirty (30) trees, extending to 1 m from the base of each tree. Scat search effort is a minimum of two person-minutes for each tree. For trees with a large DBH, it is expected that additional search time will be required. The search is concluded when koala scat is detected, or time ends with no koala scat detected. This is then repeated for all 30 trees within the plot. Survey effort depends on the area of suitable habitat and detection range of the recording unit. The density of recording units and recording period (number of consecutive nights) for suitable habitat less than 50 ha with an approximate detection range of the recording unit of approximately 100 m is one recording unit/5 ha recording for 7 nights.
Survey Period	September–December (acoustic detection) All year (SAT)
Surveys Completed	<u>Acoustic recording</u> Eight acoustic recorders (Titley Chorus programmed to record stereo acoustic) were deployed from 25 November- 14 December (19 nights). Detectors recorded for a duration of nine nights. Recorders were placed in patches of associated PCTs (about 23 ha) targeting areas containing woody vegetation and trees. The total recording time of all units was 642.80 hours acoustic recordings (.wav files). <u>Koala Spot Assessment Technique</u> Koala SAT plots were undertaken from the 14/05/2024 to the 16/05/2024. Eleven (11) K-SAT plots were surveyed with two people surveying for scat and identifying tree species. 14/05/2024 – Four sites were surveyed for koala scat utilising the K-SAT survey technique with two people completing the survey. 15/05/2024 – Four sites were surveyed for koala scat utilising the K-SAT survey technique with two people completing the survey. 16/05/2024 – Three sites were surveyed for koala scat utilising the K-SAT survey technique with two people completing the survey.
Weather Conditions	<u>Acoustic recording</u> Temperature was an average of 17.3°C to 34.83 °C with 19.4 ml of rain recorded throughout the 19-day survey period. Wind speeds averaged from 7 km/h to 46 km/h at 3 pm daily average. <u>Koala Spot Assessment Technique</u> Temperature was an average of 4.3°C to 19.9 °C with no rainfall during surveys. Rain was recorded in the three days prior to survey (11/05/2024 and 12/05/2024).
Comments/Additional Information/Justification of approach	As specified in the BAM assessment guidelines for Koala, passive acoustic surveys must not be undertaken during conditions with high wind speeds, high temperatures (>35°C) or rainfall (>3 mm per night), which can reduce koala bellowing frequency and/or detectability. Where any of these conditions occur during the recording period, the survey must be extended by an equivalent number of nights.

Survey details – Koala (*Phascolarctos cinereus)*	
	Maximum high temperatures for the 4/12/2024–13/12/2024 were >35°C. Two days/nights where rainfall was >3 mm. One of the high temperature days coincided with one of the rainfall days. Therefore, there were 8 days within the survey period that met the required suitable weather for this survey. As heightened insect activity during wet conditions increases scat decomposition rates, SAT surveys should not be undertaken within three days of rainfall. Rain was recorded in the three days prior to survey (11/05/2024 and 12/05/2024).

5.3.5.14 Southern Myotis (*Myotis macropus*)

Table 5.40 Detailed Description of Surveys – Southern Myotis

Survey details – Southern Myotis (*Myotis macropus*)	
Credit Type	Species
Habitat Description	Generally roost in groups of 10–15 close to water in caves, mine shafts, hollow-bearing trees, storm water channels, buildings, wharves, bridges and in dense foliage. Forage over streams and pools catching insects and small fish by raking their feet across the water surface. In NSW females have one young each year usually in November or December.
Associated PCTs/VZs	PCT: 10 VZ: 1
Habitat or Geographical Constraints	Waterbodies with permanent pools/stretches 3 m or wider, including rivers, large creeks, billabongs, lagoons, estuaries, dams and other waterbodies, on or within 200 m of the site. The species was allocated to species credit because it is dependent on waterways with pools of 3 m wide or greater for foraging (which will be protected under legislation). Habitat surrounding waterways is used for breeding and roosting. Additionally, selected <1 for average number of offspring because females do not give birth every year (often miscarry etc). (Campbell 2009).
Survey Requirement	Department of Planning, Industry and Environment (2021) outline several detection methods including: • Passive acoustic detection. 16 hours over 4 nights. • Active acoustic detection with visual confirmation of foraging behaviour. 8 hours over 4 nights.
Survey Period	October–March
Surveys Completed	Passive and active acoustic detection was undertaken for survey of Southern Myotis. Passive acoustic detection Passive acoustic detection was used primarily using Titley Chorus units. Data was recorded during the following survey periods. • March 2022: 5 sites, 4–6 nights of data per site, 26 nights total data. • January 2023: 4 sites, 6–7 nights per site, 27 nights total • March 2023: 6 sites, 6–7 nights per site, 40 nights total data. • October–November 2023: 6 sites, 7 nights per site, 42 nights total data. • February 2024: 6 sites, 9–12 nights per site, 55 nights total data. All data sets were analysed by Echo Ecology and Surveying. The identification of bat echolocation calls recorded during surveys was undertaken using Choose software used. Version 2.1.1) software and a noise filter was applied (EE_Allbats.als, ZC – auto, Smoothness - 4).Active acoustic detection

Survey details – Southern Myotis (*Myotis macropus*)	
	Active acoustic detection was conducted using an anabat walkabout from Titley Scientific. Equipment used for visual detection were spotlights with a red filter along with a HIKMICRO Falcon FH35 thermal monocular. A total of 32 hours of survey was undertaken over four sites by two ecologists. Four sites along Coleambally Outfall Drain and four farm dams embedded within woodland vegetation near the drain were surveyed. Details of the survey are as follows: 20/02/2024: (20:40–00:40) 4 hours x 2 people – four sites visited with 1 hour at each site of spotlighting/real-time acoustic detection. The team recorded no positive identification of any individuals through spotlighting/real-time acoustic detection. 21/02/2024: (20:40–00:40) 4 hours x 2 people – Repeat of the four sites visited with 1 hour at each site of spotlighting/real-time acoustic detection. The team recorded no positive identification of any individuals through spotlighting/real-time acoustic detection. 22/02/2024: (20:40–00:10) 3.5 hours x 2 people – Repeat of the four sites visited with 1 hour at each site of spotlighting/real-time acoustic detection. The team recorded no positive identification of any individuals through spotlighting/real-time acoustic detection. Surveys abandoned prematurely due to a storm. 23/02/2024: (20:40–01:10) 4.5 hours x 2 people – Repeat of the four sites visited with one hour at each site of spotlighting/real-time acoustic detection. The team recorded no positive identification of any individuals through spotlighting/real-time acoustic detection. Surveys extended by 30 minutes due to previous night's abandonment as a result of a storm. 24/02/2024: (20:35–00:35) 4 hours x 2 people – new four sites visited with 1 hour at each site of spotlighting/real-time acoustic detection. The team recorded no positive identification of any individuals through spotlighting/real-time acoustic detection. 25/02/2024: (20:34–00:34) 4 hours x 2 people – Repeat of new four sites visited with 1 hour at each site of spotlighting/real-time acoustic detection. The team recorded no positive identification of any individuals through spotlighting/real-time acoustic detection. 26/02/2024: (20:34–00:34) 4 hours x 2 people – Repeat of new four sites visited with 1 hour at each site of spotlighting/real-time acoustic detection. The team recorded no positive identification of any individuals through spotlighting/real-time acoustic detection. 27/02/2024: (20:34–00:34) 4 hours x 2 people – Repeat of new four sites visited with 1 hour at each site of spotlighting/real-time acoustic detection. The team recorded no positive identification of any individuals through spotlighting/real-time acoustic detection.
Weather Conditions	Active acoustic detection weather conditions were an average of 9.8°C -40.7°C, over the 8 nights. There was no rainfall during the survey period. Wind was between 28–59 m per hour. Refer to **Appendix H** for daily weather data during this period.
Comments/Additional Information/Justification of approach	Passive acoustic surveys resulted in several 'possible' or 'species group' Southern Myotis *calls.* No calls were confidently identified. Active acoustic surveys conducted resulted in no Southern Myotis being observed/recorded on site. However, numerous microbats were observed drinking from a branch channel of the Coleambally Outfall Drain. Passive acoustic detection survey data used was that collected for BBUS surveys and didn't specifically target sites over pools of water or along waterways. As such the species has assessed as **not present** within the Subject Land.

Survey details – Southern Myotis (*Myotis macropus*)	
	The identification of calls was undertaken with reference to Pennay et al. (2004) and through the comparison of recorded reference calls from the NSW Riverina. Reference calls were obtained from the NSW database and from the authors personal collection. A list of potentially occurring echolocating bat species for the region (approximately 50–100 km radius) was obtained from the Australasian Bat Society – Bat Map (https://www.ausbats.org.au/batmap.html) and was used to constrain the identification of bat calls.

5.3.6 Expert Reports

No expert reports were utilised in place of targeted surveys for the purposes of this assessment.

5.3.7 More Appropriate Local Data

This assessment has not relied on alternative data (more appropriate local data) to assess habitat suitability.

5.3.8 Limitations

Targeted threatened flora and fauna surveys were undertaken during the appropriate seasons specified within the TBDC to maximise the probability of detection.

All surveys for candidate threatened flora species consisted of multi-species searches in groups according to detection period and stratum.

Throughout the biodiversity assessment, survey programs were rescheduled at late notice due to substantial wet weather, extreme heat and active fires in the vicinity of the Project Area, either preceding or during the proposed field survey. These decisions were made with consideration of staff WHS matters as well as the considered and respectful management of landholder's properties, particularly the condition of their internal access tracks.

As a result of wet conditions, vehicular access to multiple areas of the Project Site was at times limited, resulting in access being largely restricted to walking in some areas. Furthermore, during some survey programs some sections of the Project Site inevitably could not be accessed even on foot due to the wet conditions. Any survey delays were rescheduled resulting in minimal time lost to the survey schedule.

At height bat analysis data is based off SM4 units deployed on two meteorological masts in February 2024 surveyed over five seasons. Data recorded varied based on amount of bat activity impacting on amount of available data storage of the units and hence days of recordings. The data used to inform at height bat assessment in the prescribed impacts section reflects bat activity from four seasons: summer, autumn, winter and spring 2024, and summer 2025.

Despite these limitations, Umwelt have undertaken extensive biodiversity surveys, including targeted surveys, throughout the Development Corridor including offsite areas and adjoining land within the Project boundaries.

5.4 Threatened Species Results

5.4.1 Ecosystem Credit Species Recorded During the Field Surveys

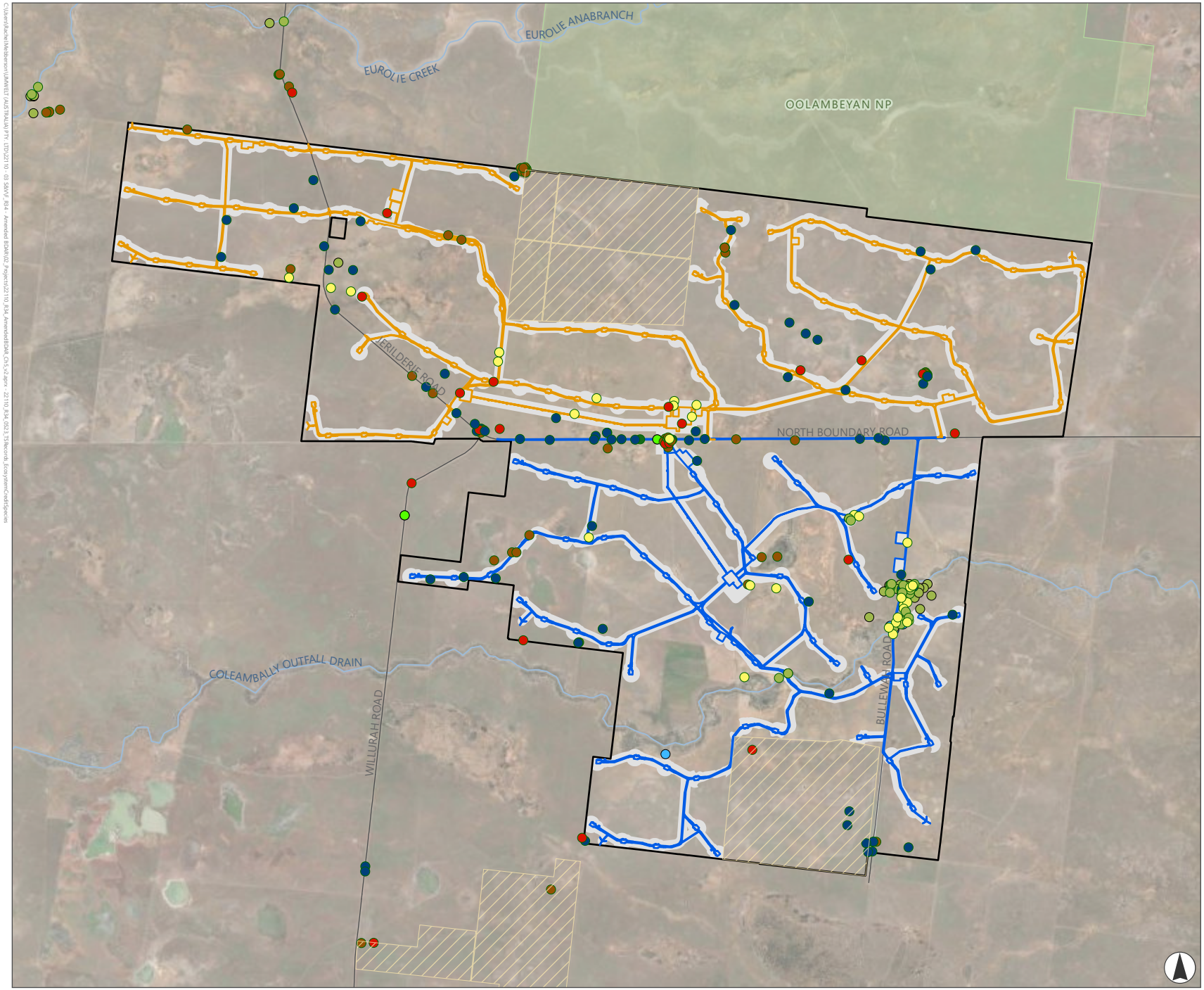
A total of eight ecosystem credit species were recorded within or adjacent to the Subject Land during the field surveys completed for this assessment. A description of the ecosystem credit species observations are detailed in **Table 5.41** below. The locations of the ecosystem credits species recorded during the assessment are shown in **Figure 5.23**.

Table 5.41 Threatened Species Credit (Ecosystem) Species Survey Results

Species Name	Common Name	BC Act	EPBC Act	Observation Details
Aphelocephala leucopsis	Southern Whiteface	V	V	This species was frequently observed foraging within the Project Area and Subject Land during field surveys including BBUS surveys, vegetation assessments and targeted threatened species surveys. The species was frequently observed within *Lycium ferocissimum* and *Lycium australe* shrubs and within saltbush dominated shrublands and on fence lines. The species was also observed within riparian shrublands along the Coleambally Outfall Drain.
Circus assimilis	Spotted Harrier	V	-	This species was frequently observed foraging within the Project Area and Subject Land during field surveys including BBUS surveys, vegetation assessments and targeted threatened species surveys. An active nest site occurs within the Project Area, within the western arm of the Development corridor.
Epthianura albifrons	White-fronted chat	V	-	This species was frequently observed foraging within the Project Area and Subject Land during field surveys including BBUS surveys, vegetation assessments and targeted threatened species surveys. The species was frequently observed in shrublands within the Subject Land.
Falco subniger	Black Falcon	V	-	This species was frequently observed foraging within the Project Area and Subject Land during field surveys including BBUS surveys, vegetation assessment and targeted threatened species surveys. Potential nests for the species were observed on the transmission towers present within the Project Area, with potentially two breeding pairs present within the Project Area.
Neophema chrysostoma	Blue-winged Parrot	V	V	A pair of this species were observed opportunistically while driving between BBUS survey sites. They were observed on the 22 of September 2022 in grassland habitat of the Subject Land and within the Project Area.
Petroica phoenicea	Flame Robin	V	-	This species was observed once within grassland scattered with chenopods. The species was recorded during July of 2023 within the Subject Land and within the Project Area along the roadside of North Boundary Road.
Pomatostomus temporalis temporalis	Grey-crowned Babbler (eastern subspecies)	V	-	This species was observed foraging within the Project Area and Subject Land during field surveys, including BBUS surveys, vegetation assessment and targeted threatened species surveys.
Stagonopleura guttata	Diamond Firetail	V	V	This species was observed foraging within the Project Area and Subject Land during field surveys, including BBUS surveys, vegetation assessment and targeted threatened species surveys. The species was recorded foraging within woodland adjacent to riparian vegetation within the Subject Land.

FIGURE 5.23.1

Threatened Species Recorded within the Subject Land
Ecosystem Credit Species

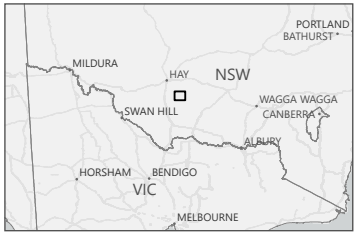


Legend

- Project Boundary
- Subject Land
- Stage 1 (South) Development Footprint
- Stage 2 (North) Development Footprint
- NPWS Reserves
- Conservation Agreement Area
- Road
- Watercourse

Threatened Species Records

- Black Falcon
- Flame Robin
- Grey-crowned Babbler
- Southern Whiteface
- Spotted Harrier
- White-fronted Chat
- Blue-winged Parrot



0 1,000 2,000

Meters

Scale 1:122,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

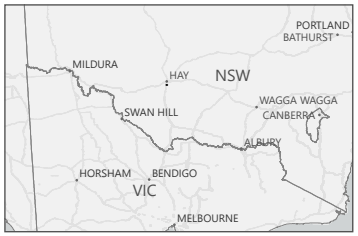
Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

FIGURE 5.23.2

Threatened Species Recorded within the Subject Land
Ecosystem Credit Species

Legend

- Stage 1 (South) Development Footprint
- Road



0 20 40

Meters

Scale 1:2,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

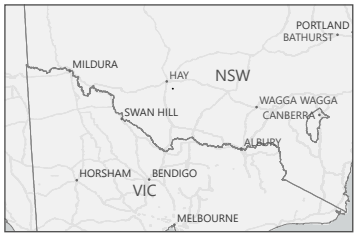
C:\Users\RachelMeiberan\UMWELT (AUSTRALIA) PTY. LTD\22110 - 03 S66VF, R44 - Amended BDAR\02_Projects\22110_R34_AmendedBDAR_Ch5_v2.aprx - 22110_R34_052_TSRecords_EcosystemCreditSpecies

FIGURE 5.23.3

Threatened Species Recorded within the Subject Land
Ecosystem Credit Species

Legend

- Stage 1 (South) Development Footprint
- Road



0 20 40

Meters

Scale 1:2,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

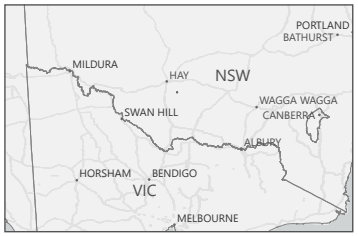
C:\Users\RachelMeiberg\on\UMWELT (AUSTRALIA) PTY. LTD\22110 - 03 S86VF: R34 - Amended BDAR\02_Projects\22110_R34_AmendedBDAR_Ch5_v2.aprx - 22110_R34_(052,575Records)_EcosystemCreditSpecies

FIGURE 5.23.4

Threatened Species Recorded within the Subject Land
Ecosystem Credit Species

Legend

- Stage 1 (South) Development Footprint
- Road
- Watercourse



0 20 40

Meters

Scale 1:2,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

5.4.2 Species Credit Species Recorded During the Field Surveys

A total of nine species credit species were recorded during field surveys. Of the nine species credit species, five were threatened flora species and four were fauna species. Details of the targeted surveys carried out for the assessment can be found within **Section 5.3**. The location of the species credit species recorded during field surveys are shown in **Figure 5.23**.

The nine (9) species credit species recorded during the field surveys are summarised as follows:

- *Maireana cheelii*
- *Swainsona sericea*
- *Swainsona murrayana*
- *Lepidium monoplocoides*
- *Eleocharis obicis*
- Plains-wanderer
- Little Eagle
- Barking Owl
- Southern Bell Frog.

A summary of the methods used and determination of presence for candidate threatened flora species credit species is provided in **Table 5.42**. Confirmation of threatened flora species identification from Royal Botanic Gardens is provided in **Appendix L**.

Table 5.42 Threatened Species Credit (Candidate) Species Survey Results

Common Name *Species Name*	BC Act	EPBC Act	Method used to determine presence	Present?	Further assessment required in this Amended BDAR?
Flora					
A spear-grass *Austrostipa wakoolica*	E	E	Targeted surveys Assumed presence	No	No
Austral Pillwort *Pilularia novae-hollandiae*	E	-	Targeted surveys	No	No
Bindweed *Convolvulus tedmoorei*	E	-	Targeted surveys Assumed presence	No	No
A burr daisy *Calotis moorei*	E	E	Targeted surveys	No	No
Chariot Wheels *Maireana cheelii*	V	V	Targeted surveys	The species was recorded during both the Stage 1 and Stage 2 grid-based surveys carried out in 2023 and 2024 respectively. A total of 1,207 *Maireana cheelii* were recorded within the Project Area during targeted surveys. The species was recorded within four discreet locations north of North Boundary Road, and within two discreet locations south of North Boundary Road within Stage 1 area. The species was recorded within PCT 28, PCT 44, PCT 46, PCT 160.	Yes
Claypan Daisy *Brachyscome muelleroides*	V	V	Targeted surveys	No	No
Lanky Buttons *Leptorhynchos orientalis*	E	-	Targeted surveys	No	No
Mossgiel Daisy *Brachyscome papillosa*	V	V	Targeted surveys	No	No
Pine Donkey Orchid *Diuris tricolor*	V	-	Targeted surveys	No	No

Common Name *Species Name*	BC Act	EPBC Act	Method used to determine presence	Present?	Further assessment required in this Amended BDAR?
Red Darling Pea *Swainsona plagiotropis*	V	V	Targeted surveys	No	No
Silky Swainson-pea *Swainsona sericea*	V	-	Targeted surveys Assumed presence	The species was recorded during targeted surveys both the Stage 1 and Stage 2 grid-based surveys carried out in 2023 and 2024 respectively. A total of 769 individuals were recorded across the Project Area within both Stage 1 – Linear assessment area and Stage 2 – Linear assessment area. The species was recorded in PCT 46, PCT 28, PCT 44, PCT 26.	Yes
Slender Darling Pea *Swainsona murrayana*	V	V	Targeted surveys Assumed presence	The species was recorded during targeted surveys. *Swainsona murryana* was recorded extensively across both Stage 1 and Stage 2 of the Project Area, with approximately 3,807 individuals recorded over spring 2023 and spring 2024. The species was recorded within PCT 164, PCT 26, PCT 28, PCT 44, PCT 46.	Yes
Small Scurf-pea *Cullen parvum*	E	-	Targeted surveys Assumed presence	No	No
Spike-rush *Eleocharis obicis*	V	V	Targeted surveys	*Eleocharis obicis* was incidentally recorded during late December 2024. It is likely that the species responded to the ~40 mm of rain which fell across the locality in late November 2024, which resulted in a flush of growth outside its BAM survey period (October-November). Approximately 110 individuals of the species recorded in two locations north of North Boundary Road: • 100 individuals were found within a swale running a long side an access track within the Stage 2 – linear assessment area • 10 individuals were found in a shallow depression north of the Subject Land within the Stage 2 – linear assessment area. It is noted that the record within the Survey Corridor is located between two 40 m Stage 1 survey grids, which accounts for why	Yes

Common Name *Species Name*	BC Act	EPBC Act	Method used to determine presence	Present?	Further assessment required in this Amended BDAR?
				these individuals were not recorded during the 2023 threatened flora surveys.	
Turnip Copperburr *Sclerolaena napiformis*	E	E	Targeted surveys	No	No
Winged Peppercress *Lepidium monoplocoides*	E	E	Targeted surveys	The species was recorded during targeted surveys. A total of 1,435 individuals of *Lepidium monoplocoides* were recorded within the Stage 1 – linear assessment area and Stage 2 – linear assessment area. The species was recorded within PCT 28, PCT 44, PCT 46, and PCT 26.	Yes
Yellow Gum *Eucalyptus leucoxylon* subsp. *pruinosa*	V	-	Targeted surveys	No	No
Fauna					
Australian Bustard *Ardeotis australis*	E	-	Targeted surveys	No	No
Bush Stone-curlew *Burhinus grallarius*	E	-	Targeted surveys	No	No
White-bellied Sea-Eagle *Haliaeetus leucogaster*	V	-	Targeted surveys	No	No
Little Eagle *Hieraaetus morphnoides*	V	-	Targeted surveys	Yes. This species was recorded during BBUS surveys as well as incidentally during threatened species surveys. Potential breeding habitat is present within the Subject Land and wider Project Area in the form of stick nests.	Yes
Pink Cockatoo *Lophochroa leadbeateri*	V	-	Targeted surveys	No	No
Square-tailed Kite *Lophoictinia isura*	V	-	Targeted surveys	No	No

Common Name *Species Name*	BC Act	EPBC Act	Method used to determine presence	Present?	Further assessment required in this Amended BDAR?
Barking Owl *Ninox connivens*	V	-	Targeted surveys	This species was not recorded during acoustic call detection surveys targeting the species, but incidentally during Southern Myotis surveys. Potential breeding habitat is present within the Subject Land and wider Project Area in the form of hollow bearing trees.	Yes
Plains-wanderer *Pedionomus torquatus*	E	CE	Important habitat mapping Targeted surveys	This species was incidentally recorded whilst leaving site following targeted threatened species surveys. This species has since been recorded across the site during targeted spotlighting surveys in the Subject Land during November and December 2024. A total of 20 individuals (male, female and juvenile individuals) have been recorded.	Yes
Superb Parrot *Polytelis swainsonii*	V	V	Targeted surveys	No	No
Masked Owl *Tyto novaehollandiae*	V	-	Targeted surveys	No	No
Southern Bell Frog *Litoria raniformis*	E	V	Targeted surveys	Southern Bell Frog was extensively recorded in the Subject Land between 5 and 12 December 2023. Breeding associated behaviour such as calling and amplexus was observed in the Coleambally Outfall Drain and most farm dams. The species has since been recorded incidentally during Plains-wanderer surveys in a farm dam.	Yes.
Grey Snake *Hemiaspis damelii*	E	E	Targeted surveys	No	No
Koala *Phascolarctos cinereus*	E	E	Targeted surveys	No	No
Southern Myotis *Myotis macropus*	V	-	Targeted surveys	No. The species was not recorded during active surveys around waterbodies within the Subject Land.	No

5.4.3 Description of Species Polygons

5.4.3.1 Overview

Species polygons have been generating for the species credit species either recorded within the Subject Land during field surveys or assumed to be present within the Subject Land as summarised in **Table 5.43.** A detailed description of how the species polygons were created for each species is described in **Section 5.4.3.2** to **Section 5.4.3.9**.

Table 5.43 Summary of Species Polygons for Species Recorded Within the Subject Land

Common Name *Species Name*	EPBC Act	BC Act	SAII	Biodiversity Risk Weighting	Unit of measure	Area (ha) Species Polygon within Subject Land			Area (ha) Species Polygon within Development Footprint			Total Area (ha) Species polygon within Subject Land	Total Area (ha) Species polygon within Development Footprint
						Stage 1 – Linear	Stage 1 – Site based	Stage 2 – Linear	Stage 1 – Linear	Stage 1 – Site based	Stage 2 – Linear		
Flora													
Chariot Wheels *Maireana cheelii*	V	V	No	2 (high)	Area	17.67	0.00	30.91	2.01	0.00	2.66	48.58	4.67
Silky Swainson-pea *Swainsona sericea*	V	-	No	2 (high)	Area	32.63	0.00	53.91	4.18	0.00	5.60	86.54	9.78
Slender Darling Pea *Swainsona murrayana*	V	V	No	2 (high)	Area	359.94	0.00	465.09	52.23	0.00	70.86	824.85	123.09
Spike-rush *Eleocharis obicis*	V	V	No	2 (high)	Area	0.00	0.00	55.75	0.00	0.00	7.31	55.75	7.31

Common Name *Species Name*	EPBC Act	BC Act	SAII	Biodiversity Risk Weighting	Unit of measure	Area (ha) Species Polygon within Subject Land			Area (ha) Species Polygon within Development Footprint			Total Area (ha) Species polygon within Subject Land	Total Area (ha) Species polygon within Development Footprint
						Stage 1 – Linear	Stage 1 – Site based	Stage 2 – Linear	Stage 1 – Linear	Stage 1 – Site based	Stage 2 – Linear		
Winged Peppercress *Lepidium monoplocoides*	E	E	No	2 (high)	Area	42.09	0.00	0.0	3.52	0.00	0.00	42.09	3.52
Fauna													
Little Eagle *Hieraaetus morphnoides*	-	V	No	1.5 (moderate)	Area	98.05	0.00	74.41	20.46	0.00	15.35	172.46	35.81
Barking Owl *Ninox connivens*	-	V	No	2 (high)	Area	28.16	0.00	0.00	4.16	0.00	0.00	28.16	4.16
Southern Bell Frog *Litoria raniformis*	E	V	N	2 (high)	Area	222.51	0.00	151.55	34.87	0.00	17.29	374.05	52.16
Fauna (Additional and Appropriate Measures)													
Plains-wanderer[1] *Pedionomus torquatus*	E	CE	Yes	3 (very high)	Area	84.61	0.00	10.38	20.20	0.00	0.69	94.99*	20.89^

1 Impacts presented for Plains-wanderer are based on the assessment of supplementary habitat, it does not include any impacts to NSW identified Important Habitat Mapping as all of that critical species habitat mapping was avoided by the Project.

** 7.01 ha comprising existing mapping of infrastructure, non-native vegetation and/or waterbodies.*

^ 2.61 ha comprising existing mapping of infrastructure, non-native vegetation and/or waterbodies.

5.4.3.2 *Maireana cheelii*

Table 5.44 *Maireana cheelii* – Species Polygon Details

Information Required	Species Polygon Details
Biodiversity Risk Weighting	2 (high)
SAII	No
Habitat constraints / microhabitats present on the Subject Land / vegetation zone	-
Extent of suitable habitat present and condition within species polygon	• PCT 160 Moderate-Good • PCT 28 Derived Native Grassland • PCT 44 Moderate-Good • PCT 46 Moderate-Good.
TBDC species specific recommendations	None listed in TBDC
Overall approach	Species polygon was generated across all PCTs / vegetation zones within a 100 m buffer of all *Maireana cheelii* records (including those located outside of the Subject Land).
Area of species polygon in Subject Land	• **Stage 1 – Linear:** 17.67 ha • **Stage 1 – Site based:** 0.00 ha • **Stage 2 – Linear:** 30.91 ha. • **Total 48.58 ha.**
Area of species polygon in Development Footprint	• **Stage 1 – Linear:** 2.01 ha • **Stage 1 – Site based:** 0.00 ha • **Stage 2 – Linear:** 2.66 ha. • **Total 4.67 ha.**

5.4.3.3 *Swainsona sericea*

Table 5.45 *Swainsona sericea* – Species Polygon Details

Information Required	Species Polygon Details
Biodiversity Risk Weighting	2 (high)
SAII	No
Habitat constraints / microhabitats present on the Subject Land / vegetation zone	-
Extent of suitable habitat present and condition within species polygon	• PCT 26 Derived Native Grassland • PCT 26 Moderate-Good • PCT 28 Derived Native Grassland • PCT 44 Moderate-Good • PCT 46 Moderate-Good.
TBDC species specific recommendations	None listed in TBDC
Overall approach	Species polygon was generated across all PCTs / vegetation zones within a 100 m buffer of all *Swainsona sericea* records (including those located outside of the Subject Land).

Information Required	Species Polygon Details
Area of species polygon in Subject Land	• **Stage 1 – Linear:** 32.63 ha • **Stage 1 – Site based:** 0.00 ha • **Stage 2 – Linear:** 53.91 ha • **Total 86.54 ha.**
Area of species polygon in Development Footprint	• **Stage 1 – Linear:** 4.18 ha • **Stage 1 – Site based:** 0.0 ha • **Stage 2 – Linear:** 5.60 ha • **Total 9.78 ha.**

5.4.3.4 *Swainsona murrayana*

Table 5.46 *Swainsona murryana* – Species Polygon Details

Information Required	Species Polygon Details
Biodiversity Risk Weighting	2 (high)
SAII	No
Habitat constraints / microhabitats present on the Subject Land / vegetation zone	-
Extent of suitable habitat present and condition within species polygon	• PCT 164 Moderate-Good • PCT 26 Derived Native Grassland • PCT 26 Moderate-Good • PCT 28 Derived Native Grassland • PCT 44 Moderate-Good • PCT 46 Moderate-Good.
TBDC species specific recommendations	None listed in TBDC
Overall approach	Species polygon was generated based on associated PCTs across the Subject Land within which the species was recorded.
Area of species polygon in Subject Land	• **Stage 1 – Linear:** 359.94 ha • **Stage 1 – Site based:** 0.00 ha • **Stage 2 – Linear:** 465.09 ha • **Total 824.85 ha.**
Area of species polygon in Development Footprint	• **Stage 1 – Linear:** 52.23 ha • **Stage 1 – Site based:** 0.00 ha • **Stage 2 – Linear:** 70.86 ha • **Total 123.09 ha.**

5.4.3.5 *Eleocharis obicis*

Table 5.47 *Eleocharis obicis* – Species Polygon Details

Information Required	Species Polygon Details
Biodiversity Risk Weighting	2 (high)
SAII	No
Habitat constraints / microhabitats present on the Subject Land / vegetation zone	-
Extent of suitable habitat present and condition within species polygon	• PCT 44 Moderate-Good • PCT 28 Derived Native Grassland.
TBDC species specific recommendations	None listed in TBDC
Overall approach	Species polygon was generated across all PCTs / vegetation zones within a 500 m buffer of all *Eleocharis obicis* records (including those located outside of the Subject Land). The 500 m buffer is consistent with the 'area of suitable habitat' placed around the other threatened flora species which were subject to Stage 2 surveys.
Area of species polygon in Subject Land	• **Stage 1 – Linear:** 0.00 ha • **Stage 1 – Site based:** 0.00 ha • **Stage 2 – Linear:** 55.75 ha • **Total 55.75 ha.**
Area of species polygon in Development Footprint	• **Stage 1 – Linear:** 0.00 ha • **Stage 1 – Site based:** 0.00 ha • **Stage 2 – Linear:** 7.31 ha • **Total 7.31 ha.**

5.4.3.6 *Lepidium monoplocoides*

Table 5.48 *Lepidium monoplocoides* – Species polygon details

Information Required	Species Polygon Details
Biodiversity Risk Weighting	2 (high)
SAII	No
Habitat constraints / microhabitats present on the Subject Land / vegetation zone	-
Extent of suitable habitat present and condition within species polygon	• PCT 24 Moderate-Good • PCT 26 Derived Native Grassland • PCT 26 Moderate-Good • PCT 28 Derived Native Grassland • PCT 44 Moderate-Good • PCT 46 Moderate-Good.
TBDC species specific recommendations	None listed in TBDC
Overall approach	Species polygon was generated across all PCTs / vegetation zones within a 100 m buffer of all *Lepidium monoplocoides* records (including those located outside of the Subject Land).

Information Required	Species Polygon Details
Area of species polygon in Subject Land	• **Stage 1 – Linear:** 42.09 ha • **Stage 1 – Site based:** 0.0 ha • **Stage 2 – Linear:** 0.00 ha • **Total 42.09 ha.**
Area of species polygon in Development Footprint	• **Stage 1 – Linear:** 3.52 ha • **Stage 1 – Site based:** 0.0 ha • **Stage 2 – Linear:** 0.0 ha. • **Total 3.52 ha.**

5.4.3.7 Little Eagle

Table 5.49 Little Eagle – Species Polygon Details

Information Required	Species Polygon Details
Biodiversity Risk Weighting	1.5 (moderate)
SAII	No
Habitat constraints / microhabitats present on the Subject Land / vegetation zone	Nest trees - live (occasionally dead) large old trees within vegetation.
Extent of suitable habitat present and condition within species polygon	• PCT 10 Moderate-Good • PCT 13 Moderate-Good • PCT 26 Derived Native Grassland • PCT 26 Moderate-Good • PCT 28 Derived Native Grassland • PCT 44 Moderate-Good • PCT 46 Moderate-Good.
TBDC species specific recommendations	Where a breeding site has been identified in accordance with the BAM the species buffer polygon should be established by providing a circular polygon with a 300 m radius around the nest tree.
Overall approach	A 300 m buffer was placed around stick nests which a) were occupied by another species, and b) of an appropriate size for the species. The species polygon was generated using associated PCTs within the 300 m buffers.
Area of species polygon in Subject Land	• **Stage 1 – Linear**: 98.05 ha • **Stage 1 – Site based**: 0.00 ha • **Stage 2 – Linear**: 74.41 ha. • **Total 172.46 ha.**
Area of species polygon in Development Footprint	• **Stage 1 – Linear**: 20.46 ha • **Stage 1 – Site based**: 0.00 ha • **Stage 2 – Linear**: 15.35 ha. • **Total 35.81 ha.**

5.4.3.8 Barking Owl

Table 5.50 Barking Owl – Species Polygon Details

Information Required	Species Polygon Details
Biodiversity Risk Weighting	2 (high)
SAII	No
Habitat constraints / microhabitats present on the Subject Land / vegetation zone	Living or dead tree with a hollow >20 cm diameter that occurs >4 m above the ground
Extent of suitable habitat present and condition within species polygon	• PCT 10 Moderate-Good • PCT 26 Derived Native Grassland • PCT 26 Moderate-Good.
TBDC species specific recommendations	The species polygon must be drawn to include all vegetation zones; 1. within 800 m (being the approximate home range) from the location of a detected owl, and 2. containing a living or dead tree with a hollow >20 cm diameter that occurs >4 m above the ground.
Overall approach	A species polygon was generated within all vegetation zones within 800 m of the location of Barking Owl which contain living or dead trees with a hollow >20 cm diameter that occurs >4 m above the ground.
Area of species polygon in Subject Land	• **Stage 1 – Linear**: 28.16 ha • **Stage 1 – Site based**: 0.00 ha • **Stage 2 – Linear**: 0.00 ha. • **Total 28.16 ha.**
Area of species polygon in Development Footprint	• **Stage 1 – Linear**: 4.16 ha • **Stage 1 – Site based**: 0.00 ha • **Stage 2 – Linear**: 0.00 ha • **Total 4.16 ha.**

5.4.3.9 Southern Bell Frog

Table 5.51 Southern Bell Frog – Species Polygon Details

Information Required	Species Polygon Details
Biodiversity Risk Weighting	2 (high)
SAII	No
Habitat constraints / microhabitats present on the Subject Land / vegetation zone	-
Extent of suitable habitat present and condition within species polygon	• PCT 10 Moderate-Good • PCT 24 Moderate-Good • PCT 26 Derived Native Grassland • PCT 26 Moderate-Good • PCT 28 Derived Native Grassland • PCT 44 Moderate-Good • PCT 46 Moderate-Good.

Information Required	Species Polygon Details
TBDC species specific recommendations	Refer to the 'NSW Survey Guide for Threatened Frogs' for information on targeted survey requirements and mapping species polygons.
Overall approach	As so many frogs were observed onsite, in almost every waterbody visited, it is assumed that all waterbodies on site would be potential habitat, even if they appear to have limited connection to others, or look to be dry on the aerial images. The following steps were followed to create the species polygon: • A 200 m buffer was placed around any water body on site, including hydroline, farm dam, and the Coleambally outfall drain and any obvious drainage lines which occur between dams. These drainage lines may not be marked by the hydrolines, but the locations recorded during field surveys. • Water bodies which occur outside the Subject Land have a buffer area which intersects the Subject Land. Where the buffer and the Subject Land intersect, this is included in the species polygon. • As waterbodies are assessed in the prescribed impacts assessment, waterbodies are not included in the species polygons. The 200 m buffer began from the edge of the waterbody. • Species polygon was generated using all known associated PCTs as well as the additional PCT list which is derived from additional species SBF were seen in on site. Species polygon only include native vegetation, excluding non-native vegetation.
Area of species polygon in Subject Land	• **Stage 1 – Linear**: 222.51 ha • **Stage 1 – Site based**: 0.00 ha • **Stage 2 – Linear:** 151.55 ha. • **Total 374.05 ha.**
Area of species polygon in Development Footprint	• **Stage 1 – Linear**: 34.87 ha • **Stage 1 – Site based**: 0.00 ha • **Stage 2 – Linear**: 17.29 ha • **Total 52.16 ha.**

5.4.3.10 Plains-wanderer (Supplementary Habitat)

Table 5.52 Plains-wanderer – Species Polygon Details

Information Required	Species Polygon Details
Biodiversity Risk Weighting	3 (very high)
SAII	Yes
Habitat constraints / microhabitats present on the Subject Land / vegetation zone	-
Extent of suitable habitat present and condition within species polygon	• PCT 44 Moderate-Good (Associated PCT) • PCT 46 Moderate-Good (Associated PCT) • PCT 10 Moderate-Good (Non-associated PCT)

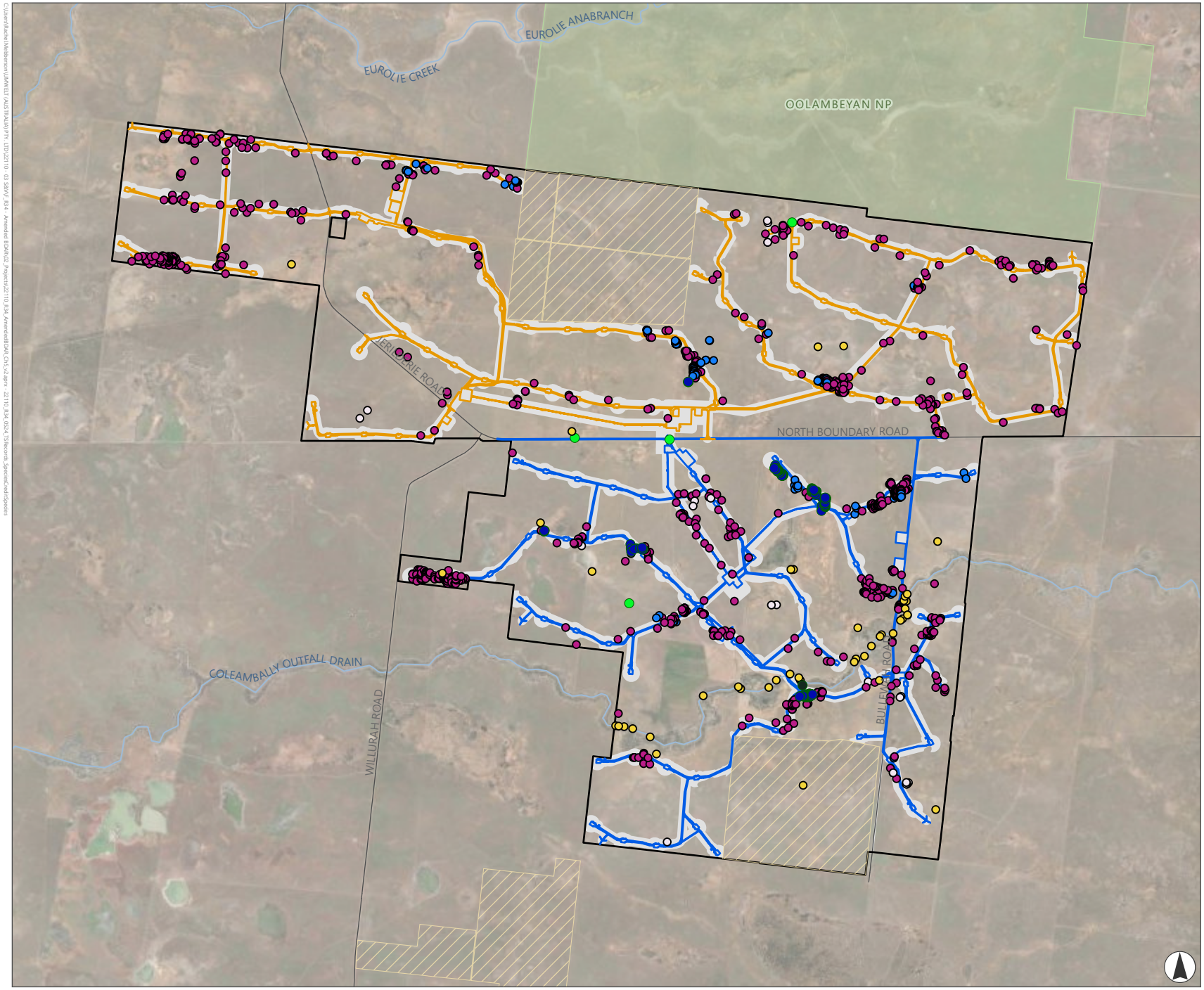
Information Required	Species Polygon Details
	• PCT 26 Moderate-Good (Non-associated PCT) • PCT 26 DNG (Non-associated PCT).
TBDC species specific recommendations	-

Overall approach	The below information details the process of preparing the supplementary habitat species polygon for plains wanderer on the Project.
	Following the collection of high-resolution aerial imagery and LiDAR, the imagery was processed and the vegetation in the image classified. The following steps were completed in order to classify the vegetation:
	• Classify the ground and non-ground: the point cloud generation software's inbuilt classifier was used with default settings in order to classify the ground and everything else as non-ground
	• Classify all other vegetation: large shrubs, small shrubs, and grasses were classified based on height the following height ranges, and colour signatures:
	  ○ trees: ≥1.5 m
	  ○ medium vegetation: 0.5 m to 1.5 m
	  ○ low vegetation (mostly shrubs, some grass): 0.1 m to 0.5 m
	  ○ grass: <0.1 m (excluding previously classified ground points).
	• Refine ground and grass classifications: using the colour signatures detected for ground and grass, the vegetation was iteratively reclassified to increase accuracy was refined as appropriate.
	• From the point cloud, hexbin layers for created for each vegetation type to highlight locations that contains 15 or more points (with 1 m hexagon edges).
	Using the layers created from the vegetation classification, the drone survey areas were then analysed to identify which parts of the survey areas were structurally similar to those preferred by Plains-wanderers. specifically, these were parts of the drone survey areas which were comprised approximately 50% bare ground, 40% herbs and grasses. In order to do this, each drone survey area was divided into 20 m x 20 m grids, within which the proportion of bare ground, low vegetation, and medium vegetation was calculated using the classification layers.
	From this point of the analysis, the final step of consolidating the supplementary habitat species polygon for the species included:
	• Associated PCTs for the species.
	• Non-associated PCTs for the species where the detailed habitat analysis indicated a high density of suitable habitat characteristics adjacent to areas of associated PCTs for the species.
	• Consideration of Umwelt plains wanderer records.
	• Consideration of BioNet plains wanderer records.

Information Required	Species Polygon Details
Area of species polygon in Subject Land	• **Stage 1 – Linear**: 84.61 ha • **Stage 1 – Site based**: 0.00 ha • **Stage 2 – Linear:** 10.38 ha • **Total 94.99 ha (7.01 ha comprising existing mapping of infrastructure, non-native vegetation and/or waterbodies).**
Area of species polygon in Development Footprint	• **Stage 1 – Linear**: 20.20 ha • **Stage 1 – Site based**: 0.00 ha • **Stage 2 – Linear**: 0.69 ha • **Total 20.89 ha (2.61 ha comprising existing mapping of infrastructure, non-native vegetation and/or waterbodies).**

FIGURE 5.24.1

Threatened Species Recorded within the Subject Land
Species Credit Species

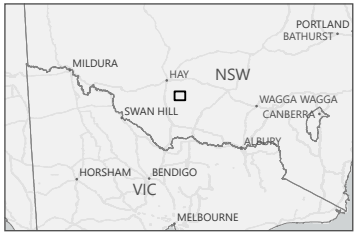


Legend

- Project Boundary
- Subject Land
- Stage 1 (South) Development Footprint
- Stage 2 (North) Development Footprint
- Conservation Agreement Area
- NPWS Reserves
- Road
- Watercourse

Threatened Species Records

- Barking Owl
- Lepidium monoplocoides
- Little Eagle
- Plains Wanderer
- Southern Bell Frog
- Swainsona murrayana
- Swainsona sericea



0 1,000 2,000

Meters

Scale 1:122,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

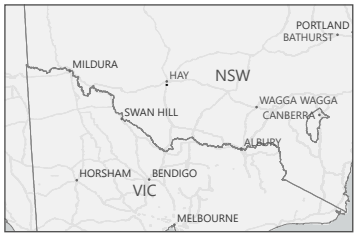
Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

FIGURE 5.24.2

Threatened Species Recorded within the Subject Land
Species Credit Species

Legend

- Stage 1 (South) Development Footprint
- Road



0 20 40

Meters

Scale 1:2,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

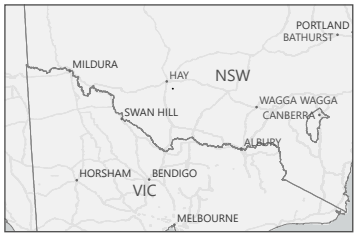
FIGURE 5.24.3

Threatened Species Recorded within the Subject Land

Species Credit Species

Legend

- Stage 1 (South) Development Footprint
- Road



0 20 40

Meters

Scale 1:2,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

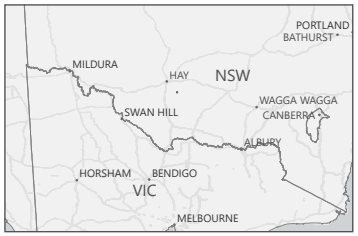
C:\Users\RachelMeberson\UMWELT (AUSTRALIA) PTY. LTD\22110 - 03 SWVF R04 - Amended BDAR\02_Projects\22110_R34_AmendedBDAR_Ch5_v2.aprx - 22110_R34_(024_TSRecords_SpeciesCreditSpecies

FIGURE 5.24.4

Threatened Species Recorded within the Subject Land
Species Credit Species

Legend

- Stage 1 (South) Development Footprint
- Road
- Watercourse



0 20 40

Meters

Scale 1:2,000 at A4

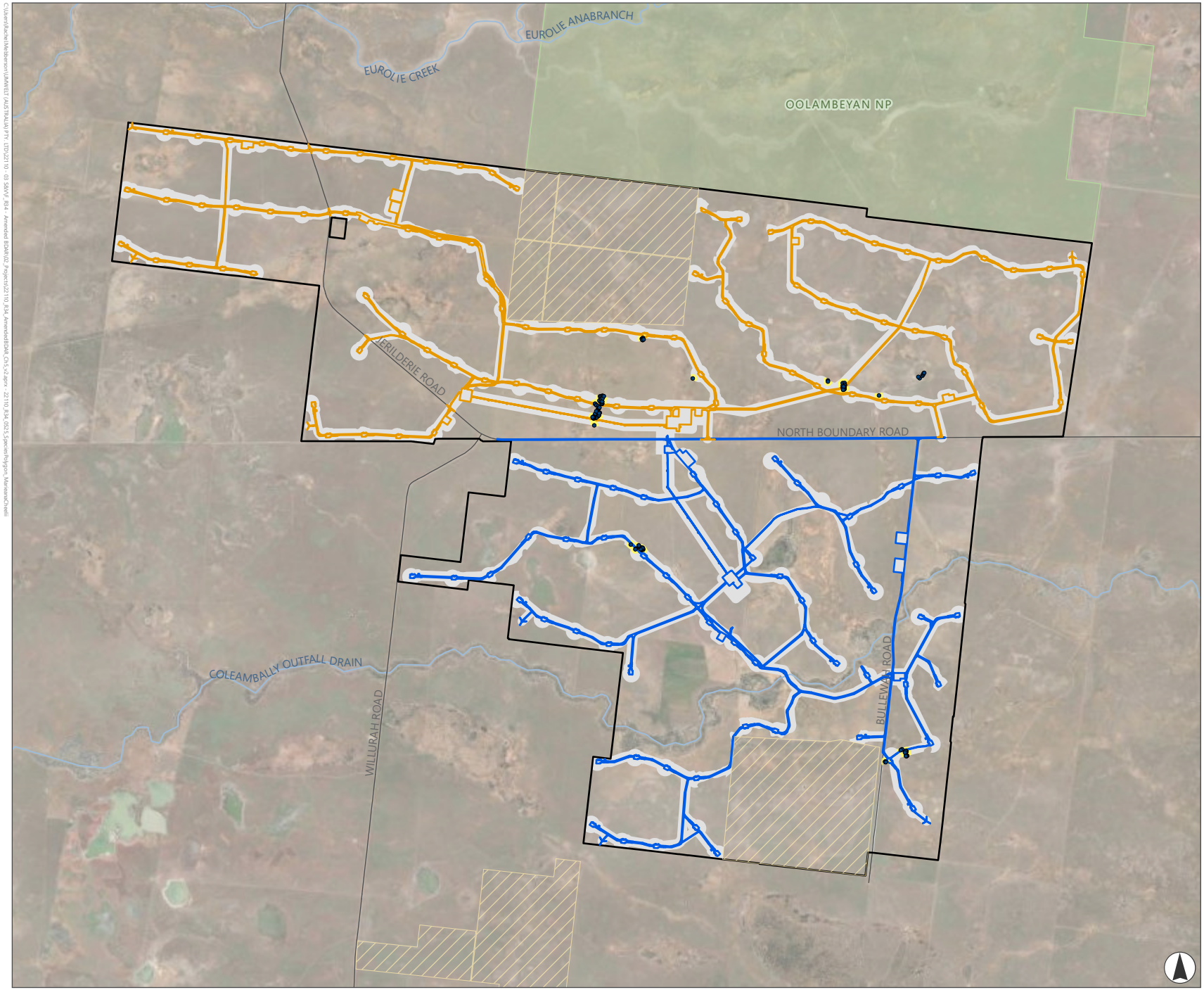
GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

FIGURE 5.25.1

Species Polygon
Marieana cheelii

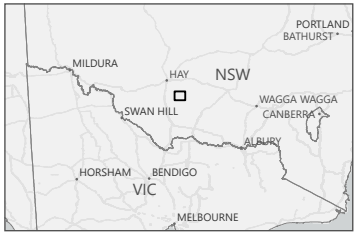


Legend

- Project Boundary
- Subject Land
- Stage 1 (South) Development Footprint
- Stage 2 (North) Development Footprint
- Conservation Agreement Area
- NPWS Reserves
- Road
- Watercourse

Threatened Species Records

- Maireana cheelii
- Maireana cheelii Species Polygon



0 1,000 2,000

Meters

Scale 1:122,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

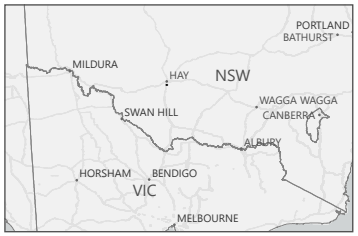
Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

FIGURE 5.25.2

Species Polygon
Marieana cheelii

Legend

- Stage 1 (South) Development Footprint
- Road



0 20 40

Meters

Scale 1:2,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

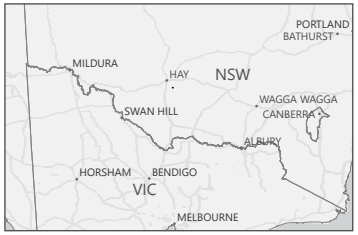
C:\Users\RachelMeiberson\UMWELT (AUSTRALIA) PTY. LTD\22110 - 03 S86VF R44 - Amended BDAR\02_Projects\22110_R34_AmendedBDAR_Ch5_v2.aprx - 22110_R34_052_SpeciesPolygon_MarieanaCheelii

FIGURE 5.25.3

Species Polygon
Marieana cheelii

Legend

- Stage 1 (South) Development Footprint
- Road



0 20 40

Meters

Scale 1:2,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

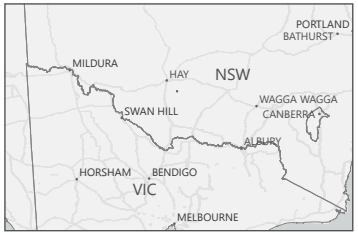
C:\Users\RachelMeberson\UMWELT (AUSTRALIA) PTY. LTD\22110 - 03 SWVF R04 - Amended BDAR\02_Projects\22110_R34_AmendedBDAR_Ch5_v2.aprx - 22110_R34_052_SpeciesPolygon_MarieanaCheelii

FIGURE 5.25.4

Species Polygon
Marieana cheelii

Legend

- Stage 1 (South) Development Footprint
- Road
- Watercourse



0 20 40

Meters

Scale 1:2,000 at A4

GDA2020 MGA Zone 55

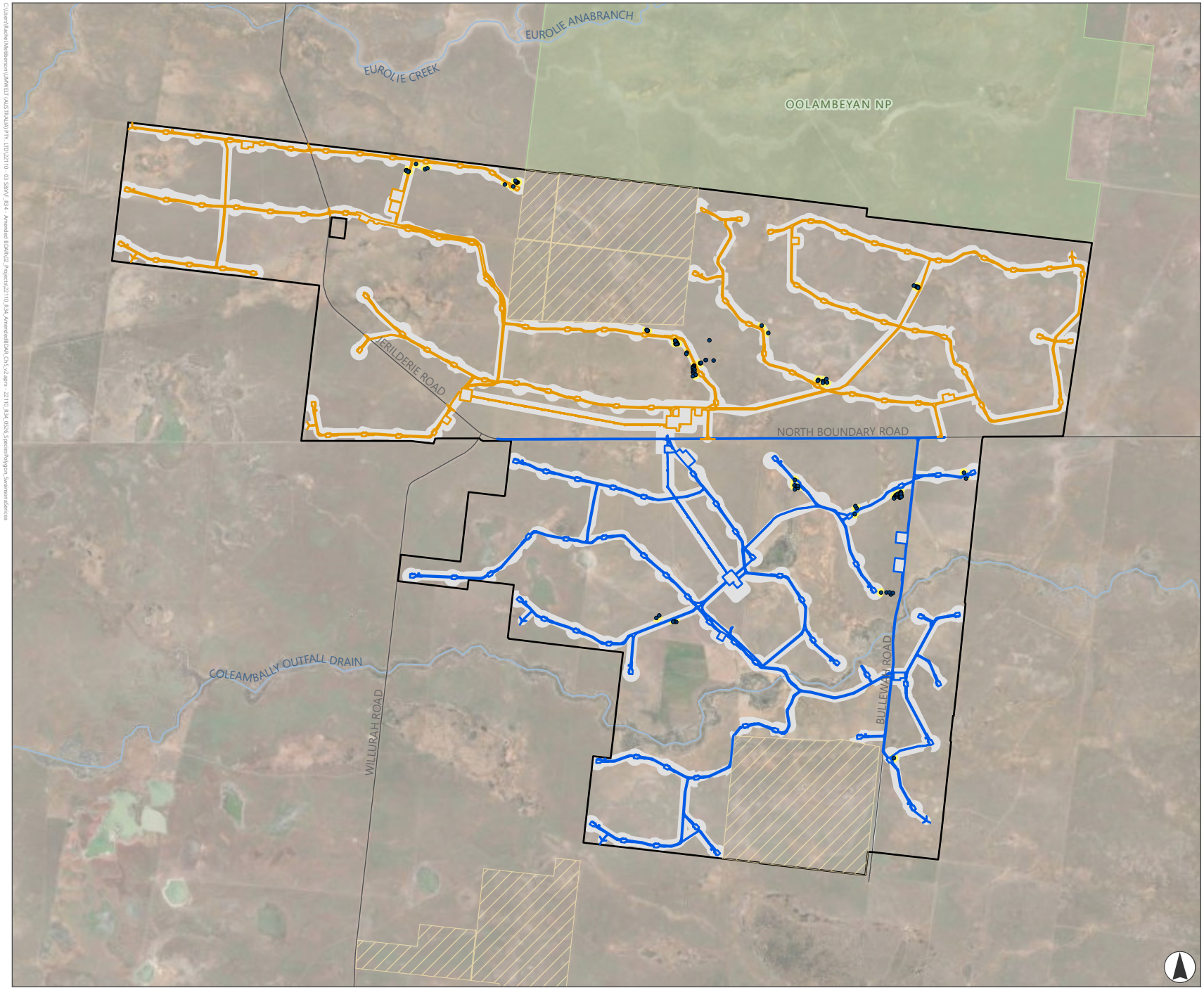
This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

C:\Users\RachelMeibersom\UMWELT (AUSTRALIA) PTY. LTD\2210 - 03 SWVF R04 - Amended BDAR\02_Projects\22110_R34_AmendedBDAR_Ch5_v2.aprx - 22110_R34_052_SpeciesPolygon_MarieanaCheelii

FIGURE 5.26.1

Species Polygon
Swainsona sericea

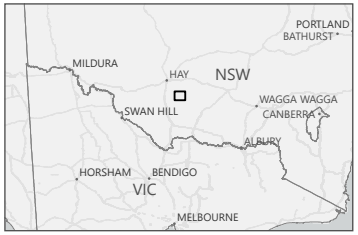


Legend

- Project Boundary
- Subject Land
- Stage 1 (South) Development Footprint
- Stage 2 (North) Development Footprint
- NPWS Reserves
- Conservation Agreement Area
- Road
- Watercourse

Threatened Species Records

- Swainsona sericea
- Swainsona Sericea Species Polygon



0 1,000 2,000

Meters

Scale 1:122,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

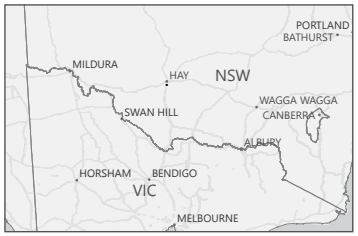
Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

FIGURE 5.26.2

Species Polygon
Swainsona sericea

Legend

- Stage 1 (South) Development Footprint
- Road



0 20 40

Meters

Scale 1:2,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

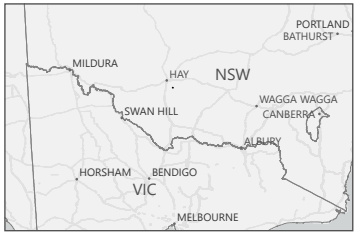
C:\Users\RachelMeiberson\UMWELT (AUSTRALIA) PTY. LTD\22110 - 03 S86VF R44 - Amended BDAR\02_Projects\22110_R34_AmendedBDAR_Ch5_v2.aprx - 22110_R34_0526_SpeciesPolygon_SwainsonaSericea

FIGURE 5.26.3

Species Polygon
Swainsona sericea

Legend

- Stage 1 (South) Development Footprint
- Road



0 20 40

Meters

Scale 1:2,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

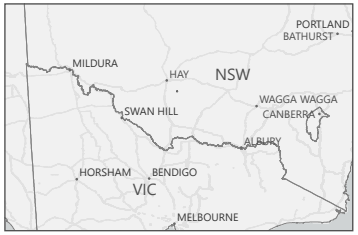
C:\Users\RachelMeberson\UMWELT (AUSTRALIA) PTY. LTD\2210 - 03 SWVF R04 - Amended BDAR\02_Projects\2210_R34_AmendedBDAR_Ch5_v2.aprx - 2210_R34_0526_SpeciesPolygon_SwainsonaSericea

FIGURE 5.26.4

Species Polygon
Swainsona sericea

Legend

- Stage 1 (South) Development Footprint
- Road
- Watercourse



0 20 40

Meters

Scale 1:2,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

C:\Users\RachelMeibersen\UMWELT (AUSTRALIA) PTY. LTD\2210 - 03 SWVF R44 - Amended BDAR\02_Projects\2210_R34_AmendedBDAR_Ch5_v2.aprx - 2210_R34_0526_SpeciesPolygon_SwainsonaSericea

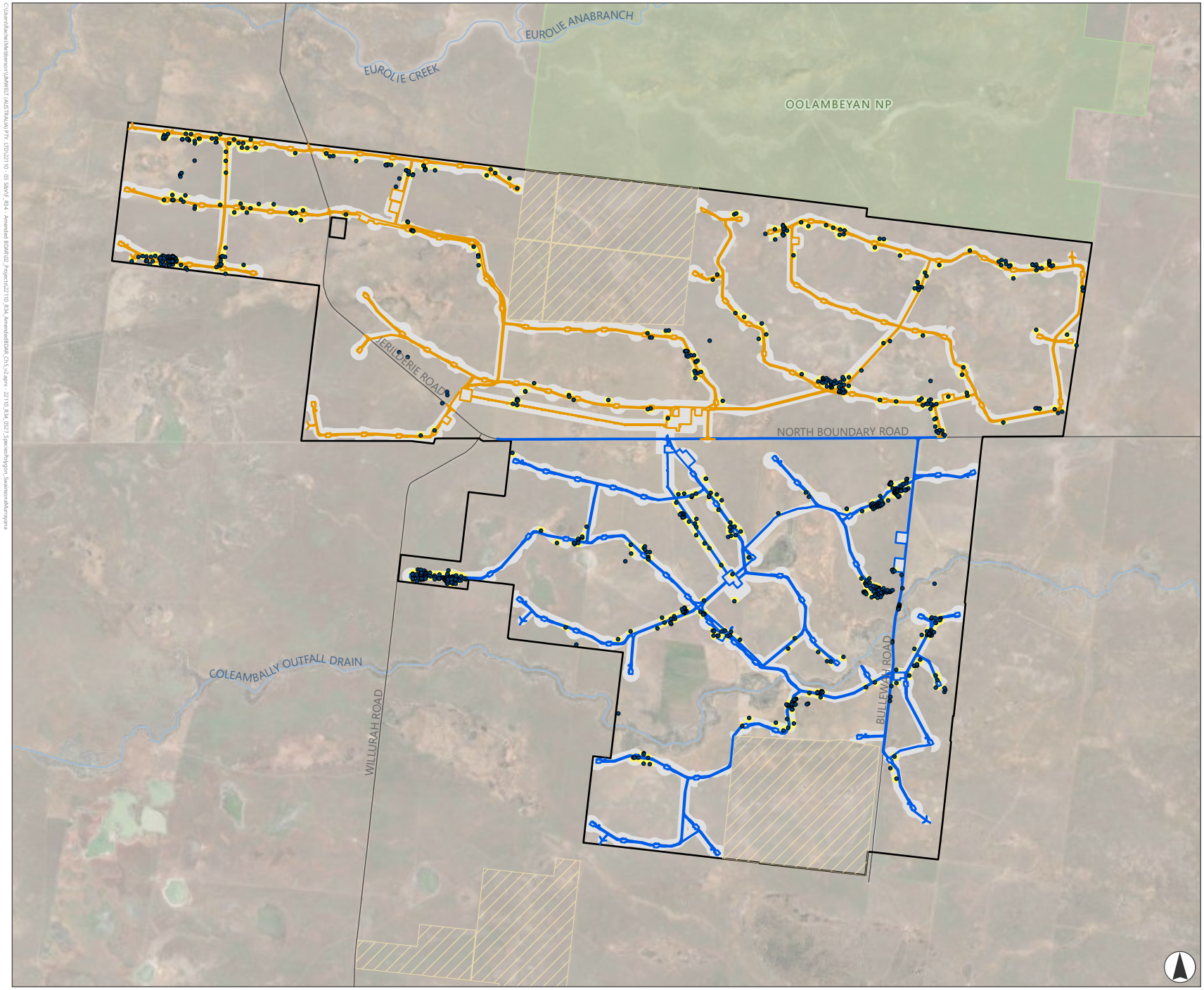


FIGURE 5.27.1

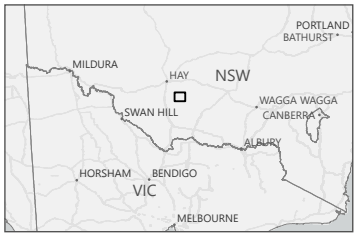
Species Polygon
Swainsona murrayana

Legend

- Project Boundary
- Subject Land
- Stage 1 (South) Development Footprint
- Stage 2 (North) Development Footprint
- Conservation Agreement Area
- NPWS Reserves
- Road
- Watercourse

Threatened Species Records

- Swainsona murrayana
- Swainsona murrayana Species Polygon



0 1,000 2,000

Meters

Scale 1:122,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

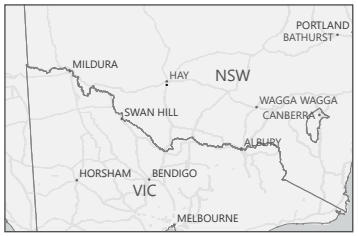
Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

FIGURE 5.27.2

Species Polygon
Swainsona murrayana

Legend

- Stage 1 (South) Development Footprint
- Road



0 20 40

Meters

Scale 1:2,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

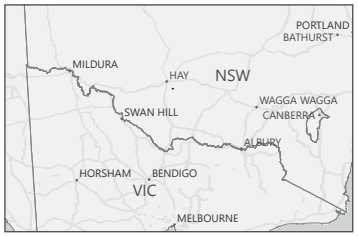
C:\Users\RachelMeiberson\UMWELT (AUSTRALIA) PTY. LTD\22110 - 03 SWVF R44 - Amended BDAR\02_Projects\22110_R34_AmendedBDAR_Ch5.v2.aprx - 22110_R34_052_SpeciesPolygon_SwainsonaMurrayana

FIGURE 5.27.3

Species Polygon
Swainsona murrayana

Legend

- Stage 1 (South) Development Footprint
- Road



0 20 40

Meters

Scale 1:2,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

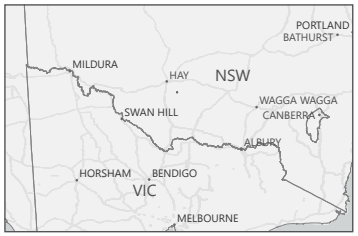
C:\Users\RachelMeberson\UMWELT (AUSTRALIA) PTY. LTD\2210 - 03 SWVF R04 - Amended BDAR\02_Projects\22110_R34_AmendedBDAR_Ch5_v2.aprx - 22110_R34_052_SpeciesPolygon_SwainsonaMurrayana

FIGURE 5.27.4

Species Polygon
Swainsona murrayana

Legend

- Stage 1 (South) Development Footprint
- Road
- Watercourse



0 20 40

Meters

Scale 1:2,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

C:\Users\RachelMeberson\UMWELT (AUSTRALIA) PTY. LTD\2210 - 03 SWVF R04 - Amended BDAR\02_Projects\22110_R34_AmendedBDAR_Ch5_v2.aprx - 22110_R34_(027_SpeciesPolygon_SwainsonaMurrayana

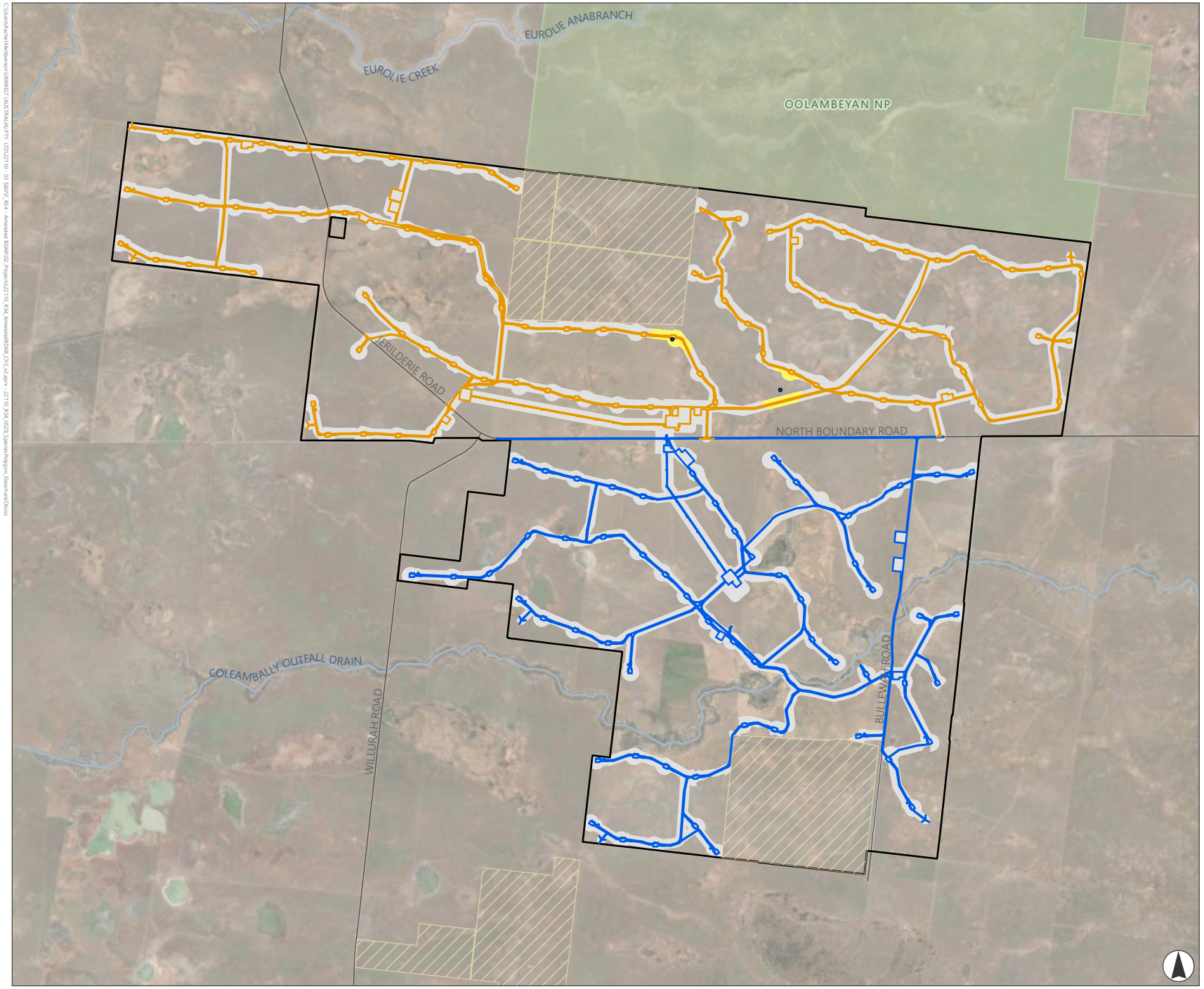


FIGURE 5.28.1

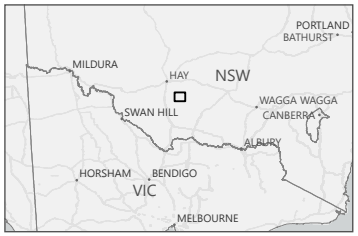
Species Polygon
Eleocharis obicis

Legend

- Project Boundary
- Subject Land
- Stage 1 (South) Development Footprint
- Stage 2 (North) Development Footprint
- Conservation Agreement Area
- NPWS Reserves
- Road
- Watercourse

Threatened Species Records

- Eleocharis obicis
- Eleocharis obicis Species Polygon



0 1,000 2,000

Meters

Scale 1:122,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

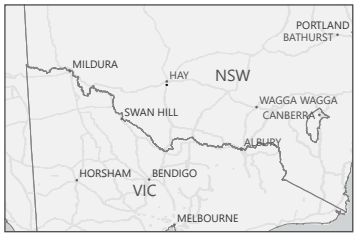
Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

FIGURE 5.28.2

Species Polygon
Eleocharis obicis

Legend

- Stage 1 (South) Development Footprint
- Road



0 20 40

Meters

Scale 1:2,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

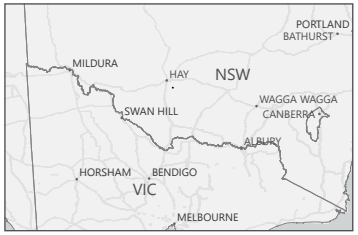
C:\Users\RachelMeiberson\UMWELT (AUSTRALIA) PTY. LTD\22110 - 03 S86VF R44 - Amended BDAR\02_Projects\22110_R34_AmendedBDAR_Ch5_v2.aprx - 22110_R34_0528_SpeciesPolygon_EleocharisObicis

FIGURE 5.28.3

Species Polygon
Eleocharis obicis

Legend

- Stage 1 (South) Development Footprint
- Road



0 20 40

Meters

Scale 1:2,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

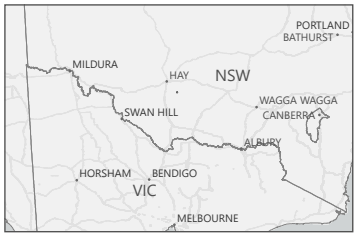
C:\Users\RachelMeberson\UMWELT (AUSTRALIA) PTY. LTD\2210 - 03 SWVF R04 - Amended BDAR\02_Projects\2210_R34_AmendedBDAR_Ch5_v2.aprx - 2210_R34_0528_SpeciesPolygon_EleocharisObicis

FIGURE 5.28.4

Species Polygon
Eleocharis obicis

Legend

- Stage 1 (South) Development Footprint
- Road
- Watercourse



0 20 40

Meters

Scale 1:2,000 at A4

GDA2020 MGA Zone 55

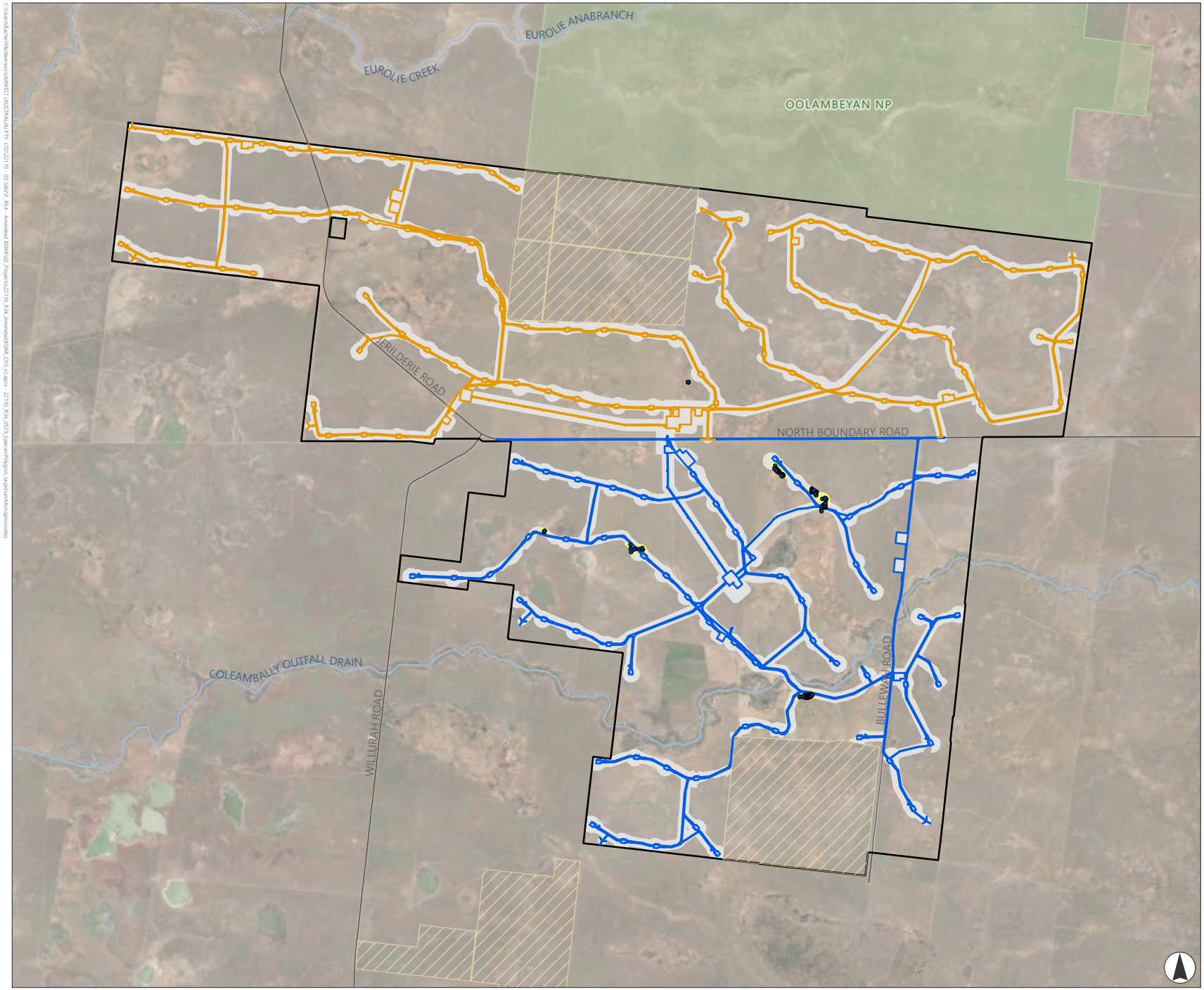
This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

C:\Users\RachelMeiberson\UMWELT (AUSTRALIA) PTY. LTD\2210 - 03 SWVF R04 - Amended BDAR\02_Projects\22110_R34_AmendedBDAR_Ch5_v2.aprx - 22110_R34_0528_SpeciesPolygon_EleocharisObicis

FIGURE 5.29.1

Species Polygon
Lepidium monoplocoides

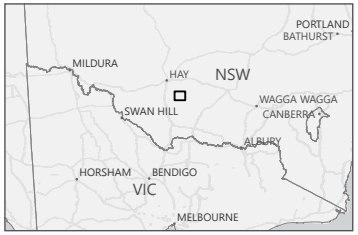


Legend

- Project Boundary
- Subject Land
- Stage 1 (South) Development Footprint
- Stage 2 (North) Development Footprint
- Conservation Agreement Area
- NPWS Reserves
- Road
- Watercourse

Threatened Species Records

- Lepidium monoplocoides
- Lepidium monoplocoides Species Polygon



0 1,000 2,000

Meters

Scale 1:122,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

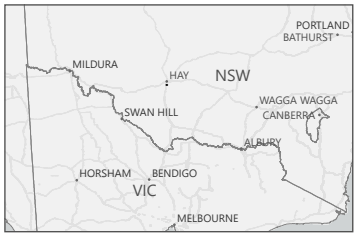
C:\Users\RachelMeiberson\UMWELT (AUSTRALIA) PTY. LTD\2210 - 03 SWVF R04 - Amended BDAR\02_Projects\22110_R34_AmendedBDAR_Ch5_v2.aprx - 22110_R34_05.29_SpeciesPolygon_LepidiumMonoplocoides

FIGURE 5.29.2

Species Polygon
Lepidium monoplocoides

Legend

- Stage 1 (South) Development Footprint
- Road



0 20 40

Meters

Scale 1:2,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

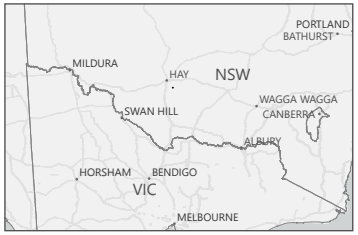
C:\Users\RachelMeiberson\UMWELT (AUSTRALIA) PTY. LTD\2210 - 03 SWVF R04 - Amended BDAR\02_Projects\2210_R34_AmendedBDAR_Ch5_v2.aprx - 2210_R34_0529_SpeciesPolygon_LepidiumMonoplocoides

FIGURE 5.29.3

Species Polygon
Lepidium monoplocoides

Legend

- Stage 1 (South) Development Footprint
- Road



0 20 40

Meters

Scale 1:2,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

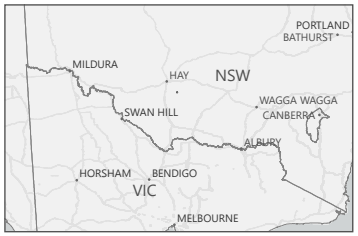
C:\Users\RachelMeberson\UMWELT (AUSTRALIA) PTY. LTD\2210 - 03 SWVF R04 - Amended BDAR\02_Projects\2210_R34_AmendedBDAR_Ch5_v2.aprx - 2210_R34_0529_SpeciesPolygon_LepidiumMonoplocoides

FIGURE 5.29.4

Species Polygon
Lepidium monoplocoides

Legend

- Stage 1 (South) Development Footprint
- Road
- Watercourse



0 20 40

Meters

Scale 1:2,000 at A4

GDA2020 MGA Zone 55

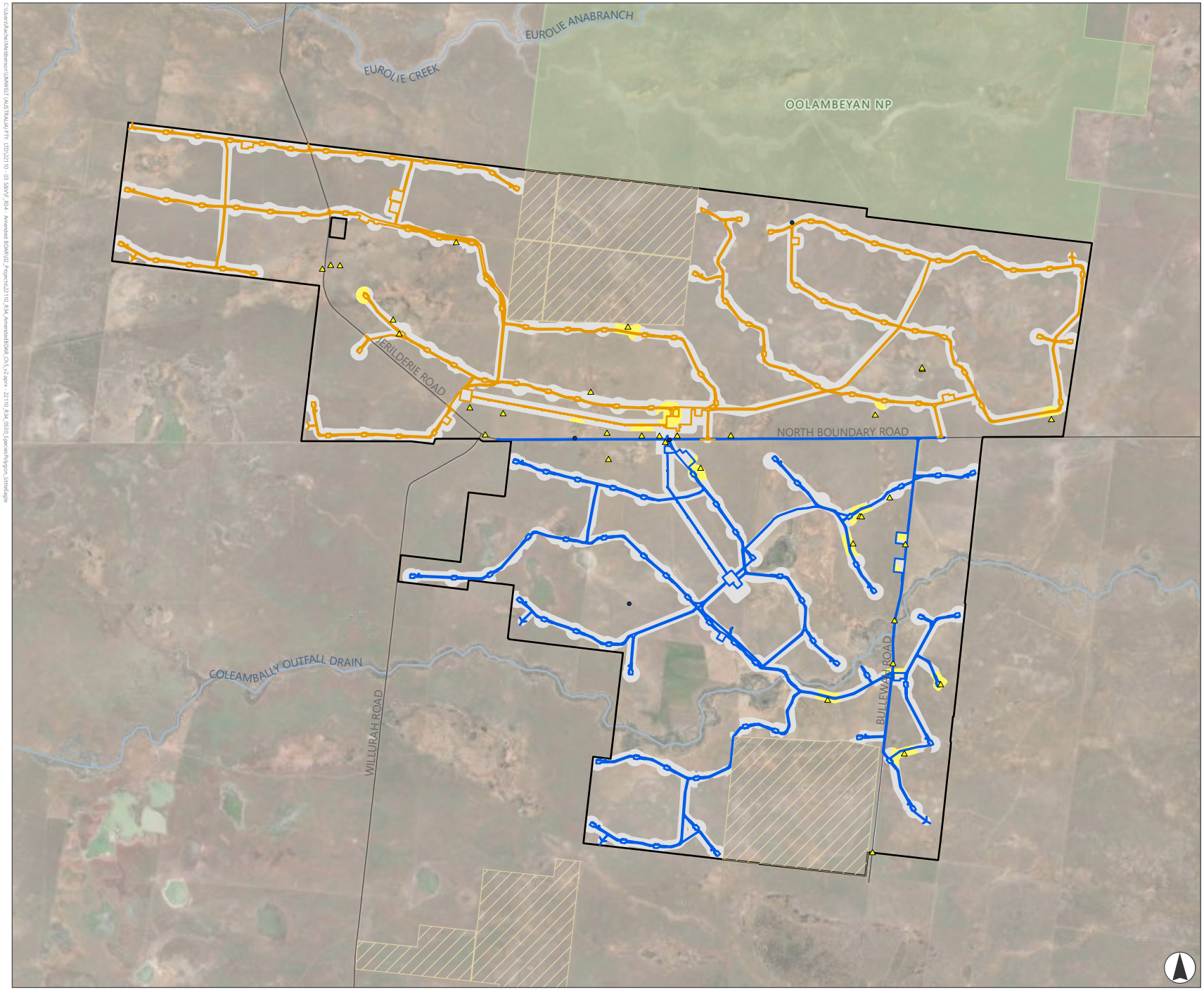
This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

C:\Users\RachelMeibersen\UMWELT (AUSTRALIA) PTY. LTD\2210 - 03 SWVF R04 - Amended BDAR\02_Projects\22110_R34_AmendedBDAR_Ch5_v2.aprx - 22110_R34_0529_SpeciesPolygon_LepidiumMonoplocoides

FIGURE 5.30.1

Species Polygon
Little Eagle

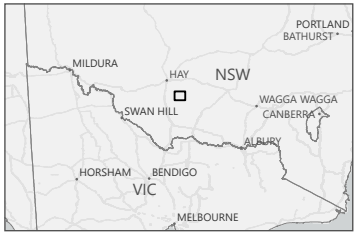


Legend

- Project Boundary
- Subject Land
- Stage 1 (South) Development Footprint
- Stage 2 (North) Development Footprint
- NPWS Reserves
- Conservation Agreement Area
- Road
- Watercourse
- Stick Nest Locations

Threatened Species Records

- Little Eagle
- Little Eagle Species Polygon



0 1,000 2,000

Meters

Scale 1:122,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

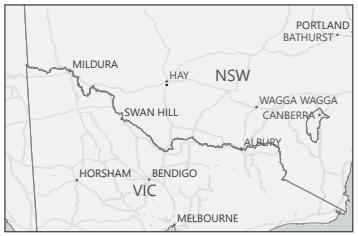
Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

FIGURE 5.30.2

Species Polygon
Little Eagle

Legend

- Stage 1 (South) Development Footprint
- Road



0 20 40

Meters

Scale 1:2,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

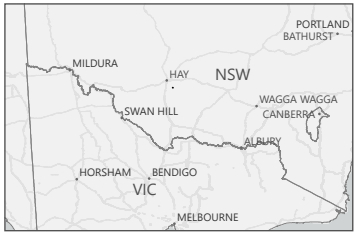
C:\Users\RachelMeiberson\UMWELT (AUSTRALIA) PTY. LTD\22110 - 03 S6IVF R4 - Amended BDAR\02_Projects\22110_R34_AmendedBDAR_Ch5_v2.aprx - 22110_R34_0530_SpeciesPolygon_LittleEagle

FIGURE 5.30.3

Species Polygon
Little Eagle

Legend

- Stage 1 (South) Development Footprint
- Road



0 20 40

Meters

Scale 1:2,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

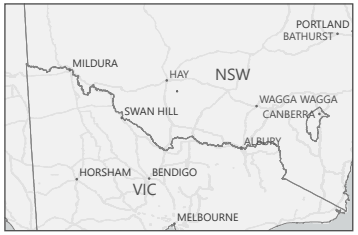
C:\Users\RachelMeberson\UMWELT (AUSTRALIA) PTY. LTD\2210 - 03 SWVF R04 - Amended BDAR\02_Projects\2210_R34_AmendedBDAR_Ch5_v2.aprx - 2210_R34_0530_SpeciesPolygon_Littleeagle

FIGURE 5.30.4

Species Polygon
Little Eagle

Legend

- Stage 1 (South) Development Footprint
- Road
- Watercourse



0 20 40

Meters

Scale 1:2,000 at A4

GDA2020 MGA Zone 55

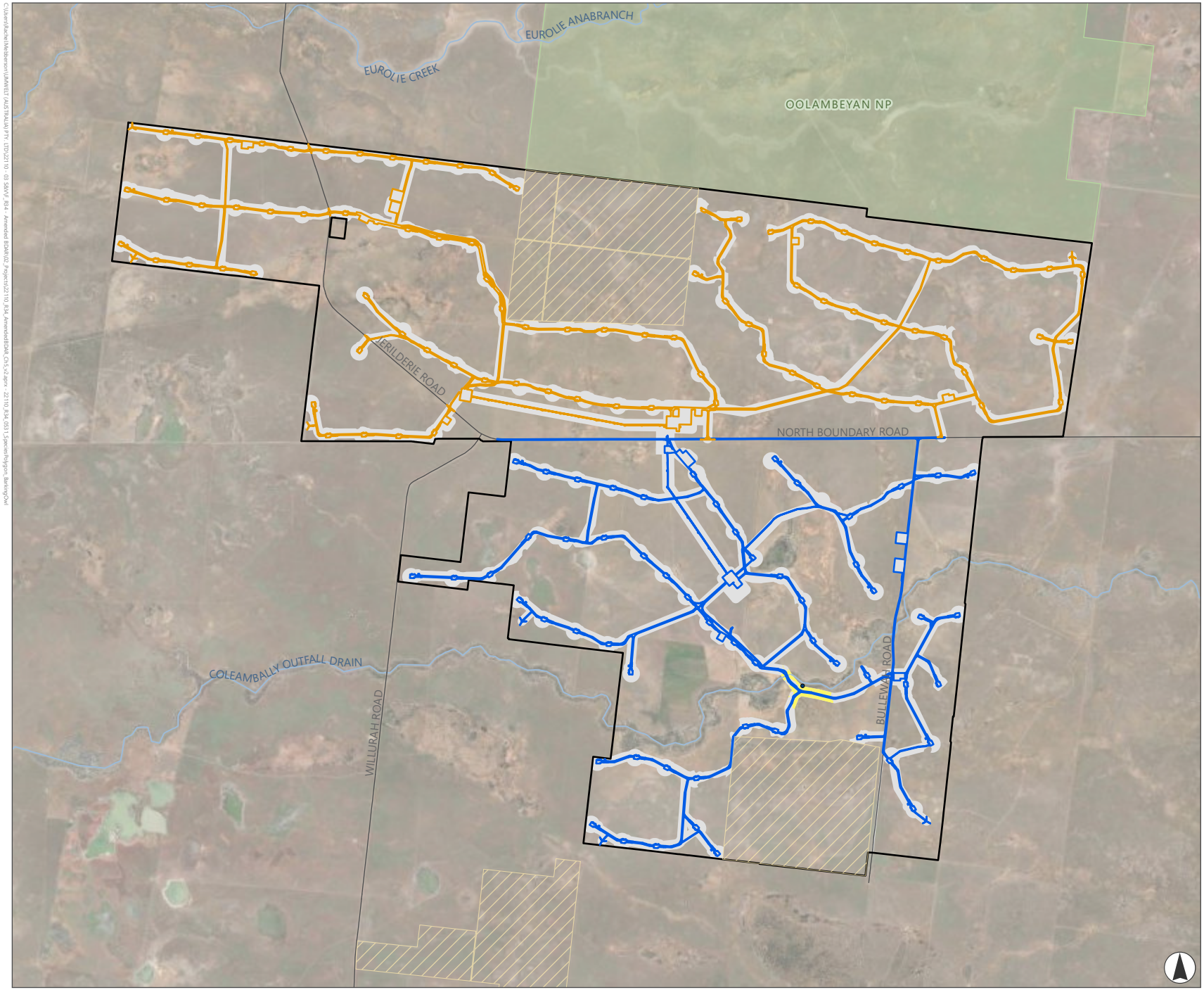
This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

C:\Users\RachelMeiberson\UMWELT (AUSTRALIA) PTY. LTD\2210 - 03 S86VF R44 - Amended BDAR\02_Projects\2210_R34_AmendedBDAR_Ch5_v2.aprx - 2210_R34_0530_SpeciesPolygon_Littleeagle

FIGURE 5.31.1

Species Polygon
Barking Owl

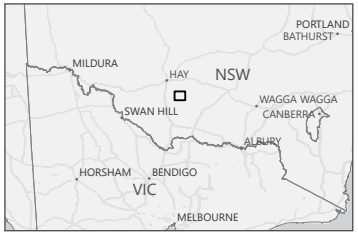


Legend

- Project Boundary
- Stage 1 (South) Development Footprint
- Stage 2 (North) Development Footprint
- Subject Land
- NPWS Reserves
- Conservation Agreement Area
- Road
- Watercourse

Threatened Species Records

- Barking Owl
- Barking Owl Species Polygon



0 1,000 2,000

Meters

Scale 1:122,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

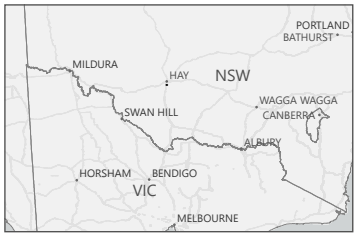
Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

FIGURE 5.31.2

Species Polygon
Barking Owl

Legend

- Stage 1 (South) Development Footprint
- Road



0 20 40

Meters

Scale 1:2,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

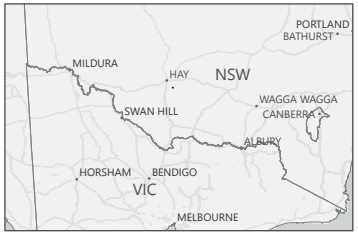
C:\Users\RachelMeiberan\UMWELT (AUSTRALIA) PTY. LTD\22110 - 03 S6IVF R4 - Amended BDAR\02_Projects\22110_R34_AmendedBDAR_Ch5_v2.aprx - 22110_R34_053_SpeciesPolygon_BarkingOwl

FIGURE 5.31.3

Species Polygon
Barking Owl

Legend

- Stage 1 (South) Development Footprint
- Road



0 20 40

Meters

Scale 1:2,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

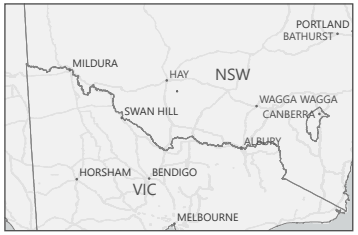
C:\Users\RachelMeberson\UMWELT (AUSTRALIA) PTY. LTD\22110 - 03 S86VF R44 - Amended BDAR\02_Projects\22110_R34_AmendedBDAR_Ch5_v2.aprx - 22110_R34_053_SpeciesPolygon_BarkingOwl

FIGURE 5.31.4

Species Polygon
Barking Owl

Legend

- Stage 1 (South) Development Footprint
- Road
- Watercourse



0 20 40

Meters

Scale 1:2,000 at A4

GDA2020 MGA Zone 55

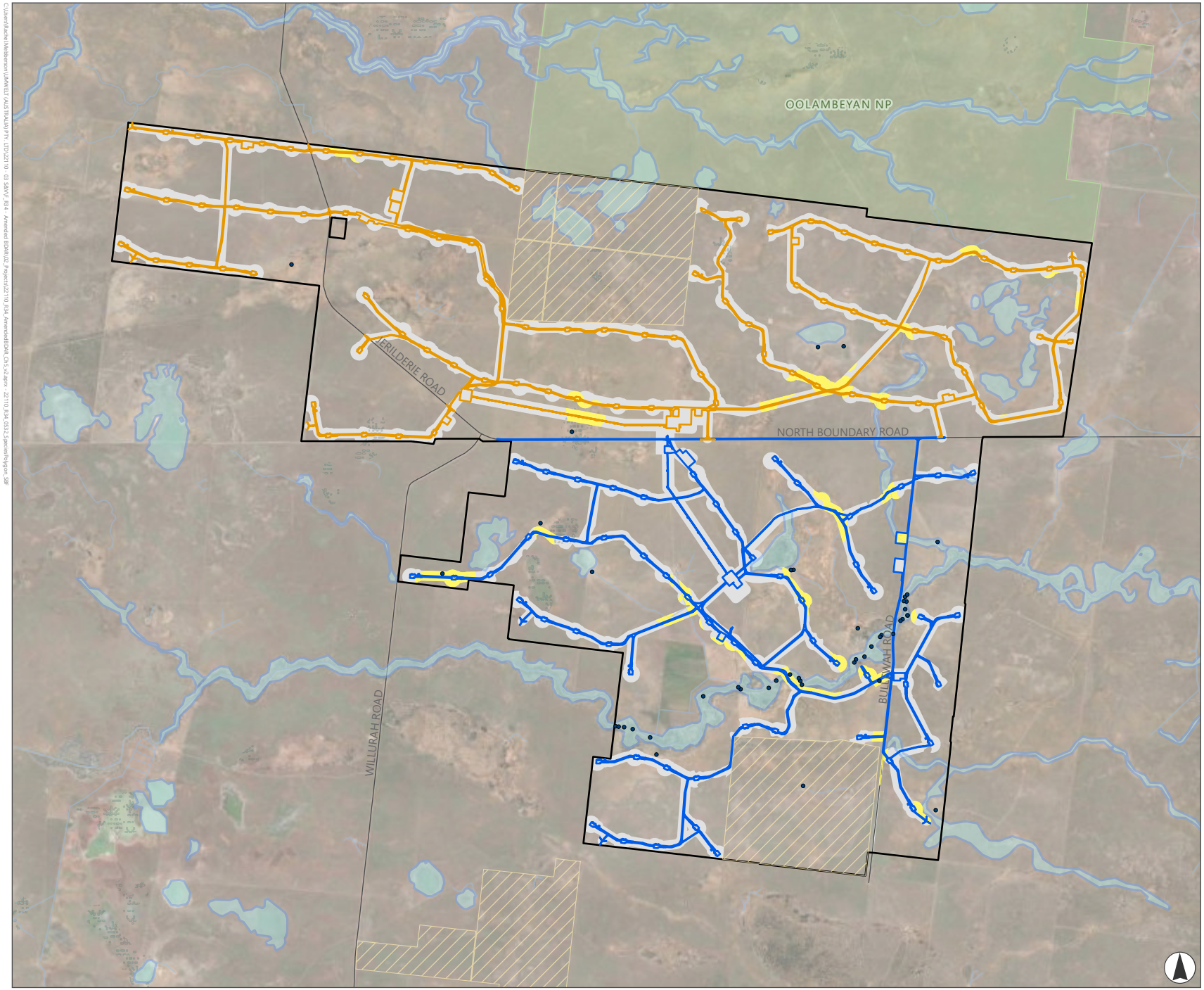
This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

C:\Users\RachelMeiberson\UMWELT (AUSTRALIA) PTY. LTD\2210 - 03 S86VF R44 - Amended BDAR\02_Projects\2210_R34_AmendedBDAR_Ch5_v2.aprx - 2210_R34_053_SpeciesPolygon_BarkingOwl

FIGURE 5.32.1

Species Polygon
Southern Bell Frog

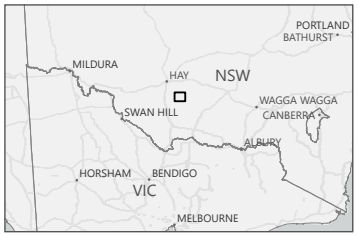


Legend

- Project Boundary
- Stage 1 (South) Development Footprint
- Stage 2 (North) Development Footprint
- Subject Land
- NPWS Reserves
- Conservation Agreement Area
- Road
- Watercourse
- Waterbodies
- Swamps

Threatened Species Records

- Southern Bell Frog
- Southern Bell Frog Species Polygon



0 1,000 2,000

Meters

Scale 1:122,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

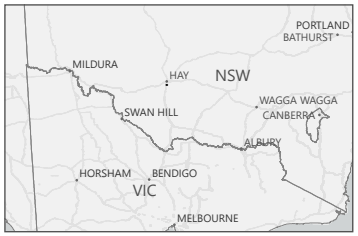
Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

FIGURE 5.32.2

Species Polygon
Southern Bell Frog

Legend

- Stage 1 (South) Development Footprint
- Road



0 20 40

Meters

Scale 1:2,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

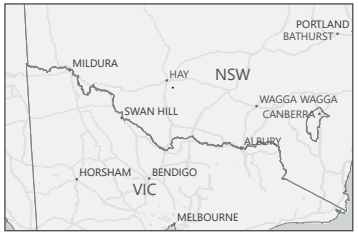
C:\Users\RachelMeberson\UMWELT (AUSTRALIA) PTY. LTD\2210 - 03 SWVF R04 - Amended BDAR\02_Projects\2210_R34_AmendedBDAR_Ch5_v2.aprx - 2210_R34_0532_SpeciesPolygon_SBF

FIGURE 5.32.3

Species Polygon
Southern Bell Frog

Legend

- Stage 1 (South) Development Footprint
- Road



0 20 40

Meters

Scale 1:2,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

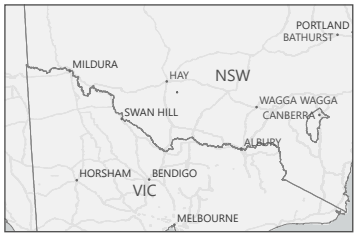
C:\Users\RachelMeberson\UMWELT (AUSTRALIA) PTY. LTD\2210 - 03 SWVF R04 - Amended BDAR\02_Projects\2210_R34_AmendedBDAR_Ch5_v2.aprx - 2210_R34_0532_SpeciesPolygon_SBF

FIGURE 5.32.4

Species Polygon
Southern Bell Frog

Legend

- Stage 1 (South) Development Footprint
- Road
- Watercourse



0 20 40

Meters

Scale 1:2,000 at A4

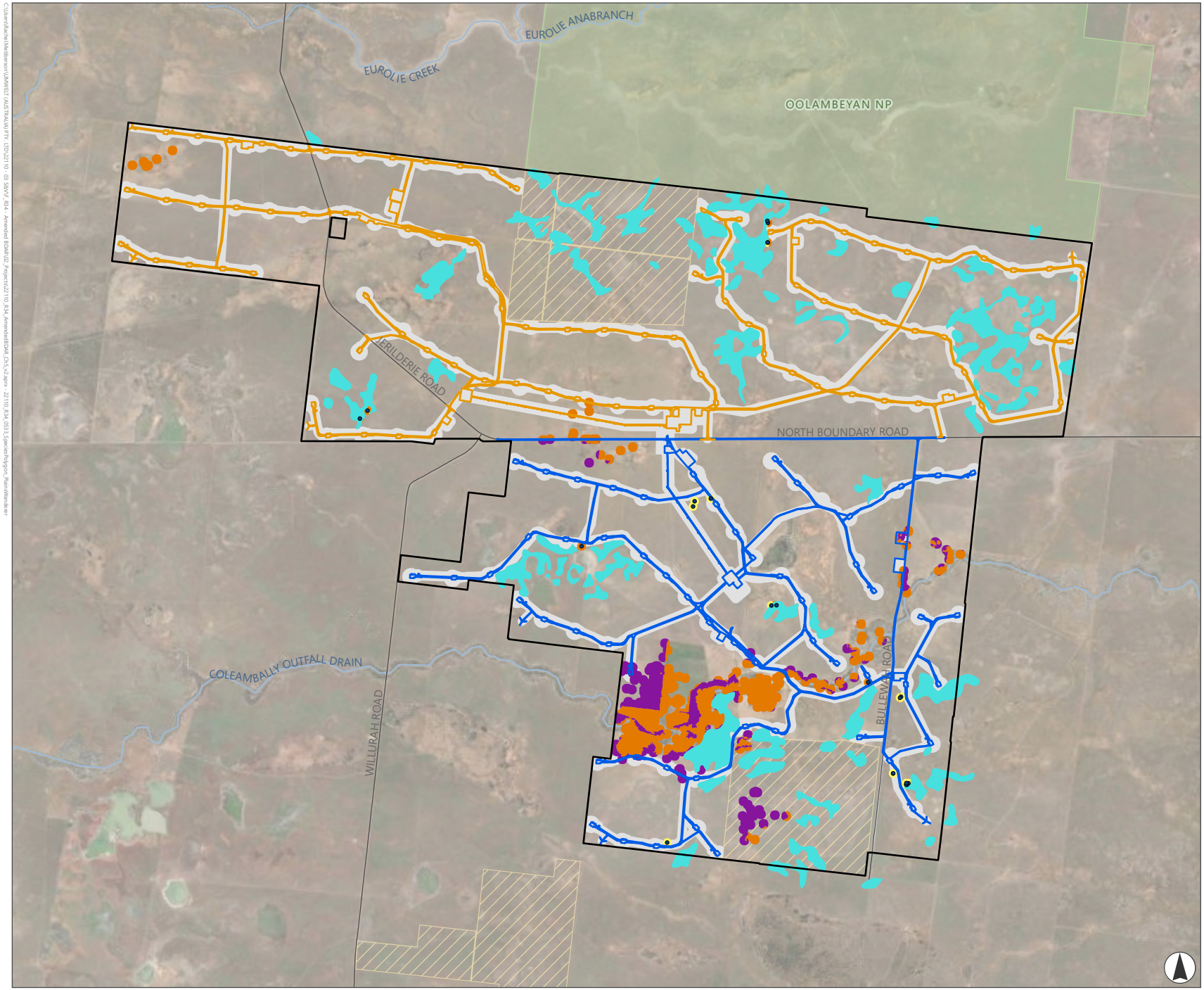
GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

FIGURE 5.33

Supplementary Habitat Plains-Wanderer



Legend

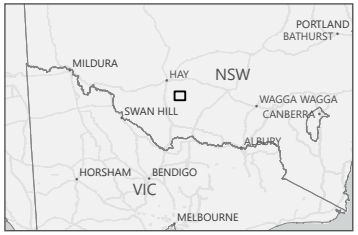
- Project Boundary
- Subject Land
- Stage 1 (South) Development Footprint
- Stage 2 (North) Development Footprint
- NPWS Reserves
- Conservation Agreement Area
- Road
- Watercourse
- Plains-Wanderer Important Habitat

Plains-Wanderer Supplementary Habitat

- Associated PCTs (100m buffer on Umwelt records)
- Non-Associated PCTs derived from Spatial Analysis Areas
- Overlap of Associated PCTs and Spatial Analysis Areas

Threatened Species Records

- Plains-Wanderer



0 1,000 2,000

Meters

Scale 1:122,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

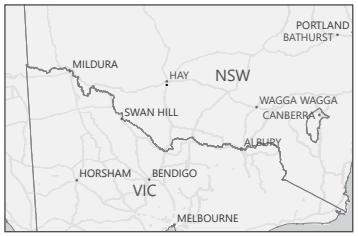
Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

FIGURE 5.33

Supplementary Habitat Plains-Wanderer

Legend

- Stage 1 (South) Development Footprint
- Road



0 20 40

Meters

Scale 1:2,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

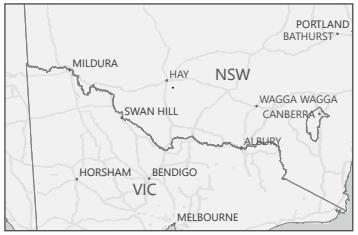
C:\Users\RachelMeiberson\UMWELT (AUSTRALIA) PTY. LTD\22110 - 03 SWVF R04 - Amended BDAR\02_Projects\22110_R34_AmendedBDAR_Ch5_v2.aprx - 22110_R34_053_SpeciesPolygon_PlainsWanderer

FIGURE 5.33

Supplementary Habitat Plains-Wanderer

Legend

- Stage 1 (South) Development Footprint
- Road



0 20 40

Meters

Scale 1:2,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

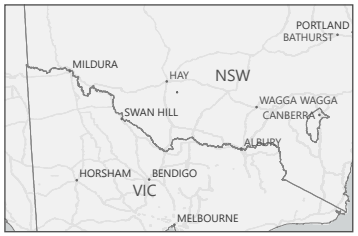
C:\Users\RachelMeiberg\on\UMWELT (AUSTRALIA) PTY. LTD\22110 - 03 SWVF R04 - Amended BDAR\02_Projects\22110_R34_AmendedBDAR_Ch5_v2.aprx - 22110_R34_053_SpeciesPolygon_PlainsWanderer

FIGURE 5.33

Supplementary Habitat Plains-Wanderer

Legend

- Stage 1 (South) Development Footprint
- Road
- Watercourse



0 20 40

Meters

Scale 1:2,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

5.5 Aquatic Habitat and Threatened Species

Potential impacts on the biodiversity values of aquatic habitat occurring within the Subject Land and known or potential aquatic vegetation occurring were assessed in accordance with the NSW *Fisheries Management Act 1994* (FM Act).

5.5.1 Habitat Assessment

A desktop review of the following resources was undertaken to determine threatened species presence, current conditions on the aquatic and riparian ecosystems within the Subject Land, and to understand constraints and pressures associated with the project. A combination of spatial data and database searches were reviewed which included:

- Water Management (General) Regulation 2018 Hydro Line spatial data – to determine Strahler stream order.
- NSW Key Fish Habitat Mapping.
- Freshwater threatened species distribution.
- BioNet – the Atlas of Wildlife.
- MNES Protected Matters Search Tool.
- Species Profile and Threats Database (SPRAT).
- Freshwater Fish Community Status.
- SVTM Vegetation.
- Umwelt Vegetation Mapping.

5.5.2 Threatened Species

Two threatened aquatic species listed under the FM Act were identified as having the potential to occur within the aquatic habitat within the Subject Land. One threatened aquatic species listed under the EPBC Act was identified as having the potential to occur within the aquatic habitat within the Subject Land (**Table 5.53**). The likelihood of their occurrence within the Subject Land is presented in **Table 5.53.**

No endangered populations were identified as potentially occurring within the Subject Land.

Table 5.53 Threatened Aquatic Species and their Likelihood of Occurrence within the Subject Land

Common Name (*Scientific name*)	BC	EPBC	Distribution and habitat	Likelihood of Occurrence	Further Assessment Required?
Flathead Galaxias ***Galaxias rostratus***	CE	CE	Mapped habitat on Fisheries spatial portal through Coleambally drain. Species is considered regionally extinct from the area, with the last confirmed record occurring in 1971 (DPI 2008). The species is threatened by degradation of habitat, loss of aquatic vegetation, predatory fish species, construction of weirs and dams and agricultural pollution, all of which impact on the Coleambally Outfall Drain.	Moderate	Assessment of Significance (AoS) undertaken in **Appendix F**
Silver Perch ***Bidyanus bidyanus***	V	CE	Mapped potential habitat on Fisheries spatial portal occurs throughout Coleambally Outfall Drain. Silver Perch have been found in a wide range of habitats and climates across the Murray-Darling Basin. They are generally found in faster-flowing water including rapids and races and more open sections of river. Spawning and recruitment success are both considered to be heavily dependent on high flows and overbank flooding. Silver perch, like many other native fish, need to be able to move freely between different areas for feeding, dispersal, and reproduction.	Moderate	Assessment of Significance (AoS) undertaken in **Appendix F**
Murray Cod	-	V	Species flagged in PMST search of the area (refer to **Appendix E**). The Murray Cod has a broad but patchy distribution across much of NSW, including along the Murrumbidgee River between Wagga Wagga to Hay. The species is strongly associated with structurally complex waterways at all life history stages (Department of the Environment, 2016). The Coleambally Outfall Drain is a highly managed watercourse, and vegetation or debris which occurs along the waterway is removed to ensure irrigation is not disrupted. It is unlikely that this waterway would provide the structural complexity required to sustain a population of Murray Cod.	Low	No further assessment required

5.5.3 Endangered Ecological Communities

A single Endangered ecological community listed under the FM Act was identified to have the potential of occurring within the Subject Land:

- Lower Murray River aquatic ecological community.

This EEC occurs along a number of rivers, creeks and their tributaries in Southwest NSW, including the Murrumbidgee River below Burrinjuck Dam. Artificial canals, water distribution and drainage works are excluded from the aquatic ecological community (DPI 2007).

As the only consistent waterway which occurs onsite is the Coleambally Outfall Drain, which is an artificial irrigation canal, the Lower Murray River aquatic ecological community is not considered to be impacted by the Project. No further assessment is required.

5.5.4 Aquatic Results

Coleambally Outfall Drain is a ninth order steam which runs for approximately 11 km east to west along the Project Area. It intersects with a total of 280 m of the Subject Land in two locations. Coleambally Outfall Drain is an irrigation canal supplying water sourced from the Murrumbidgee to 300,000 ha of agricultural land. It is highly regulated and has levees along its length to control and deliver water orders to its members, meaning that water flow within the Subject Land may be reduced or restricted for periods of time. The banks of the canal are predominantly clear of vegetation, with small areas exhibiting both native and exotic vegetative regrowth, and the canal itself is regularly maintained to ensure vegetation and sedimentation do not hinder water flow. During targeted surveys for species surrounding the drain, the water was observed to be turbid, as shown in **Photo 5.6**. The Freshwater Fish Community Status of this waterway was identified to be poor, and it has not been identified to be Key Fish Habitat within the Murray Darling South Basin. The invasive Mosquito Fish (*Gambusia holbrookii*) and European Carp (*Cyprinus carpio*) were both seen within the drain during surveys, as well as a number of native Rakali (*Hydromys chrysogaster*).

Two unnamed first order tributaries of Eurolie Creek intersect with approximately 400 m of the north-east and north-west corners of the Subject Land, however these waterways are highly ephemeral and occur across areas of mapped grassland. These tributaries are highly unlikely to provide any habitat for aquatic species. One of the three offsite disturbance areas assessed (associated with the Stage 1 – site-based assessment) occurs approximately 350 m north of Eurolie Creek. This creekline is ephemeral and may provide marginal suitable habitat for aquatic species. Nyangay and Abercrombie Creek are located approximately 10 km north east of the Subject Land.

Two bridge upgrades over the Coleambally Outfall Drain will potentially occur in the first stages of construction, pending weight limit assessments; one on Bullawah Road (**Photo 5.7**), and one on an unnamed road within one of the private properties (**Photo 5.8**). There is currently no design work for these upgrades, however, two options have been proposed. The upgrades will either involve strengthening the bridge by underpinning or building additional piers which would require excavation or drilling; or building an additional temporary road alongside the bridge to take the abnormal loads. No blasting or directional drilling will occur as a result of construction. All works will take place within the current development corridor. The drain is continually subject to disturbance as a result of surround land use; therefore it is unlikely that these works would have a significant impact on any aquatic species which may occur within the drain.

The riparian vegetation occurring directly along the areas where the canal and the Subject Land intersect has been mapped as Non-native Vegetation, and the Vegetation Beyond that has been mapped as PCT10 - River Red Gum - Black Box woodland wetland of the semi-arid (warm) climatic zone (mainly Riverina Bioregion and Murray Darling Depression Bioregion)(see **Section 4.2** for more information). A maximum of approximately 2 ha of riparian vegetation is proposed to be removed to allow for the bridge upgrade and preceding road construction.

Two species of threatened fish were identified as having a moderate likelihood of occurring within the development corridor; silver perch (*Bidyanus bidyanus*), and flathead galaxias (*Galaxias rostratus*), due to there being mapped potential habitat within the Coleambally Outfall Drain on the Fisheries Spatial Portal (see **Table 5.53**). No record of either of these species occurs within 30 km of the channel, and these species were not identified incidentally during other surveys along the drain. No targeted surveys were undertaken for either of these species, therefore an Assessment of Significance has been completed for both (see **Appendix F**).

Photo 5.6 Coleambally Outfall Drain

Photo 5.7 Current Bullawah Road Bridge Spanning Coleambally Outfall Drain

Photo 5.8 Current Unnamed Road Bridge Spanning Coleambally Outfall Drain

6.0 Identification of Prescribed Impacts

Prescribed impacts which are predicted to occur as a result of the proposed development are documented in **Table 6.1**. Further assessment of the prescribed impacts of the Project are included in **Section 8.3** and **Appendix D**.

Table 6.1 Prescribed Impacts Identified

Feature	Present	Description of feature characteristics and location	Threatened entities that use, are likely to use, or are part of the habitat feature. Where relevant, threatened species or fauna that are part of a TEC or EC
Karst, caves, crevices, cliffs, rocks or other geological features of significance	☐ Yes ☒ No	There are no karst, caves, crevices, cliffs, rocks or other geological features of significance within the Subject Land. There are no areas of rock piles, rock outcropping or surface rock within the subject area.	Based on the results of completed surveys, no such features have been identified, therefore there will be no known threatened entities using the characteristic features.
Human-made structures	☒ Yes ☐ No	There are two concrete bridges spanning the Coleambally Outfall Drain which are proposed to be upgraded. There is currently no design work for these upgrades, however, two options have been proposed. The upgrades will either involve strengthening the bridge by underpinning or building additional piers which would require excavation or drilling; or building an additional temporary road alongside the bridge to take the abnormal loads.	Based on the outcomes of completed surveys, it is considered unlikely that threatened entities would use any of the human-made structures that will be removed or modified by the Project. Human-made structures may be used for roosting by a number of microbat species, including: *Chalinolobus gouldii*, *Chalinolobus morio*, *Nyctophilus* spp., *Ozimops petersi*, *Ozimops planiceps*, *Saccolaimus flaviventris*, *Scotorepens balstoni*, *Scotorepens greyii*, *Vespadelus darlingtoni*, *Vespadelus regulus, Vespadelus vulturnus, and Myotis macropus*.
Non-native vegetation	☒ Yes ☐ No	The non-native vegetation has been attributed to Category 1 - Exempt Land. The Non-native vegetation consists of agricultural grazing land, or the cleared banks of the Coleambally Outfall Drain.	A number of the raptor species (e.g. Black Falcon, Spotted Harrier, Little Eagle) observed during field surveys which may forage within agricultural grazing land on occasion, but this area represents a very small proportion of available habitat. Southern Bell Frogs may move through areas of non-native vegetation as they move between suitable breeding habitats, especially during periods of rainfall when low-lying areas become inundated and facilitate dispersal.

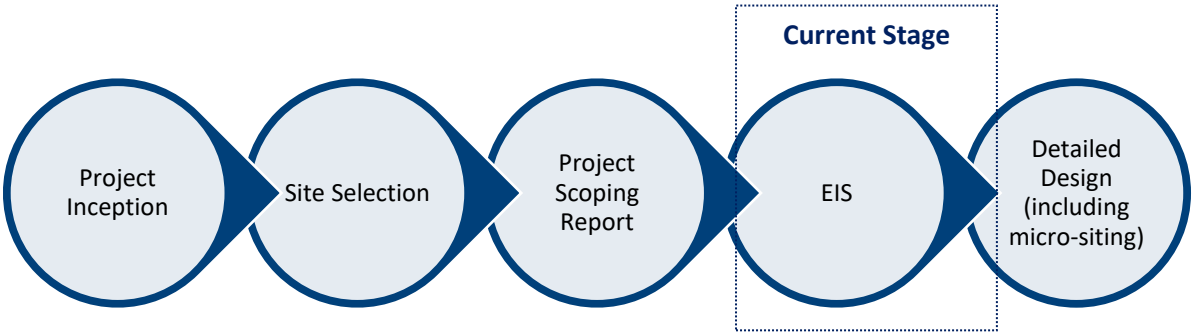
Feature	Present	Description of feature characteristics and location	Threatened entities that use, are likely to use, or are part of the habitat feature. Where relevant, threatened species or fauna that are part of a TEC or EC
Habitat connectivity	☒ Yes ☐ No	There will be clearing of native vegetation, this will predominantly be areas of native grassland, derived native grassland, and native shrubland. An area of approximately 1.8 ha of woodland will also be cleared.	The majority of the threatened fauna recorded during field surveys are highly mobile species, capable of flying over the areas proposed for development. Habitat connectivity is limited to grassland and shrubland dependent species that do not require trees for movement, as woodland connectivity is limited with fragmented and isolated woodland patches dispersed across the Subject Site. Threatened bird species that could use scrubland habitat connectivity include Southern Whiteface, White-fronted Chat, Flame Robin, Diamond Firetail, Blue-winged Parrot, Grey-crowned Babbler. In addition to threatened bird species, threatened microbats species such as Yellow-bellied Sheathtail-bat, Little Pied Bat, Inland Forest Bat may also use this habitat. However, it is unlikely that these species would rely on habitat connectivity in the Project Area as they are highly mobile species that will also utilise the retained areas of connectivity across the Project Area. The Project may impact the movement of the two-ground dwelling threatened fauna species, Plains-wanderer and Southern Bell Frog, across the site. Impacts on the Plains-wanderer may include to isolation of important habitat and areas subject to BCT conservation agreements within the study area. The Project may also reduce connectivity between the study area Oolambeyan National Park. These issues are elaborated upon in Section 8.3.2. Impacts to Southern Bell Frog may include isolation of waterbodies that may provide suitable breeding and non-breeding habitat.
Waterbodies, water quality and hydrological processes	☒ Yes ☒ No	Coleambally Outfall Drain and a number of ephemeral first order streams will be impacted by the Project. A number of areas of ephemeral fresh water wetland will also be impacted. Sediment mobilisation and deposition, particularly during the construction	Southern Bell Frog was recorded utilising a number of waterbodies within the Subject Land. Migratory birds predicted to occur within the Subject Land may utilise the freshwater wetlands, creeklines, and dams within the Subject Land on occasion.

Feature	Present	Description of feature characteristics and location	Threatened entities that use, are likely to use, or are part of the habitat feature. Where relevant, threatened species or fauna that are part of a TEC or EC
		phase, may alter the characteristics of ephemeral wetlands and farm dams.	Potential foraging and roosting habitat (two bridges over Coleambally Outfall Drain and numerous hollow-bearing trees) for the Southern Myotis occurs along the Coleambally Outfall Drain and nearby farm dams. Despite this, targeted surveys using active detection failed to detect the Southern Myotis. It is unlikely that the Southern Myotis occurs in the study area. The Plains-wanderer does not use wetland habitat. However, the study area is very flat and therefore, small variations in elevation and slope affect landscape drainage patterns. Thus, hydrological processes affect the distribution of various habitat types, including those used by the Plains-wanderer.
Wind turbine strikes (wind farm development only)	☒ Yes ☐ No	143 wind turbines and the associated infrastructure are proposed for construction throughout the Subject Land. These would have various direct and indirect impacts to protected fauna species.	Refer to **Section 8.3.4** and **Appendix D**.
Vehicle strikes	☒ Yes ☐ No	Vehicle movements would be on access tracks throughout the Development Footprint and would utilise existing access tracks where possible. Public roads would be used to transport machinery, materials and components to the Development Footprint.	A low speed limit would be enforced for vehicles traveling to and through the Project Area. Even so, there is still a chance of vehicle strike for the Southern Bell Frog and Plains-wanderer during construction when traffic volumes are high and machinery is in operation. The propensity of the well-camouflaged Plains-wanderer to freeze when disturbed makes it vulnerable to strike by vehicles and other machinery as it is difficult to detect. Raptors that feed on carrion (e.g. Little Eagle) are at risk of vehicle strike on public roads used for site access. The Southern Bell Frog is particularly at risk during wet periods when breeding activity occurs and when individuals are more likely to disperse among the landscape.

7.0 Avoid and Minimise Impacts

7.1 Avoidance and Minimisation of Direct and Indirect Impacts on Native Vegetation, Threatened Species, Threatened Ecological Communities and Their Habitat

This section describes the efforts made to avoid and minimise impacts to biodiversity in accordance with Chapter 7 of the BAM. Biodiversity impacts have been avoided and minimised through iterative refinements to the Project Area and Development Footprint, in response to key site constraints and feedback from key stakeholders. Consideration of the adjacent Oolambeyan National Park being an aspect contemplated during this iterative process. The key stages are set out below.



At each stage of the design process, from Project inception, through Project Scoping and the development of the BDAR (and broader EIS), BWF has applied the following hierarchy (in order of priority):

- **Avoid** – in the first instance, all efforts were made to avoid potential environmental, cultural and social impacts.
- **Minimise** – where potential impacts could not be avoided, design principles sought to minimise impacts, as far as reasonably practicable.
- **Mitigate** – mitigation strategies have been identified and will be implemented to manage the extent and severity of the remaining impacts, refer to **Section 8.7.1**.
- **Offset** – biodiversity offsets are only used following all efforts to first avoid, minimise and mitigate impacts, refer to **Section 12.0**.

7.1.1 Overview of Refinements

From the Scoping Report (October 2022) to the present, the Project Area, Development Corridor and Development Footprint have reduced in size to respond to the emerging understanding of site-specific biodiversity constraints and to prioritise the avoidance of impacts on potential serious and irreversible impact entities.

In summary:

- The Project Area has been reduced by 9,976 ha from the Scoping Report (~30,603 ha) to present day (20,627.56 ha). This represents a 32% reduction in total Project Area.
- The Development Corridor has been reduced by 1,490.9 ha from the Scoping Report (where it covered 5,802.8 ha of the Project Area) to present day (4,330.41 ha). This represents a 25% reduction in the total area considered for the placement of WTG and associated infrastructure.
- Importantly, the Development Footprint has been reduced by 351 ha from the Scoping Report (where it covered 1,012.6 ha of the Project Area) to present day (660.96 ha). This represents a 34% reduction in developable area to prioritise retention of ecological values.

Table 7.1 shows how avoidance to biodiversity values has occurred across design iterations based on current PCT mapping, the SVTM, and Important Habitat Mapping. **Figure 7.1** below provides a summary view of the evolution of the Project layout over time.

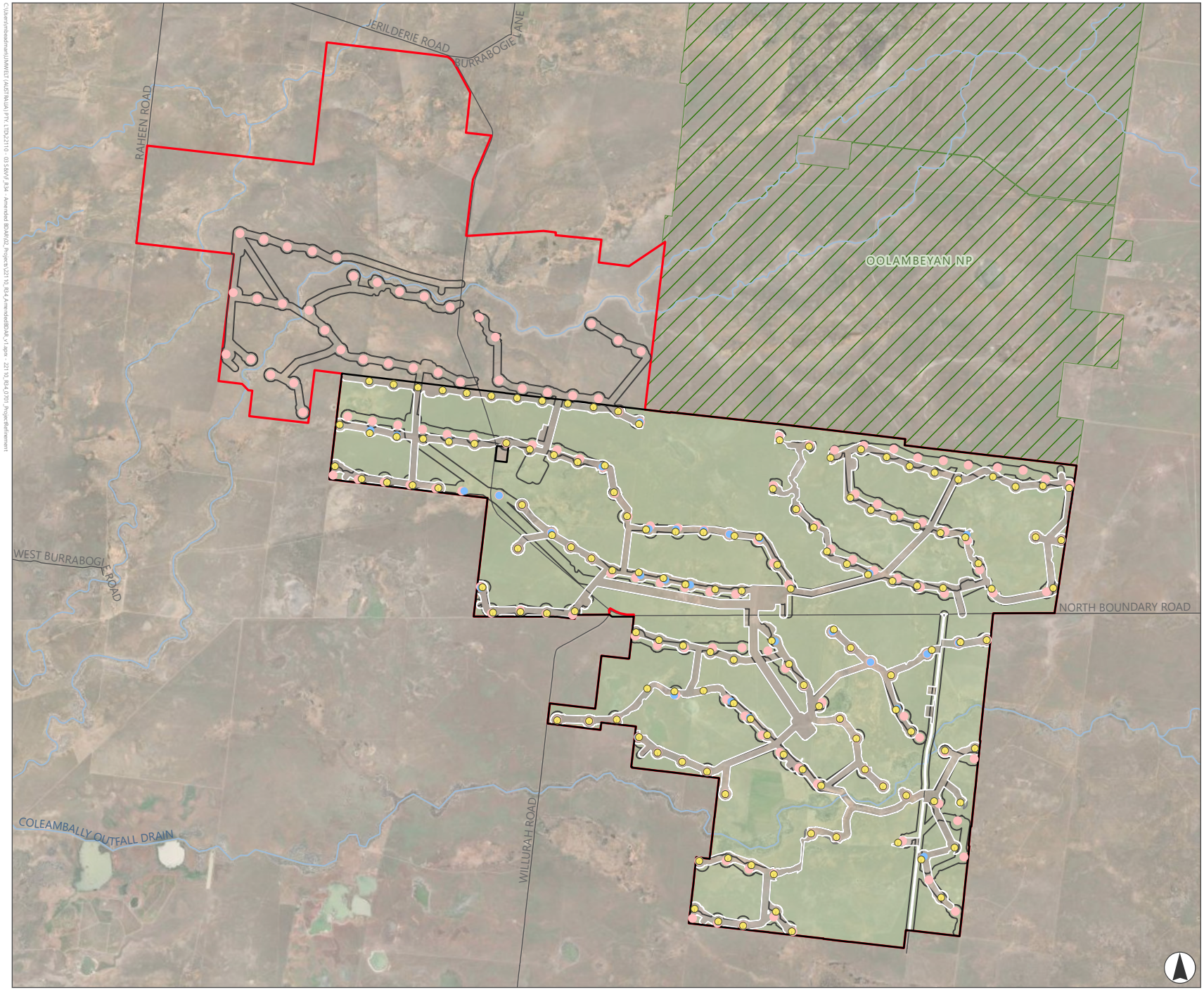
Table 7.1 Changes in impacts to high priority constraints as a result of Project design changes

High Priority Constraint	Total Area Impacted (ha) - Early Scoping		Total Area Impacted (ha) - Scoping		Total Area Impacted (ha) – Early EIS		EIS/Amendment Report	
	Subject Land	Disturbance Footprint	Subject Land	Disturbance Footprint	Subject Land	Disturbance Footprint	Subject Land	Disturbance Footprint
Important Habitat								
Plains-wanderer Important Habitat	68.62	0.01	4.24	0.01	5.76	0.62	0.00	0.00
Plains-wanderer supplementary habitat[1]	n/a	n/a	n/a	n/a	n/a	n/a	94.99	20.89
TECs listed under the BC Act								
Myall Woodland	139.87	20.73	137.22	20.73	114.74	22.80	114.74	22.80
Sandhill Pine Woodland	810.23	136.60	778.07	136.60	484.76	59.70	484.75	59.70
TECs listed under the EPBC Act								
Weeping Myall Woodland	51.41	6.78	51.31	6.78	42.56	4.92	42.56	4.921
Other								
Native vegetation	6020.40	998.93	4279.63	998.93	4279.63	638.14	4273.87	638.01

[1] Impacts presented for Plains-wanderer are based on the assessment of supplementary habitat, it does not include any impacts to NSW identified Important Habitat Mapping as all of that critical species habitat mapping was avoided by the Project.

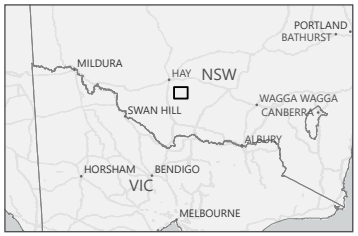
FIGURE 7.1

Project Refinement



Legend

- EIS Project Boundary
- Scoping Report Project Boundary
- EIS Development Corridor
- Early EIS Development Corridor
- Scoping Report Development Corridor
- EIS Wind Turbine Generators
- Early EIS Wind Turbine Generators
- Scoping Report Wind Turbine Generators
- Impact Avoidance Area
- NPWS Reserves
- Road
- Hydroline



0 2.5 5

Kilometres

Scale 1:160,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

C:\Users\mbeadman\UMWELT (AUSTRALIA) PTY LTD\22110 - 03.5KMY..R34 - Amended BDAR\02. Projects\22110_R34_AmendedBDAR_v1.aprx - 22110_R34_0701 - ProjectRefinement

7.1.2 Project Location

The Project location was selected based on a range of factors primarily relating to suitability of the location for wind energy generation, specifically:

- Its strategic position within the South West REZ.
- The reliability of the wind resource.
- The low density of potentially affected residences within the surrounding area.
- Proximity to existing and approved transmission infrastructure and the existing road network.
- Ability to provide grid connections to both the existing Transgrid 220 kV transmission line which runs through the Project Area (i.e. Stage 1) and the 330 kV Eastern Section of Project EnergyConnect, which is now under construction and which will also run through the Project Area in an east to west direction (i.e. Stage 2).
- Mostly supportive or neutral attitudes towards the Project from potentially affected landholders.
- The Project Area has suitable terrain as it is generally flat, with some minor undulation in the landscape.
- The total Project Area is 20,627.56 ha and the associated Development Corridor is approximately 4,330 ha, well beyond the size of the Development Footprint and providing flexibility in the design to prioritise avoidance of high value biodiversity areas.

7.1.3 Project Design and Planning

Following lodgement of the Scoping Report and EPBC Act referral, further environmental and social impact assessments and community consultation activities occurred. As a result, BWF developed the design, a 660.96 ha Development Footprint, to the area subject to this BDAR based on several factors, the following being those relevant to biodiversity as discussed in **Table 7.2**. The biodiversity which has been avoided as a result of changes to design between the Scoping and EIS are shown in **Figure 7.2**, **Figure 7.3** and **Figure 7.4**.

Table 7.2 Design Refinements that have Avoided and/or Minimised Impacts

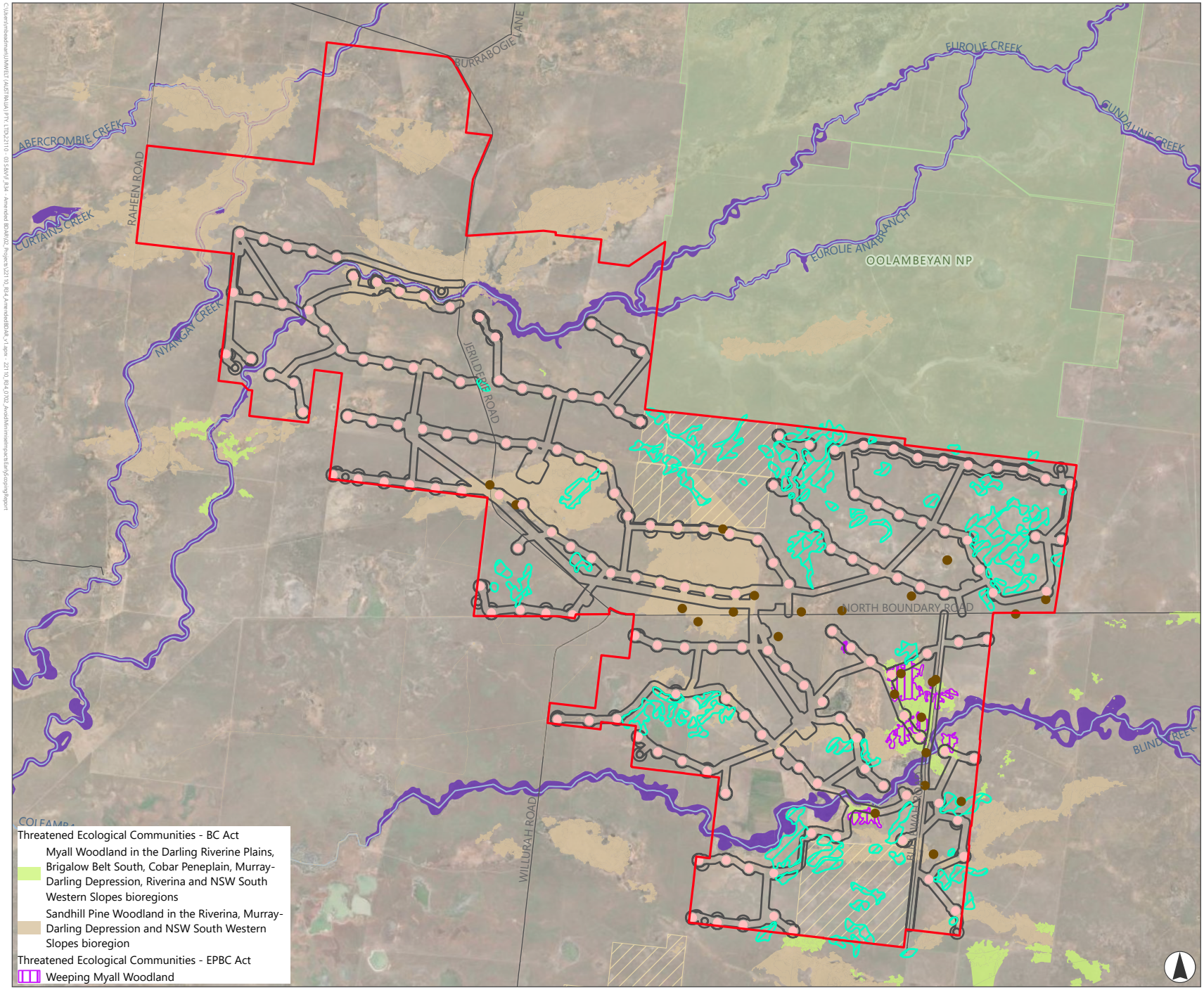
Design Aspect	Options Implemented	Rationale for Design Refinement
WTG and associated ancillary infrastructure	Avoidance of major constraints, including the existence of conservation agreements	A hierarchical approach to avoidance was adopted as follows: a) avoidance of Plains-wander Important Habitat, b) seeking to avoid large patches of TEC or patches of TEC which are contiguous with large tracts of non-threatened woody vegetation prioritised for retention over smaller, fragmented patches or scattered trees, c) avoidance of threatened species and their habitat, d) avoidance and minimisation of design within biodiversity corridors / biodiverse riparian land, e) minimisation of design within areas considered to be additional habitat that may be suitable for Plains-wanderer, f) avoidance and minimisation of design within non-threatened native woody vegetation and g) minimisation of design non-threatened native grassy vegetation stratification. BFW has adopted this avoidance hierarchy as part of project design, as such the Subject Land and Development Footprint were developed such that impacts to native vegetation, and particularly impacts to threatened ecological communities were reduced as far as reasonably practicable. Conservation and management agreements have been established in respect of the Project Area. The purpose of each of these agreements is to conserve and maintain existing primary habitat for the Plains-wanderer which is present in patches across the Project Area. These agreements comprise of • A conservation agreement (CA0465) made under the BC Act, noting that no Project activities or infrastructure are proposed within land subject to this agreement. The proposed Project design avoids this conservation area in its entirety. • Land management agreements made by Murray LLS under the Regional Land Partnerships Program. While these land management agreements apply generally to the identified areas, the management obligations under these agreements relate to the areas of mapped primary habitat. These obligations include maintaining sustainable grazing practices and weed management to maintain 'ideal' conditions within Plains-wanderer primary habitat. The 'Ideal' condition refers to 50% bare ground, 10% fallen litter and 40% herbs and grasses. The Development Corridor has been specifically designed to avoid all areas of mapped Plains-wanderer primary habitat, and existing land management practices within the areas of primary habitat would be maintained over the life of the Project, consistent with the obligations of those agreements. BWF has designed the Project's Development Corridor specifically to avoid all parts of the Project Area within which conservation and land management agreements have been established. Where feasible, the design has allowed for substantial buffer from these agreement areas.

Design Aspect	Options Implemented	Rationale for Design Refinement
WTG and associated ancillary infrastructure	Avoidance of all primary habitat for the Plains-wanderer	The species is identified as an entity with the potential for Serious and Irreversible Impact (SAII) under the BC Act, and the conservation of the species (and enhancement of existing primary habitat) is of vital importance to the local community and BWF. As such, BWF has designed the Project's Development Corridor specifically to avoid all mapped Important Habitat for Plains-wanderer. Accordingly, the Project's Development Footprint avoids all mapped Important Habitat and provides a substantial buffer to this habitat across the vast majority of the Project Area.
WTG and associated ancillary infrastructure	Avoiding and minimising impacts to native vegetation, particularly threatened ecological communities:	From Project inception, regional vegetation mapping was integrated into BWF's model for wind turbine placement to focus on avoiding high and medium value vegetation and areas of threatened ecological communities. As biodiversity fieldwork progressed and a more detailed understanding of the biodiversity values of the Project Area became available, the Development Corridor was progressively refined and the Development Footprint were developed such that impacts to native vegetation, and particularly impacts to threatened ecological communities were reduced as far as reasonably practicable.
WTG and associated ancillary infrastructure	Avoiding and minimising impacts to raptors and their potential breeding habitat	BWF has sought to avoid in the first instance and then minimise impacts to raptors and their potential breeding habitat through the placement of WTGs. A 300 m buffer was placed around all recorded stick nest and each nest stick given a risk rating based on the known or likely species utilising the nests. The highest risk rating was given to nests known or likely to be used by threatened raptors such as Black Falcon and Little Eagles, as well as Wedge-tail Eagle and these were avoided as a priority. • Seven (7) WTG (being WTG 23, WTG 28, WTG 38, WTG 34, WTG 115, WTG 107 and WTG 132) were relocated within the Development Corridor to maximise distance offsets to nearby stick nests, and minimise impacts to these raptor species. • Between the Scoping phase and EIS WTG 17, WTG 38 and WTG 112 (as they were identified in the Scoping phase) were removed to avoid stick nests. Noting that WTG identified as 17, 38 and 112 exist in the current Project design but do not correlate to those identified as being removed from the Scoping phase design, this is because WTG were renumbered sequentially for the EIS phase, and following these avoidance measures. • WTG 38 (current design ID) has been subsequently removed from the Project design as noted in **Section 1.2.3** and hence avoids impact to the nearby stick nests and these raptor species.
Access roads	Minimising interactions with Biodiverse Riparian Land:	BWF has sought to avoid placement of WTGs and other key infrastructure (primarily access roads) within Biodiverse Riparian Land, as identified on the NSW Biodiversity Values Map. A number of stream crossings are still required; however, these have been minimised as far as reasonably practicable.

Design Aspect	Options Implemented	Rationale for Design Refinement
WTG and associated ancillary infrastructure (northern area of the Development Footprint)	Increasing distance from Oolambeyan National Park	The Scoping Report Project Area also incorporated spatial extents adjacent to both the southern and western boundaries of Oolambeyan National Park. The reduced Project Area (the subject of this BDAR) saw all infrastructure adjacent to the western boundary of the Oolambeyan National Park being removed, resulting in the remaining Project infrastructure only being situated south of the Oolambeyan National Park. This refinement also removed infrastructure from the Project layout that had the potential to impact waterways which traversed both the Scoping Report Project Area and Oolambeyan National Park boundaries.
WTG and associated ancillary infrastructure (northern area of the Development Footprint)	Increasing distance from Oolambeyan National Park	The Development Footprint (present day) maintains a variable buffer between the northern-most WTGs and Oolambeyan National Park. This buffer was established for the Scoping Report, and then increased during the EIS phase to a minimum distance of 450 m, but generally in excess of 600 m.
WTG and associated ancillary infrastructure	Removal of WTG 37 and WTG 38	Whilst not assessed in this Amended BDAR, the removal of WTG 37 and WTG 38 (as a result of the blade throw assessment) will reduce impacts to biodiversity values in that area. This will occur as a result of the removal of the WTG themselves but also the associated ancillary infrastructure (i.e. access roads, hardstands etc) that will reduce the size of the Development Corridor and Disturbance Footprint.

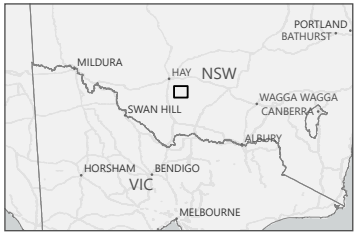
FIGURE 7.2.

Avoid and Minimise Impacts - Early Scoping Report



Legend

- Scoping Report Project Boundary
- Early Scoping Development Corridor
- Early Scoping Report Wind Turbine Generators
- Conservation Agreement Area
- NPWS Reserves
- Road
- Watercourse
- Little Eagle Stick Nests
- Plains Wanderer Important Habitat Mapping
- Biodiverse riparian land



0 1,000 2,000

Meters

Scale 1:160,000 at A4

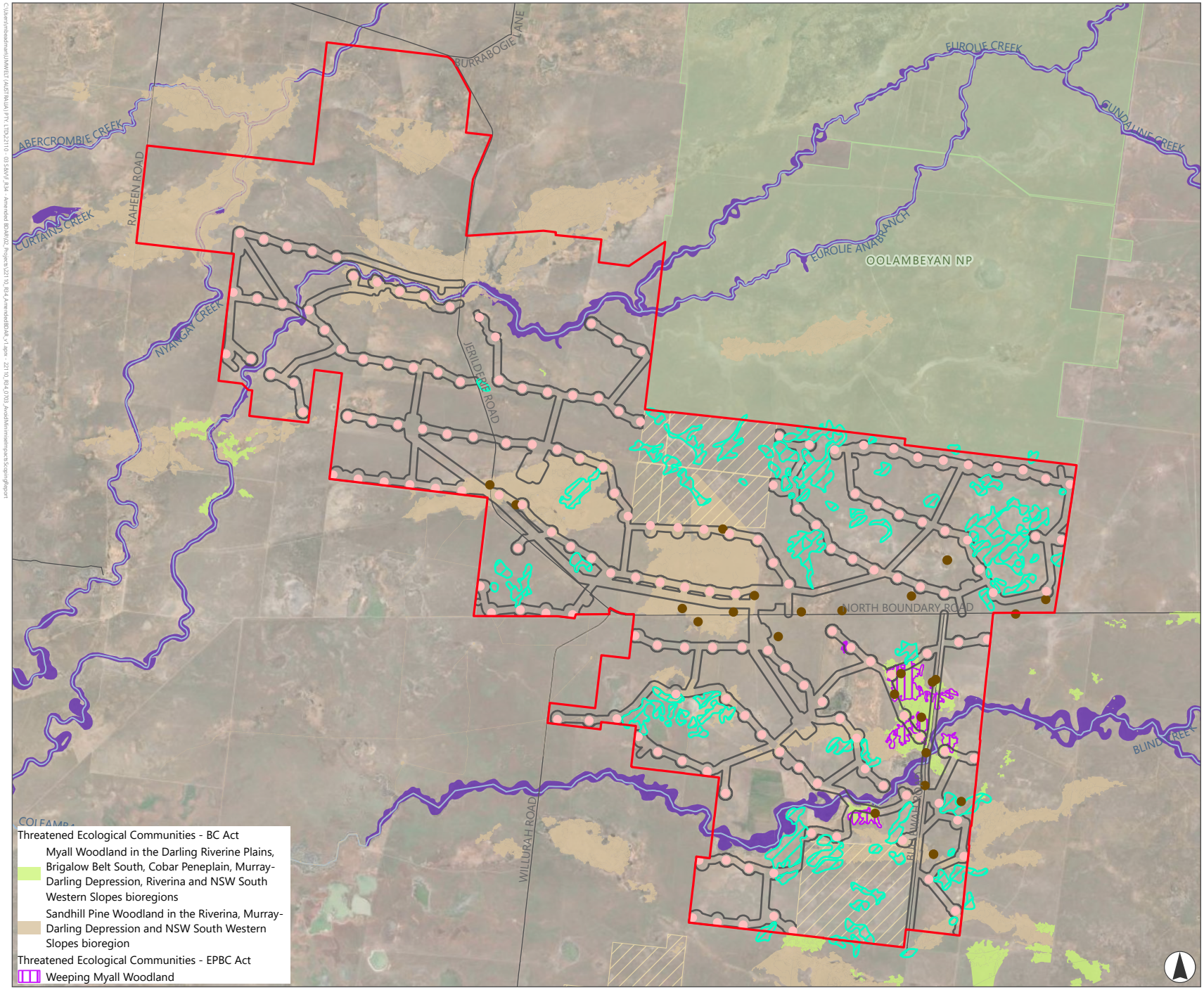
GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

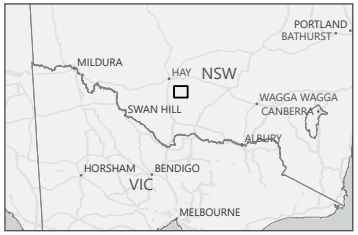
FIGURE 7.3.

Avoid and Minimise Impacts - Scoping Report



Legend

- Scoping Report Project Boundary
- Scoping Report Development Corridor
- Scoping Report Wind Turbine Generators
- Conservation Agreement Area
- NPWS Reserves
- Road
- Watercourse
- Little Eagle Stick Nests
- Plains Wanderer Important Habitat Mapping
- Biodiverse riparian land



0 1,000 2,000

Meters

Scale 1:160,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

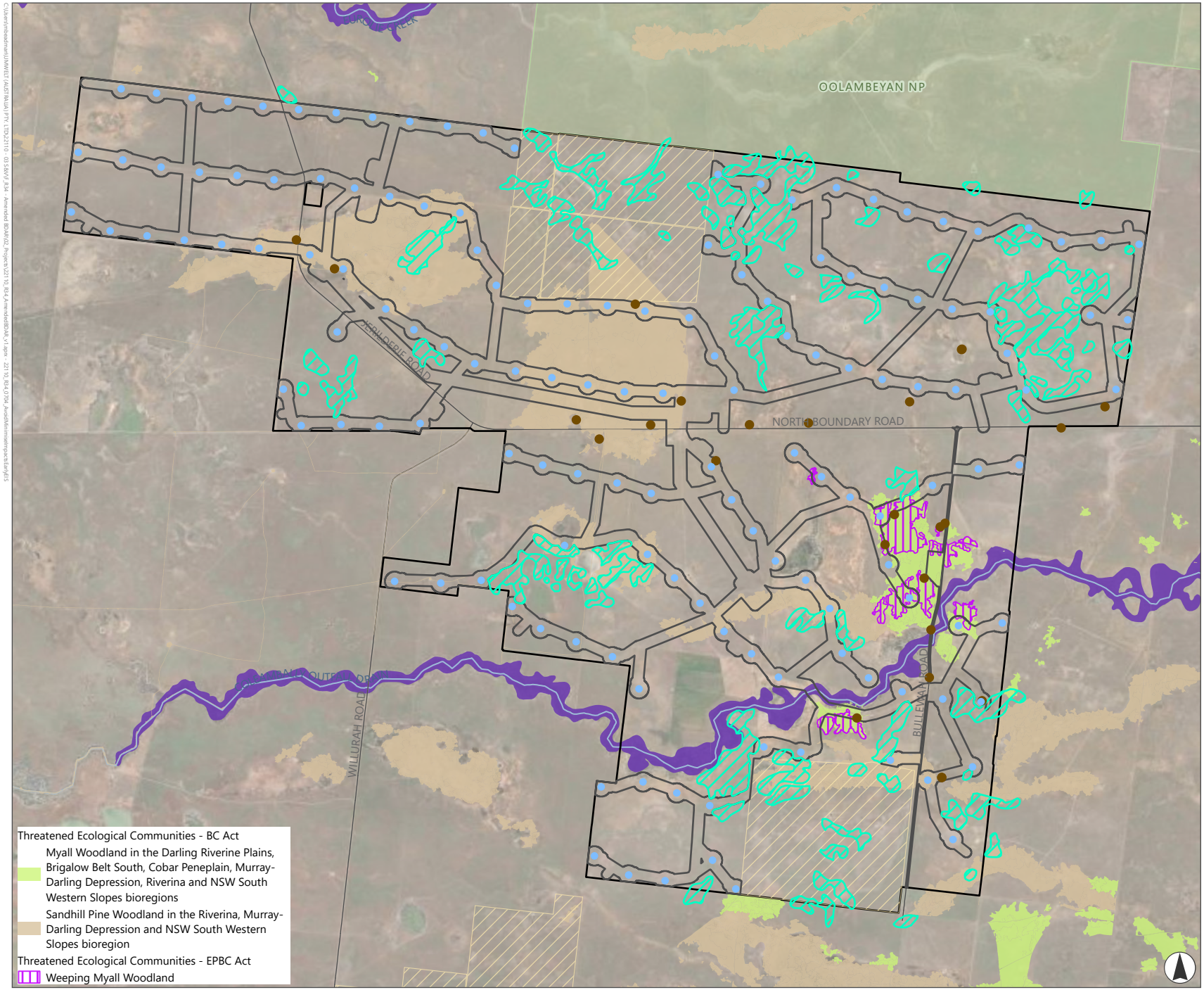


Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

FIGURE 7.4.

Avoid and Minimise Impacts - Early EIS

Legend

- Project Boundary
- Early EIS Development Corridor
- Early EIS Wind Turbine Generators
- Conservation Agreement Area
- NPWS Reserves
- Road
- Watercourse
- Little Eagle Stick Nests
- Plains Wanderer Important Habitat Mapping
- Biodiverse riparian land

0 1,000 2,000

Meters

Scale 1:110,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Table 7.3 below outlines specific design refinements made by BWF during the development of this BDAR (and broader EIS) to avoid and minimise impacts in accordance with the hierarchy and specific principles outlined above.

Changes to WTG ID

As a result of these design refinements, and other changes implemented by BWF, the unique numeric identifiers (ID) for most WTG were updated between the Scoping and EIS phases; these changes (current and Scoping phase ID) are clearly noted in **Table 7.3**.

Furthermore:

- Three (3) WTG were removed from the Project design in accordance with the hierarchy and specific principles outlined above, and the ID nominated at that Scoping phase is reproduced below i.e. previous WTG 17, 38 and 112. These Scoping phase WTG have been removed from the Project (as assessed in this BDAR) and do not correlate to those with the same ID shown in the current design. This is because WTG were renumbered sequentially for the EIS phase, and following these avoidance measures being implemented.
- There has been no sequential renumbering of WTG following the removal of WTG 37 and 38 during the preparation of the Amendment Report (refer **Section 1.2.3**).

These matters are specifically addressed for each of the avoidance measures identified in **Table 7.3**.

Table 7.3 Refinement of Project Design – EIS Phase

Design Change	Summary
1	**WTG 23** (Scoping phase ID: WTG 24) moved 31.8 m south-south-west of its original position but within the Development Corridor to maximise distance offsets to nearby stick nests, and minimise disturbance in potential southern bell frog habitat.
2	**WTG 28** (Scoping phase ID: WTG 29) moved 88.9 m north-east of its original position but within the Development Corridor to maximise distance offsets to nearby stick nest, whilst continuing to avoid potential southern bell frog habitat.
3	**WTG 17** and **WTG 38** (as they were identified in the Scoping phase) removed to avoid three (3) stick nests. *Note: WTG identified as 17 and 38 remain in the Project design but do not correlate to those identified as being removed from the Scoping phase design, this is because WTG were renumbered sequentially for the EIS phase, and following these avoidance measures.*
4	**WTG 38** (Scoping phase ID: WTG 40) moved 81.6 m south east of its original position but within the Development Corridor to maximise distance offsets to nearby stick nests. *Note: WTG 38 (current design ID) has been subsequently removed from the Project design as noted in **Section 1.2.3** and hence avoids impact to the nearby stick nests.*
5	**WTG 34** (Scoping phase ID: WTG 35) moved 161.6 m east-south east of its original position but within the Development Corridor to maximise distance offset to nearby stick nest, and avoid threatened species records.
6	**WTG 35** (Scoping phase ID: WTG 36) moved 50.2 m north-north west of its original position but within the Development Corridor to avoid threatened species records.

Design Change	Summary
7	**WTG 71** (Scoping phase ID: WTG 73) moved 90.0 m south west of its original position but within the Development Corridor to maximise distance offset to nearby Plains-wanderer primary habitat and potential southern bell frog habitat.
8	**WTG 79** (Scoping phase ID: WTG 81) moved 53.2 m south west of its original position but within the Development Corridor to avoid threatened species records.
9	**WTG 112** (as identified in the Scoping phase) removed to avoids three (3) nearby stick nests. *Note: a WTG identified as 112 remains in the Project design but does not correlate to that identified as being removed from the Scoping phase design, this is because WTG were renumbered sequentially for the EIS phase, and following this avoidance measure.*
10	**WTG 115** (Scoping phase ID: WTG 118) moved 188.0 m north east of its original position but within the Development Corridor to maximise to maximise distance offset to nearby stick nests, Plains-wanderer primary habitat, nearby threatened species records and potential southern bell frog habitat.
11	**WTG 119** (Scoping phase ID: WTG 121) moved 108.8 m north of its original position but within the Development Corridor to maximise distance to nearby primary Plains-wanderer habitat.
12	**WTG 107** (Scoping phase ID: WTG 109) moved 404.9 m north west of its original position but within the Development Corridor to maximise distance to nearby stick nests and primary Plains-wanderer habitat.
13	**WTG 132** (Scoping phase ID: WTG 133) moved 119.1 m south west of its original position but within the Development Corridor to maximise distance to nearby stick nest and potential southern bell frog habitat.

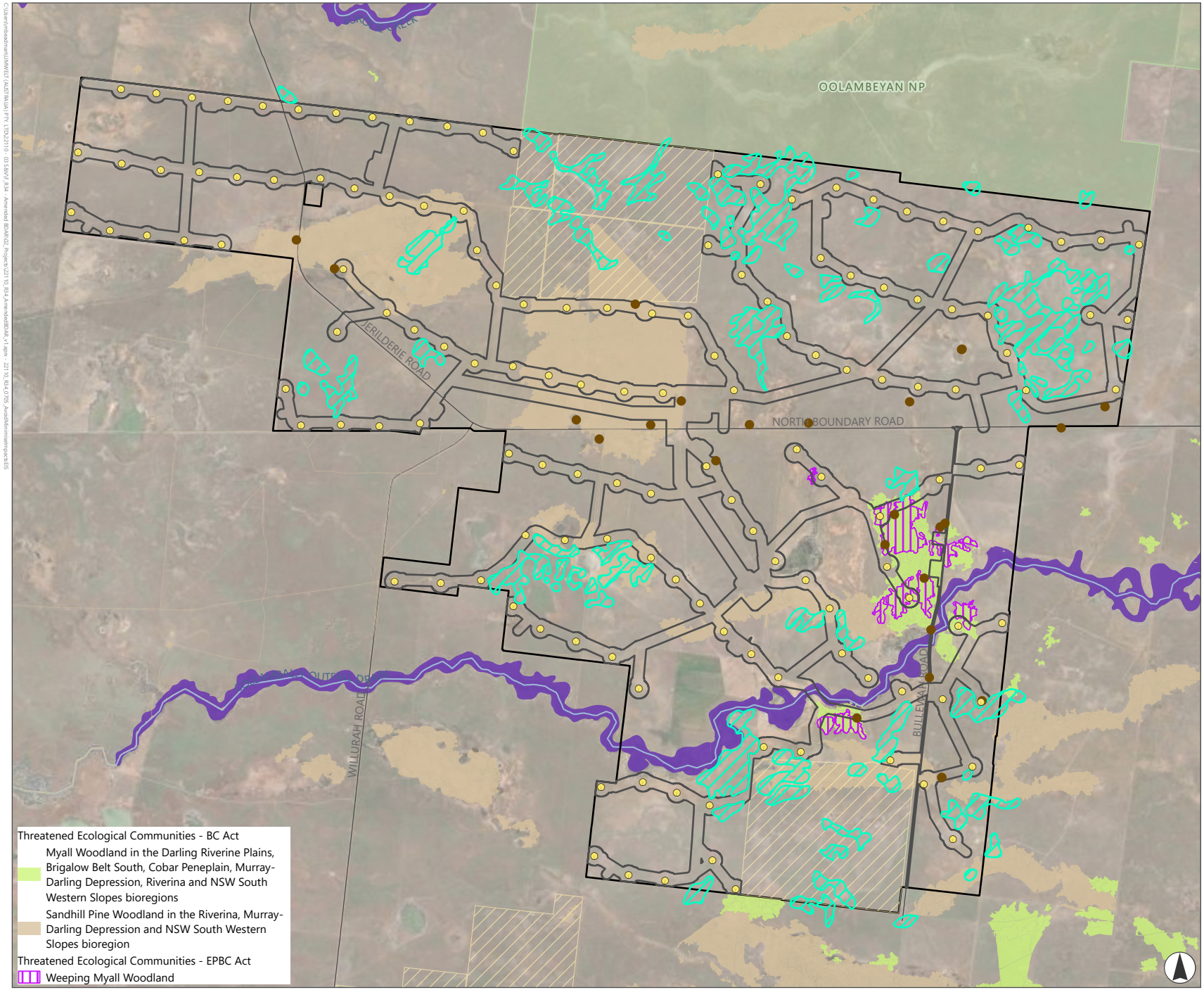


Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

FIGURE 7.5.

Avoid and Minimise Impacts - EIS

Legend

- Project Boundary
- EIS Development Corridor
- EIS Wind Turbine Generators
- Conservation Agreement Area
- NPWS Reserves
- Road
- Watercourse
- Little Eagle Stick Nests
- Plains Wanderer Important Habitat Mapping
- Biodiverse riparian land

0 1,000 2,000

Meters

Scale 1:110,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

7.2 Avoidance and Minimisation of Prescribed Impacts

7.2.1 Project Location

Potential prescribed impacts of relevance to the Project are identified in **Section 6.0** of this report and comprise disturbances to non-native vegetation, human made structures and waterbodies such as dams and watercourses. The factors that fed into the selection of the Project location are detailed in **Section 7.1.2**. The Project has, as far as practicable, sought to avoid and minimise prescribed impacts through the site selection process.

7.2.2 Project Design

Efforts made to avoid and minimise prescribed impacts to biodiversity values (as defined by Section 8.3 of the BAM) in accordance with Section 7.2 of the BAM are summarized in **Table 7.4**.

Table 7.4 Design Refinements that have Avoided and/or Minimised Prescribed Impacts

Prescribed impacts	Rationale for design
Karst, caves, crevices, cliffs, rocks and other geological features of significance	Not applicable.
Human-made structures or non-native vegetation	Southern Bell Frogs have been observed within the non-native vegetation on the banks of the Coleambally Outfall Drain, as well as around farm dams outside. This species is known to utilise non-native vegetation if it occurs adjacent to a waterbody. Only a small area of non-native vegetation adjacent to a waterbody will be impacted, in an area surrounded by other suitable habitat. The Development corridor has avoided all farm dams while a number of stream crossings are still required, however, these have been minimised as far as reasonably practicable. Non-native vegetation may also be used as hunting grounds for threatened raptor species which occur on site. As a majority of the Subject Land and surrounding habitat contains suitable raptor hunting grounds, it is unlikely that this loss will have a significant impact on the threatened raptor population. Artificial structures (e.g. buildings, fences, electrical wires) may be used as perches by raptors similar to the use of trees as perches (Baker-Gabb 2014 cited in Commonwealth of Australia 2016). This may reduce the area of habitat occupied Plains-wanderer due to predation risk.
Habitat connectivity	The Project has sought to avoid impacts to habitat connectivity. The Project does not require large areas of clearing or the erection of barriers that would affect fauna movement or the disruption of ecosystem services (e.g. pollination, seed dispersal). While the turbines create strike risk for flying fauna (birds and bats), this is unlikely to be sufficient to cause a loss of habitat connectivity. Strike risk can be reduced by understanding flight patterns on the site and applying this knowledge to adaptive management (e.g. targeted turbine shut-downs and curtailment). The Plains-wanderer is generally sedentary, but it is known to move when habitat becomes unsuitable due to climatic extremes. Movement distances at such times have not been established (Commonwealth of Australia 2016). However, the capacity for intra-regional movement suggests that habitat connectivity for the Plains-wanderer would not be compromised by small-scale reductions in habitat (e.g. along access tracks). However, the disturbance footprint may fragment individual home-ranges, causing changes in habitat utilisation within these home-ranges, or potentially isolate areas of occupied habitat. The Development Footprint (present day) maintains a variable buffer between the northern-most WTGs and Oolambeyan National Park. This buffer was established for the Scoping Report, and then increased during the EIS phase to a minimum distance of 450 m, but generally in excess of 600 m.
Water bodies, water quality and hydrological processes	The Development Footprint has avoided all farm dams while a number of stream crossings are still required, however, these have been minimised as far as reasonably practicable.

Prescribed impacts	Rationale for design
	The Project will directly impact on Coleambally Outfall Drain, as well as a number of first order ephemeral streams. The impact on the drain is minimal. The impact on the first order streams is minimal, as these are dry a majority of the time. The project is not expected to impact on any hydrological process. A minor reduction in water quality of Coleambally Outfall Drain may occur during the construction phase due to earthworks and sediment transport and deposition. This impact is minimal, as the Coleambally Outfall drain is a regulated irrigation canal and is subject to regular earthworks to remove sedimentation and vegetation to ensure water flows unhindered through the adjacent agricultural land. The risk of sedimentation can also be minimised through the implementation of standard erosion and sediment control measures (e.g. sediment fences, temporary stabilisation).
Vehicle strikes	Vehicle strikes are a potential impact, particularly during construction when traffic volumes are high and heavy machinery is in operation. Thus, the maximum intensity of this impact will only be a relatively short amount of time during the construction phase. The Plains-wanderer has a tendency to freeze in response to threats. The species is also well-camouflaged, making it difficult to see, particularly in the taller, denser habitat used for diurnal foraging (Nugent et al. 2022a). These factors suggest the Plains-wanderer is likely to be vulnerable to vehicle strike in occupied paddocks. This includes 4WDs and construction machinery. Another period of potentially high intensity impact is during periods of high intensity rain, particularly in warmer months, as threatened amphibians are likely to disperse widely across the landscape, likely crossing roads in the process. Raptors that feed on carrion are vulnerable to vehicle strike along public roads. Woodland birds feeding on road edges may also be vulnerable to vehicle strike. The impacts of vehicle strike can be reduced by: • Use of existing public and private roads. • Limit vehicle speeds to a maximum of 80 km/hr. • Avoiding or minimizing driving at dawn and dusk when fauna activity is highest (e.g. macropods). • Avoiding or minimizing driving during periods of high rainfall and warm temperatures. If driving is required, vehicle speed should be reduced when passing by waterbodies. • Monitor the locations of Plains-wanderers (e.g. using radio-tracking) during periods of high vehicle activity and clearing. • Worker induction to include driving protocols, including promoting driver awareness of fauna road behaviour.

7.3 Other Measures Considered

7.3.1 Do Nothing Option

The Project Area is currently used primarily for livestock grazing. The 'do nothing option' would allow for the continued use of the whole Project Area for agricultural purposes. The 'do nothing option' would also mean that the Project is not developed and would therefore forgo the Project's identified benefits, namely:

- assisting in meeting the NSW and Commonwealth government's objectives of transitioning to renewable electricity generation
- increased energy security and supply into the National Energy Market (NEM)
- significant social and economic benefits created through capital investment and provision of direct and indirect employment opportunities during the construction and operation of the Project
- project related agreements and community benefit sharing initiatives, as described in Section 2.5 of the EIS
- further, the 'do nothing option' would also result in a lost opportunity for the landholders to diversify their income streams.

The 'do nothing option' would avoid the biodiversity impacts associated with the construction, operation and decommissioning of the Project, and other environmental and social impacts such as noise, traffic, social amenity and visual impacts etc.

Whilst impacts will occur with the construction, operation and decommissioning of the Project, these impacts will be managed to acceptable levels through the careful design of the Project and the implementation of the management and mitigation measures outlined in **Section 8.7.1**.

7.3.1.1 Project Justification and Need

The expansion of renewable energy generation aligns with both Commonwealth and NSW commitments to increase renewable energy generation and reduce carbon emissions across the NSW and Australian economies. By developing the Project, BWF aims to provide cleaner reliable energy generation to assist with meeting current load demand while simultaneously reducing GHG emissions and the impacts of climate change.

As a renewable energy project located within the South West REZ, the Project is located within a defined area planned for renewable energy development by the NSW Government. The NSW government has indicated that REZs will play a vital role in delivering affordable energy generation to help prepare the State for the expected retirement of thermal power stations over the coming decades. The Project will contribute to meeting these Federal and NSW Government objectives and is appropriately located.

The Project is consistent with the objectives of the NSW Electricity Strategy and Infrastructure Road Map (NSW Government, 2020), in aiming to provide large-scale renewable electricity generation that is affordable and reliable. With a proposed capacity of approximately 815.1[1] megawatts (MW), the Project will make a material contribution to the planned energy generation capacity for the South West REZ.

The Project will also contribute significant capital investment within the Riverina region, generate jobs during the construction, operational and decommissioning phases, provide indirect benefits to local services throughout the life of the Project (e.g. indirect employment creation in local and regional economies would include jobs supported through transportation, trade supplies, services, accommodation, catering, retail services, etc.), deliver additional income to host and other associated landowners, and provide benefits to the local community through the implementation of planning agreements with local Councils and the Community.

BWF has refined the Project based on feedback received from relevant stakeholders throughout its development, as outlined above. BWF has considered a range of alternatives in planning the Project and in determining the layout considered in this BDAR. The preliminary WTG layout and infrastructure design was subject to several iterations to minimise environmental and social impacts.

The Project will provide long-term, strategic benefits to the State of NSW, including:

- renewable energy supply to assist with fulfilling the current obligations under State and Commonwealth renewable energy targets
- providing for cleaner reliable electricity generation, assisting with meeting current load demand while reducing greenhouse gas emissions and the impacts of climate change
- providing regional investment in the NSW renewable energy sector
- making a positive contribution towards achieving the target of at least 2.5 GW of renewable energy generation from the South West REZ.

The Project will also provide direct financial benefits to the region and local community, including:

- Creation of 350 direct full time equivalent (FTE) positions during construction and 40 FTE positions during the 30-year operational life of the Project.
- Indirect benefits to local services through the construction and operation phases.

[1] This value will reduce with the removal of WTG 37 and WTG 38 to 803.7 MW.

- Payments to host and neighbouring landowners via private agreements, biodiversity stewardship agreements, and a community benefit sharing scheme, resulting in financial contributions to the local community.
- Annual payments to the community under Planning Agreements with each of the three Councils.
- Annual community payments via the Access Rights Benefits Scheme for the South West REZ.

7.4 Minimisation and Management of Impacts

BWF has committed to the design and implementation of a comprehensive biodiversity mitigation strategy to minimise the unavoidable impacts of the Project. The following Management Plans will be prepared post approval as part of the Biodiversity Management strategy:

- Bird and Bat Adaptive Management Plan (BBAMP).
- Construction Environmental Management Plan (CEMP).
- Biodiversity Management Plan, which will include the following subplans:
    - Plains-wanderer Management Sub-plan.
    - Threatened Species Sub-plan.
    - Rehabilitation Management Subplan.

The key biodiversity management controls that BWF would include in these management plans to minimise and manage biodiversity impacts are outlined in the following sections. It is noted that these management plans will require approval from relevant government agencies prior to their implementation.

7.4.1 Bird and Bat Adaptive Management Plan

A BBAMP will be implemented to measure any impacts on aerial fauna by the Project. The development and implementation of the BBAMP is an integral part of managing impacts to bat and bird species and a key mitigation measure to address the prescribed impacts associated with turbine strike outlined in **Section 8.4** and **Appendix D**.

BWF has installed two meteorological masts with fixed microphones at 50 m and 100 m to assist with bat utilisation data collection. Data collected from these ongoing surveys will form the baseline monitoring data set and will underpin the adaptive management strategy prepared as part of the BBAMP.

The plan will include trigger levels and mitigation measures designed to manage impacts, in consultation with CPHR. The BBAMP will provide guidance to develop a framework for monitoring impacts and will include baseline and ongoing monitoring. The BBAMP will be prepared following approval of the Project in consultation with relevant government agencies, however, a conceptualisation of the BBAMP is provided below in **Table 7.5** with consideration of feedback from South West CPHR detailing their expectations of BBAMP content within BDARs. A draft Table of Contents, outlining what will be contained in the BBAMP, is provided in **Appendix D**.

Table 7.5 Conceptual BBAMP Components

Component	Description	Timeframe
Objectives of the BBAMP		
Purpose and objectives of the BBAMP	The BBAMP will present an adaptive management strategy to monitor and mitigate impacts to birds and bats attributable to the construction and operation of the wind farm development. The overall objective of the BBAMP will be to ensure the wind farm development does not result in a significant impact on birds and bats by retaining viable local populations of threatened species. It will achieve this by undertaking on-going bird and bat utilisation surveys and operational carcass studies to estimate bird and bat mortality and identify any factors that influence mortality rates (e.g. season). The mitigation and management measures to address Project impacts will be iteratively updated as required pending the outcomes of the monitoring program.	Operational life of the Project
Baseline Survey Programs		
Bird Utilisation Surveys	As agreed with CHPHR, the methods utilised to inform the two year BBUS program through the impact assessment satisfies the requirements of the baseline survey program for bird utilisation. The methodology of this program is detailed in **Appendix G**.	Autumn 2022 Winter 2022 Spring 2022 Summer 2022/23 Autumn 2023 Winter 2023 Spring 2023 Summer 2023/24
Bat Utilisation Survey	As agreed with CHPHR, the methods utilised to inform the two year BBUS program through the impact assessment satisfies the requirements of the baseline survey program for bat utilisation. The methodology of this program is detailed in **Appendix G**.	Autumn 2022 Winter 2022 Spring 2022 Summer 2022/23 Autumn 2023 Winter 2023 Spring 2023 Summer 2023/24
Targeted Bird Surveys	Area searches were carried out in accordance with Survey guidelines for Australia's threatened birds (DEWHA, 2010b) and were completed by 2 ecologists per survey, covering areas of tree cover to search for hollows and the presence of breeding Pink Cockatoo's. Surveys were comprised of the 20 min / 2 ha area searches were undertaken at 12 survey locations, repeated four times. Nine (9) acoustic recorders (Titley Chorus programmed to record stereo acoustic) were deployed for a duration of 10 nights.	Pink Cockatoo/Superb Parrot: 30 September 2024 1–2 October 2024 1–2 November 2024 Barking Owl: 8–18 August 2023
Habitat Assessments for Avifauna	Meandering transects in proximity to wind turbines, recorded suitable habitat for aerial species, such as large stick nests for raptors, abundance of winter flowering gums, hollow bearing trees, and hollows with an aperture of >20 cm and suitable depth for barking owls, masked owls and cockatoos.	Autumn 2023
Operational Monitoring		
Bird Utilisation Surveys	Replication of the BBUS program that was undertaken during the impact assessment. In the absence of any substantial Project design changes, the same BBUS sites should be used for operational monitoring for statistical robustness. Additional BBUS sites will be added into the BBAMP monitoring to allow for changes to sampling density described within the *'Draft Wind Farm Assessment Guidance - South West REZ Projects'* in July 2023.	First year, third year and fifth year (after the commencement of each stage i.e., Stage 1 and Stage 2) within three months of commencement of wind farm operation, that is, once all of the following have occurred: • all turbines are commissioned and tested (including testing dependent on wind conditions) • all turbines have been handed over from the Contractor to BWF • Australian Energy Market Operator (AEMO) testing is complete (grid compliance testing).

Component	Description	Timeframe
Bat Utilisation Survey	Replication of the of the BBUS program that was undertaken during the impact assessment. In the absence of any substantial Project design changes, the same BBUS sites should be used for operational monitoring for statistical robustness. Additional BBUS sites will be added into the BBAMP monitoring to allow for changes to sampling density described within the *'Draft Wind Farm Assessment Guidance - South West REZ Projects'* in July 2023.	First year, third year and fifth year (after the commencement of each stage i.e., Stage 1 and Stage 2) within three months of commencement of wind farm operation, as described above.
Targeted Bird Surveys	Replication of the Pink Cockatoo and Superb Parrot surveys described above A survey method involving targeted surveys for potential breeding locations for Barking Owl would be prepared in consultation with CPHR during the drafting and approval of the BBAMP.	First year, third year and fifth year (after the commencement of each stage i.e., Stage 1 and Stage 2) within three months of commencement of wind farm operation, as described above.
Carcass Search Program	Carcass searches will be undertaken to estimate the frequency of bird and bat mortality due to collision at the Project, from which the total number of collisions can be estimated. Searches are undertaken to identify and record any carcasses beneath wind turbines. Carcass searches will be undertaken at approximately 50% of the constructed wind turbines, with the same wind turbines being monitored each event. Carcass searches will be conducted once per month throughout the survey years, involving surveying inner (120 m diameter) and outer (240 m diameter) search zones beneath a subset of wind turbines. Transect intensity varies between the inner (6 m apart) and outer (12 m apart) search zones and will be completed preferentially by conservation dogs (and handler) with human searches being permissible where conservation dogs are not available. All carcasses recorded as part of this program will be subject to a strict reporting and timeframe commitments. All carcasses will be reported to the Environmental Representative (BWF) as well as to CHPR and/or Commonwealth DCCEEW in the event of the impacted species being listed as a threatened species.	First and second year initially, starting within commencement of operation, as described above. The search program will be reviewed for efficacy after two years, with the possibility of extension for a further three years, potential total five-year program. Requirement for extension of the program if there is clear discrepancy between estimated and realised frequency of bird and bat mortality.
Carcass Persistence Trial	Carcass persistence trials are undertaken to estimate persistence rates of different sized carcasses beneath turbines (to aid estimation of mortality rates of birds and bats impacted by turbines). The trial will occur at a subset of wind turbines. A pre-determined number of bird and bat carcasses, varying in size, will be used in the trial. Carcass persistence trials can either be undertaken by human searches or use of remote survey cameras.	Completed during the first- and second-year carcass search program, but once per season (not each month).
Carcass Detectability Trials	Carcass detectability varies depending on a range of factors such as efficacy of the observer, size of the carcass and type of ground cover. Given this, carcass detectability trials will be undertaken to determine the efficacy of the conservation dog and handler; or the ecologist undertaking searches at finding carcasses. Determining the probability of the selected trained dog or observers detecting a carcass and how it may vary depending on turbine site ground conditions or carcass size is important to ascertain the correction factor needed to accurately estimate total number of collisions.	During the first-year carcass search program, but one per season (not each month).
Incidental Finds Protocol	Any carcass or feather spot discovered incidentally by site personnel or any contractor during the operational lifetime of the Project will be formally recorded and the find reported to the Environmental Representative as well as to CHPR and/or Commonwealth DCCEEW in the event of the impacted species being listed as a threatened species.	Operational lifetime of the Project.
Mortality Estimation	All data will be analysed to estimate annual number of collisions for birds and bats overall and species. This will be estimated in consideration of the carcass search area and effort, and the observed carcass persistence times and observer detectability rates. Estimates of the number of carcasses per turbine per year will also be determined and 95% confidence intervals around total annual estimates and rates of mortality calculated.	During the reporting periods, described below.
Impact Triggers and Response Procedure		

Threatened Species	• Impact triggers will be determined for threatened species listed under the EPBC Act and/or BC Act, which will relate to a particular number of carcasses, injured individual or featherspot recorded through formal searches or incidentally.
	• Impact trigger criteria will be based on the combination of the following factors:
	  ○ BC Act listing status
	  ○ EPBC Act listing status
	  ○ number of individuals impacted
	  ○ number of turbines where the species has been impacted
	  ○ frequency of impacts for the particular species across monitoring events (i.e., has the impact been recorded in two consecutive monitoring events)
	  ○ particular season the impact was recorded (i.e., breeding season for the particular species).
	• In the event of a trigger being recorded, it is the responsibility of the person who discovered the carcass, injured individual or featherspot to notify the Environmental Representative* upon discovery (allowing for identification if required). The Environmental Representative* must then notify CPHR and/or Commonwealth DCCEEW of the trigger event within two working days.
		Not applicable.

Component	Description	Timeframe
	• Additional actions and mitigation measures may be required in the event of an impact trigger being recorded, these would be determined through consultation with CPHR and/or Commonwealth DCCEEW. It is not considered suitable to specify particular mitigation measures for a potential impact at this point in time due to the large number of variables that should be considered to assess the severity of a particular impact. Rather, following notification of the initial impact trigger consultation with CPHR/Commonwealth DCCEEW will include (but not be limited to) the following: ○ An initial online or in-person meeting within five working days (excluding government shutdown periods and subject to the availability of government agency personnel) of the impact trigger being recorded, with the consultation stakeholders specified above. Should the impact trigger or consultation period occur during government shutdown periods, this meeting is required to occur within five working days following conclusion of the shutdown period (subject to the availability of government agency personnel), and ○ Additional online or in-person meetings may be required depending on the nature of the consultation. The specific timeframe of this additional consultation will be determined in the initial meeting. • The BBAMP will not ascribe numerical values to what should be considered an adverse impact at the total population and/or the local population scale. Rather, the BBAMP will describe an assessment process through which an ecologist first prepares an impact investigation that examines whether the event may be regular or may constitute, or lead to, an adverse impact on the species' local or total population. The findings of this impact investigation will determine whether consultation with CPHR and/or Commonwealth DCCEEW regarding the need for additional monitoring or mitigation action is required. The minimum requirements of the impact investigation report are detailed below: ○ Specify the particular impact trigger level that was recorded including the species and number of individuals. ○ Specify the date/s and location/s of recovered carcasses/featherspot. ○ Discuss any potentially influential ecological factors that may have contributed to the impact trigger such as recent climate, weather, presence of prey species/foraging opportunities or seasonal factors (i.e., migration). ○ Estimate whether the event is likely to be rare or regular. ○ Verify whether or not the species has been impacted (including number of individuals and frequency) at neighbouring wind farms within a 10 km radius of the Project by accessing their publicly available annual BBAMP reports. Neighbouring wind farms within this radius will be considered at the time the impact trigger is recorded to consider any future wind farms. • For the purposes of the BBAMP, post-trigger assessment of impacts on threatened and/or migratory species is to be conducted with reference to the species' total population and local population. ○ Total population refers to the estimated total Australian population or, in the case of international migrants, the relevant subspecies' entire population. Local population refers to the estimated population in the Project Site. Density is to be estimated using data from the pre-construction surveys in combination with existing density estimates from primary literature (preferably from temperate woodland in south-eastern Australia where distinction is made between different habitat types). ○ Local population estimates are to be derived using vegetation mapping for the Project. Estimates should take into consideration population dynamic assumptions such as, but not limited to, seasonal or inter-annual fluctuations in abundance in the Project Site. The local population of a given species is to be estimated by the contracted ecologist if an impact trigger for that species is met.	
Non-threatened Species	• Impact triggers will not be required for all non-threatened species and common species such as the sulphur-crested cockatoo and little corella will not be included. • Impact triggers will be determined separately for wedge-tailed eagle and other non-threatened species in recognition of increased susceptibility of wedge-tailed eagles to turbine strike. • No management actions are triggered following mortality of introduced species. • In the event of a trigger species being recorded, it is the responsibility of the person who discovered the carcass, injured individual or featherspot to notify the Environmental Representative upon discovery (allowing for identification if required). The Environmental Representative must then notify CPHR of the trigger event within five working days. • The BBAMP will not ascribe numerical values to what should be considered an adverse impact at the total population and/or the local population scale. Rather, the BBAMP will describe an assessment process through which an ecologist first prepares an impact investigation that examines whether the event may be regular or may constitute, or lead to, an adverse impact on the species' local or total population. The findings of this impact investigation will determine whether consultation with CPHR and/or DCCEEW regarding the need for additional monitoring or mitigation action is required. The minimum requirements of the impact investigation report are detailed below: ○ Specify the particular impact trigger level that was recorded including the species and number of individuals. ○ Specify the date/s and location/s of recovered carcasses/featherspot.	Not applicable.

Component	Description	Timeframe
	○ Discuss any potentially influential ecological factors that may have contributed to the impact trigger such as recent climate, weather, presence of prey species/foraging opportunities or seasonal factors (i.e., migration). ○ Estimate whether the event is likely to be rare or regular. ○ Verify whether or not the species has been impacted (including number of individuals and frequency) at neighbouring wind farms within a 10 km radius of the Project by accessing their publicly available annual BBAMP reports. Neighbouring wind farms within this radius will be considered at the time the impact trigger is recorded to consider any future wind farms. ○ For the purposes of the BBAMP, post-trigger assessment of impacts on non-listed species, is to be conducted with reference to the species' local population only. ○ Local population estimates are to be derived using vegetation mapping for the Project. Estimates should take into consideration population dynamic assumptions such as, but not limited to, seasonal or inter-annual fluctuations in abundance in the Project Site. The local population of a given species is to be estimated by the contracted ecologist if an impact trigger for that species is met.	
Mitigation Measures	Mitigation measures may include consideration of the following, amongst others: • Carrion removal program. • Pest animal control. • Raptor perch management. • Lighting and deterrents. • Alteration of cut-in speeds. • Temporary shutdown of turbines. • Acoustic deterrents. • Transmission line warning markers. • Triggers for the deployment of radars to inform the need for shutdown in real time. • Offset requirements. • Formal commitment to any particular mitigation measures will only be made in consultation with CPHR and/or DCCEEW.	Operational lifetime of the Project.
Reporting Requirements	• Carcass search programs will be reported annually for two years. Review of the program will be undertaken following two years of operation. • Impact trigger reporting will be required as described above. · Annual reports will be prepared for three years and once following the fifth year of bird and bat monitoring. • Minor review of the BBAMP will occur once after the first year, following completion of the first annual report. • Major review of the BBAMP will occur after the third year, following completion of the first annual report. After the fifth year, following the completion of the annual report.	Not applicable.

**Environmental Representative - refers to BWF Environment Manager or appropriate delegate.*

7.4.2 Construction Environmental Management Plan

Prior to construction a CEMP will be prepared and implemented as part the Project's construction. A detailed description of the mitigation measures proposed to avoid and minimise direct, indirect and prescribed impacts associated with the Project is provided in **Table 9.1** in **Section 9.1**.

Mitigation measures proposed to be included within the Construction Environmental Management Plan (CEMP) is summarised below:

- Non-inhibiting fauna fencing (where appropriate).
- Traffic control including limiting speeds on internal roads.
- Water management.
- Weed management.
- Fencing and access control.
- Bushfire management.
- Erosion and sediment control.
- Workforce education and training.

7.4.3 Biodiversity Management Plan

A Biodiversity Management Plan (BMP) will be implemented to minimise and mitigated impacts to the biodiversity values found within the Subject Land and broader Project Area. The BMP would be prepared in consultation with CPHR and include three sub-plans as follows:

- Plains-wander Management Sub-plan.
- Threatened Species Management Sub-plan.
- Rehabilitation Sub-plan.

A detailed description of the mitigation measures to be included within the BMP are provided in **Table 9.1** in **Section 9.1**.

A summary of the measures to be included within the BMP are as follows:

- Protection of vegetation and threatened species habitat outside of approved disturbance areas, measures to minimise unnecessary disturbance associated with construction and operation.
- Protection of fauna and their habitat through vegetation clearing and fauna management protocols.
- Maximising the salvage of natural resources, including soil, soil seed bank, logs, and rocks for rehabilitation and habitat enhancement.
- Rehabilitation and restoration of temporary disturbance areas.

- Protocols to control and manage weeds, pests, and pathogens.
- Incidental and unexpected finds protocol.
- Enhancement of remnant vegetation and threatened species habitat.
- Minimising impacts to entities at risk of SAII, including monitoring of Plains-wanderer locations during clearing and other high intensity activities in occupied habitat.
- Monitoring and reporting program.

8.0 Impact Assessment

8.1 Impacts Associated with the Removal of Native Vegetation, Threatened Ecological Communities, Threatened Species and Their Habitat

8.1.1 Direct Impacts on Native Vegetation and Threatened Ecological Communities

The Project would directly impact up to 638.01 ha of native vegetation within the Development Footprint across the three (3) assessment areas as follows:

- Stage 1 – Linear assessment: 269.69 ha.
- Stage 1 – Site-based assessment: 0.91 ha.
- Stage 2 – Linear assessment: 367.41 ha.

The anticipated duration of the Project construction period is approximately 3 years (35 months), commencing in Stage 2 (North). Stage 2 (North) is planned to commence in approximately Q4 of 2025 and take approximately 26 months to complete. Stage 1 (South) is planned to commence in approximately Q2 of 2026 (overlapping with Stage 1 construction for around 21 months) and take approximately 30 months to complete. Hence, direct impacts associated with Stage 2 (North) of the Project (367.41 ha) and Stage 1 (South) of the Project (269.69 ha) are both proposed to take place within 12 months of project approval.

The 638.01 ha of direct impacts to native vegetation represents approximately 15% of the native vegetation within the Subject Land, and 3% of the total Project Area.

The native vegetation to be directly impacted within the Development Footprint comprises 10 PCTs across 11 vegetation zones as follows:

- Zone 1 - PCT 10: River Red Gum - Black Box woodland wetland of the semi-arid (warm) climatic zone (mainly Riverina Bioregion and Murray Darling Depression Bioregion) – Moderate-good
- Zone 2 – 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) – Moderate-good
- Zone 3 - PCT17: Lignum shrubland wetland of the semi-arid (warm) plains (mainly Riverina Bioregion and Murray Darling Depression Bioregion) – Moderate-good
- Zone 4 – PCT 24: Canegrass swamp tall grassland wetland of drainage depressions: lakes and pans of the inland plains – Moderate-good
- Zone 5 – PCT 26: Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion – DNG
- Zone 6 – PCT 26: Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion – Moderate-good

- Zone 7 – PCT 28: White Cypress Pine open woodland of sand plains, prior streams and dunes mainly of the semi-arid (warm) climate zone – DNG
- Zone 9 – PCT 44: Forb-rich Speargrass - Windmill Grass - White Top grassland of the Riverina Bioregion – Moderate-good
- Zone 10 – PCT 46: Curly Windmill Grass - speargrass - wallaby grass grassland on alluvial clay and loam on the Hay Plain: Riverina Bioregion – Moderate-good
- Zone 11 - PCT160: Nitre Goosefoot shrubland wetland on clays of the inland floodplains – Moderate-good
- Zone 12 - PCT164: Cotton Bush open shrubland of the semi-arid (warm) zone – Moderate-good.

The Project has avoided direct impacts to Zone 8 - PCT28: White Cypress Pine open woodland of sand plains, prior streams and dunes mainly of the semi-arid (warm) climate zone – Moderate-good.

Two of the PCTs to be directly impacted by the Project were found to conform to three TEC listed under the BC Act and EPBC Act. PCT26: Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion was identified as being a component of Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions, listed as endangered under the BC Act. The Project would result in the removal of 22.80 ha of Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions across both stages of the Project.

Components of PCT26: Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion was also found to conform to Weeping Myall Woodland, listed as endangered under the EPBC Act. Only Zone 6 – PCT 26: Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion – Moderate-good conformed to the TEC under the EPBC Act. Zone 5 – PCT 26: Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion – DNG did not meet the necessary condition requirements of the listing advice under the EPBC Act. The Project would result in direct impacts to 4.92 ha of Weeping Myall Woodland across both stages of the Project.

PCT 28: White Cypress Pine open woodland of sand plains, prior streams and dunes mainly of the semi-arid (warm) climate zone was identified as being a component of Sandhill Pine Woodland in the Riverina, Murray-Darling Depression and NSW South Western Slopes bioregion, listed as endangered under the BC Act. Both of the two condition zones, DNG and Moderate-good, mapped within the Development Footprint meet the final determination for the TEC under the BC Act. The Project would result in the removal of 59.70 ha of TEC across both stages of the Project. Direct impacts to this TEC would be limited to the DNG form of the TEC. The Project has avoided all of the TEC in Moderate-good condition mapped within the Subject Land.

The direct impacts associated with the Project are summarised in **Table 8.1** below and shown on **Figure 8.1** and **Figure 8.2**. A summary of the expected impacts to vegetation integrity as a result of the Project are detailed in **Table 8.2**.

Table 8.1 Summary of Impacts to Native Vegetation

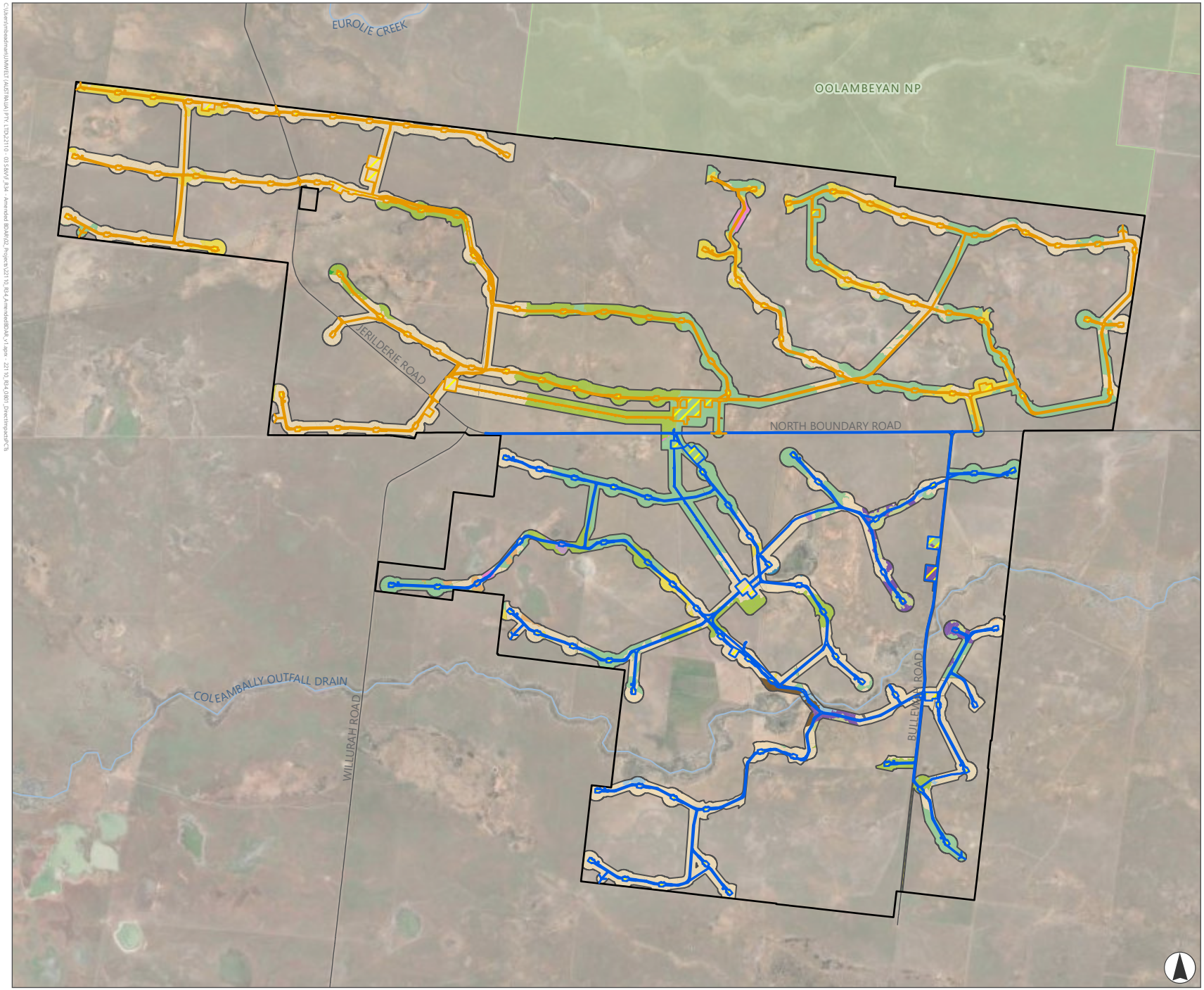
Vegetation Zone	PCT	Condition	TEC	BC Act	EPBC Act	SAII	Area to be Impacted (ha)			Total Area to be Impacted (ha)	Change (Loss) in Vegetation Integrity Score
							Stage 1 – Linear	Stage 1 – Site based	Stage 2 – Linear		
Zone 1	PCT 10: River Red Gum - Black Box woodland wetland of the semi-arid (warm) climatic zone (mainly Riverina Bioregion and Murray Darling Depression Bioregion)	Moderate-good	-	-	-	No	2.23	0.00	0.00	2.23	-34.9
Zone 2	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)	Moderate-good	-	-	-	No	0.08	0.00	0.00	0.08	-66.4
Zone 3	PCT 17: Lignum shrubland wetland of the semi-arid (warm) plains (mainly Riverina Bioregion and Murray Darling Depression Bioregion)	Moderate-good	-	-	-	No	2.05	0.00	0.00	2.05	-85.4
Zone 4	PCT 24: Canegrass swamp tall grassland wetland of drainage depressions: lakes and pans of the inland plains	Moderate-good	-	-	-	No	1.97	0.00	0.00	1.97	-37.2
Zone 5	PCT 26: open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion	DNG	Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions	E	-	No	17.88	0.00	0.00	17.88	-34.3
Zone 6	PCT 26: Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion	Moderate-good	Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions Weeping Myall Woodlands	E	E	No	4.92	0.00	0.00	4.92	-54.7
Zone 7	PCT 28: White Cypress Pine open woodland of sand plains, prior streams and dunes mainly of the semi-arid (warm) climate zone	DNG	Sandhill Pine Woodland in the Riverina, Murray-Darling Depression and NSW South Western Slopes bioregion	E	-	No	20.44	0.53	38.74	59.70	-49.2
Zone 8	PCT 28: White Cypress Pine open woodland of sand plains, prior streams and dunes mainly of the semi-arid (warm) climate zone	Moderate-good	Sandhill Pine Woodland in the Riverina, Murray-Darling Depression and NSW South Western Slopes bioregion	E	-	No	0.00	0.00	0.00	0.00	0.00
Zone 9	PCT 44: Forb-rich Speargrass - Windmill Grass - White Top grassland of the Riverina Bioregion	Moderate-good	-	-	-	No	76.46	0.00	92.79	169.25	-48.2
Zone 10	PCT 46: Curly Windmill Grass - speargrass - wallaby grass grassland on alluvial clay and loam on the Hay Plain: Riverina Bioregion	Moderate-good	-	-	-	No	138.83	0.00	197.59	336.43	-68.4
Zone 11	PCT 160: Nitre Goosefoot shrubland wetland on clays of the inland floodplains	Moderate-good	-	-	-	No	0.91	0.00	1.63	2.55	-58.4
Zone 12	PCT 164: Cotton Bush open shrubland of the semi-arid (warm) zone	Moderate-good	-	-	-	No	3.91	0.38	36.65	40.95	-48.6
Total							**269.69**	**0.91**	**367.41**	**638.01**	**-**

Table 8.2 Impacts to Vegetation Integrity

Vegetation Zone	PCT	Broad Condition State	Before Development				After Development				Change (Loss) in Vegetation Integrity Score
			Composition condition score	Structure condition score	Function condition score	Vegetation integrity score	Composition condition score	Structure condition score	Function condition score	Vegetation integrity score	
Zone 1	PCT 10: River Red Gum - Black Box woodland wetland of the semi-arid (warm) climatic zone (mainly Riverina Bioregion and Murray Darling Depression Bioregion)	Moderate-good	37.0	20.4	56	34.9	0	0	0	0	-34.9
Zone 2	PCT13: Black Box - Lignum woodland wetland of the inner floodplains in the semi-arid (warm) climate zone (mainly Riverina Bioregion and Murray Darling Depression Bioregion)	Moderate-good	63.7	60.9	75.3	66.4	0	0	0	0	-66.4
Zone 3	PCT17: Lignum shrubland wetland of the semi-arid (warm) plains (mainly Riverina Bioregion and Murray Darling Depression Bioregion)	Moderate-good	88.5	82.4	-	85.4	0	0	0	0	-85.4
Zone 4	PCT24: Canegrass swamp tall grassland wetland of drainage depressions: lakes and pans of the inland plains	Moderate-good	35.0	39.6	-	37.2	0	0	0	0	-37.2
Zone 5	PCT26: Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion	DNG	56.2	48.5	14.9	34.3	0	0	0	0	-34.3
Zone 6	PCT26: Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion	Moderate-good	90.3	53.5	33.9	54.7	0	0	0	0	-54.7
Zone 7	PCT28: White Cypress Pine open woodland of sand plains, prior streams and dunes mainly of the semi-arid (warm) climate zone	DNG	93.5	84.1	15.2	49.2	0	0	0	0	-49.2
Zone 8	PCT28: White Cypress Pine open woodland of sand plains, prior streams and dunes mainly of the semi-arid (warm) climate zone	Moderate-good	-	-	-	-	0	0	0	0	-
Zone 9	PCT44: Forb-rich Speargrass - Windmill Grass - White Top grassland of the Riverina Bioregion	Moderate-good	61.3	37.9	-	48.2	0	0	0	0	-48.2
Zone 10	PCT46: Curly Windmill Grass - speargrass - wallaby grass grassland on alluvial clay and loam on the Hay Plain: Riverina Bioregion	Moderate-good	70.3	66.6	-	68.4	0	0	0	0	-68.4
Zone 11	PCT160: Nitre Goosefoot shrubland wetland on clays of the inland floodplains	Moderate-good	52.0	65.5	-	58.4	0	0	0	0	-58.4
Zone 12	PCT164: Cotton Bush open shrubland of the semi-arid (warm) zone	Moderate-good	67.4	35.1	-	48.6	0	0	0	0	-48.6

FIGURE 8.1.1

Direct Impacts to PCTs



Legend

- Project Boundary
- Subject Land
- Stage 1 (South) Development Footprint
- Stage 2 (North) Development Footprint
- NPWS Reserves
- Road
- Watercourse
- Area of Impact

Plant Community Type

- PCT 10 Moderate-Good
- PCT 13 Moderate-Good
- PCT 17 Moderate-Good
- PCT 24 Moderate-Good
- PCT 26 Derived Native Grassland
- PCT 26 Moderate-Good
- PCT 28 Derived Native Grassland
- PCT 28 Moderate-Good
- PCT 44 Moderate-Good
- PCT 46 Moderate-Good
- PCT 160 Moderate-Good
- PCT 164 Moderate-Good
- Non-native vegetation
- Water
- Infrastructure

0 1,000 2,000

Meters

Scale 1:110,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

FIGURE 8.1.2

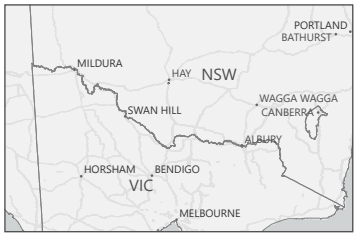
Direct Impacts to PCTs

Legend

- Stage 1 (South) Development Footprint
- Road
- Area of Impact

Plant Community Type

- PCT 164 Moderate-Good



0 60 120

Meters

Scale 1:5,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

C:\Users\mbeadman\UMWELT (AUSTRALIA) PTY LTD\2110 - 03.5 MVF_R34 - Amended BDAR\02. Projects\2110_R34 Amended BDAR_v1.aprx - 2110_R34_0801 - DirectImpactsPCTs

FIGURE 8.1.3

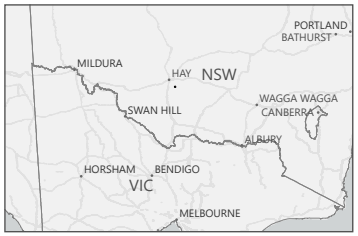
Direct Impacts to PCTs

Legend

- Stage 1 (South) Development Footprint
- Road
- Area of Impact

Plant Community Type

- PCT 28 Derived Native Grassland



0 60 120

Meters

Scale 1:5,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

C:\Users\mbeadman\UMWELT (AUSTRALIA) PTY LTD\22110 - 03.SKKY..R34 - Amended BDAR\02. Projects\22110_R34_AmendedBDAR_v1.aprx - 22110_R34_0801 - DirectImpactsPCTs

FIGURE 8.1.4

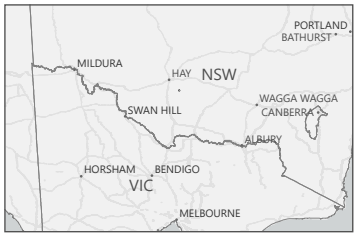
Direct Impacts to PCTs

Legend

- Stage 1 (South) Development Footprint
- Road
- Watercourse
- Area of Impact

Plant Community Type

- PCT 28 Derived Native Grassland



0 60 120

Meters

Scale 1:5,000 at A4

GDA2020 MGA Zone 55

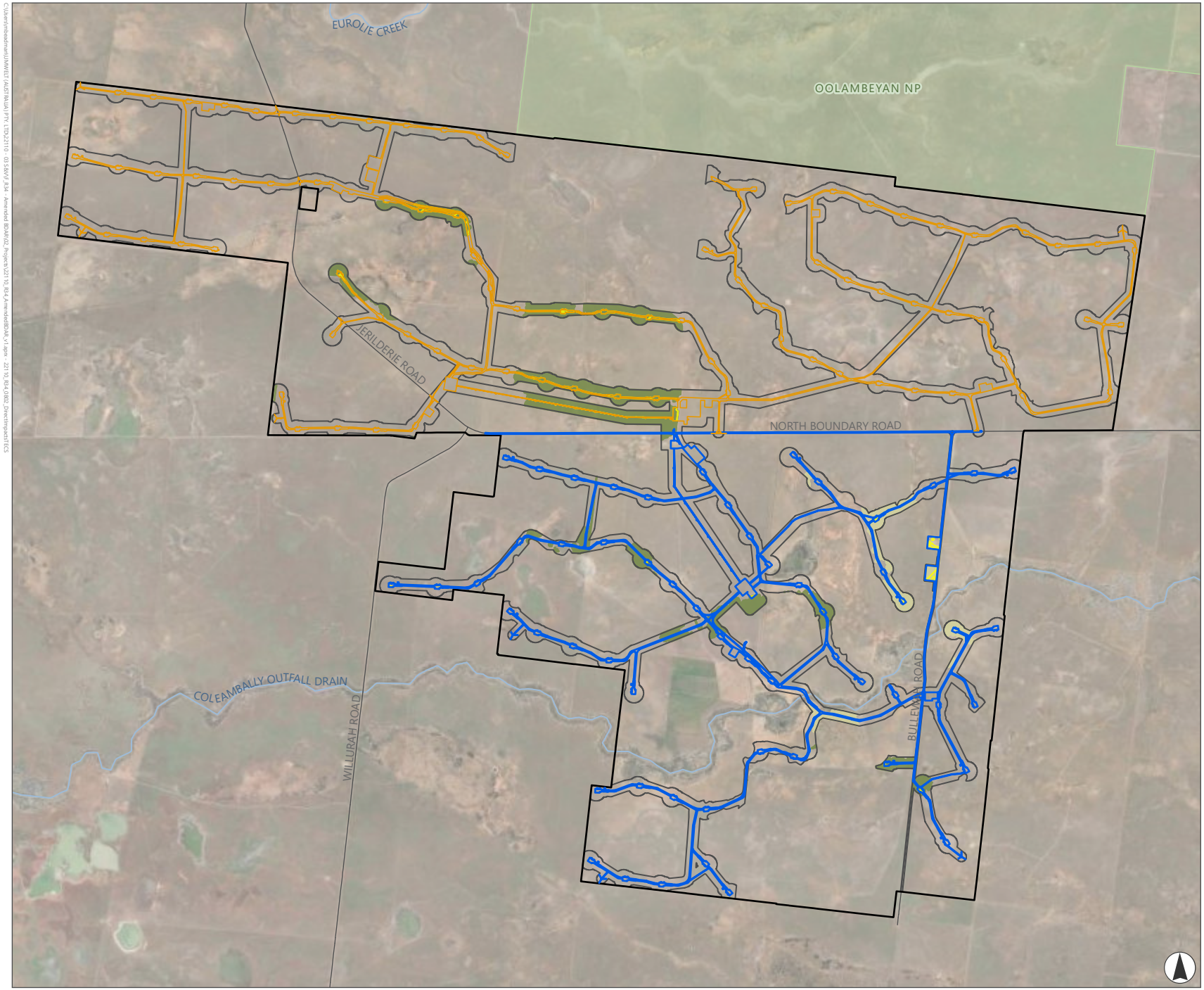
This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

C:\Users\mbeadman\UMWELT (AUSTRALIA) PTY LTD\22110 - 03.SKNY..R34 - Amended BDAR\02. Projects\22110_R34_AmendedBDAR_v1.aprx - 22110_R34_0801_DirectImpactsPCTs

FIGURE 8.2.1

Direct Impacts to TECs



Legend

- Project Boundary
- Subject Land
- Stage 1 (South) Development Footprint
- Stage 2 (North) Development Footprint
- NPWS Reserves
- Road
- Watercourse
- Area of Impact

Threatened Ecological Communities - BC Act

- Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions
- Sandhill Pine Woodland in the Riverina, Murray-Darling Depression and NSW South Western Slopes bioregion

0 1,000 2,000

Meters

Scale 1:110,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

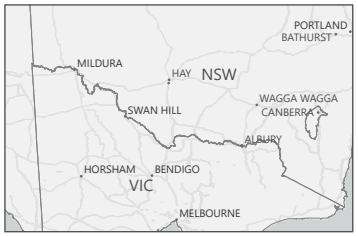
Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

FIGURE 8.2.2

Direct Impacts to TECs

Legend

- Stage 1 (South) Development Footprint
- Road



0 60 120

Meters

Scale 1:5,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

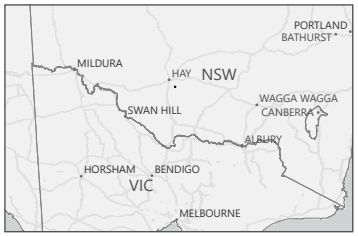
C:\Users\mbeadman\UMWELT (AUSTRALIA) PTY LTD\2110 - 03.SKKY..R34 - Amended BDAR\02. Projects\2110_R34 Amended BDAR_v1.aprx - 2110_R34_0302_DirectImpactsTECS

FIGURE 8.2.3

Direct Impacts to TECs

Legend

- Stage 1 (South) Development Footprint
- Road
- Area of Impact



0 60 120

Meters

Scale 1:5,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

C:\Users\mbeadman\UMWELT (AUSTRALIA) PTY LTD\22110 - 03.SKAF.R34 - Amended BDAR\02. Projects\22110_R34_AmendedBDAR_v1.aprx - 22110_R34_0802_DirectImpactsTECS

FIGURE 8.2.4

Direct Impacts to TECs

Legend

- Stage 1 (South) Development Footprint
- Road
- Watercourse
- Area of Impact

0 60 120

Meters

Scale 1:5,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

C:\Users\mbeadman\UMWELT (AUSTRALIA) PTY LTD\22110 - 03.SKMY.R34 - Amended BDAR\02. Projects\22110_R34_AmendedBDAR_v1.aprx - 22110_R34_0302_DirectImpactsTECS

8.1.2 Direct Impacts to Threatened Species

Direct impacts are described in the BAM as those impacts 'on biodiversity values and threatened species habitat that relate to clearing native vegetation and impacts on biodiversity values prescribed by the BC Regulation. This includes impacts from activities related to the construction or operational phase of the proposal'. Within the Development Footprint, clearance of native vegetation has presumed to result in complete loss of biodiversity values, with complete loss of individuals occupying that area of vegetation and complete loss of any habitat values.

Associated with the direct impacts as clearing of native vegetation detailed in **Section 8.1.1**, there will be clearing of areas of occupancy and habitat for nine species credit species as recorded during the completed field surveys in the Stage 1 – Linear and Stage 2 – Linear Development Footprints:

- *Eleocharis obcis*
- *Maireana cheelii*
- *Swainsona sericea*
- *Swainsona murrayana*
- *Lepidium monoplocoides*
- Little Eagle
- Barking Owl
- Southern Bell Frog
- Plains-wanderer.

Two (2) previously assumed present species, *Austrostipa wakoolica* and *Cullen parvum*, have had targeted flora surveys completed in the Project Area since exhibition of the BDAR. Neither target species was recorded through these detailed surveys. As such, there is no species polygon applicable for these two (2) species and the Project is not considered to impact them.

All these species are assessed as area-based assessment species credit species. **Table 8.3** details the areas of all species credit species being directly impacted by the Development Footprint. The area impacted is shown in **Figure 8.3**.

Table 8.3 Summary of Direct Impacts on Threatened Species Credit Species

Species name	Common name	BC Act	EPBC Act	Sensitivity to gain class	SAII?	Habitat to be impacted (hectares)			Total Area to be Impacted (ha)
						Stage 1 – Linear	Stage 1 – Site based	Stage 2 – Linear	
Flora									
Eleocharis obicis	Spike-rush	V	V	Moderate	No	0.0	0.0	7.31	7.31
Lepidium monoplocoides	Winged Pepper-cress	E	E	High	No	3.52	0.0	0.0	3.52
Maireana cheelii	Chariot Wheels	V	V	High	No	2.01	0.0	2.66	4.67
Swainsona murrayana	Slender Darling Pea	V	V	High	No	52.23	0.0	70.86	123.09
Swainsona sericea	Silky Swainson-pea	V	-	High	No	4.18	0.0	5.6	9.78
Fauna									
Hieraaetus morphnoides	Little Eagle	V	-	Moderate	No	20.46	0.0	15.35	35.81
Litoria raniformis	Southern Bell Frog	E	V	Moderate	No	34.87	0.0	17.29	52.16
Ninox connivens	Barking Owl	V	-	High	No	4.16	0.0	0.0	4.16
Fauna (Additional and Appropriate Measures)									
Pedionomus torquatus	Plains-wanderer[1]	E	CE	High	Yes	20.20	0.00	0.69	20.89*

[1] Impacts presented for Plains-wanderer are based on the assessment of supplementary habitat, it does not include any impacts to NSW identified Important Habitat Mapping as all of that critical species habitat mapping was avoided by the Project.

** 2.61 ha comprising existing mapping of infrastructure, non-native vegetation and/or waterbodies.*

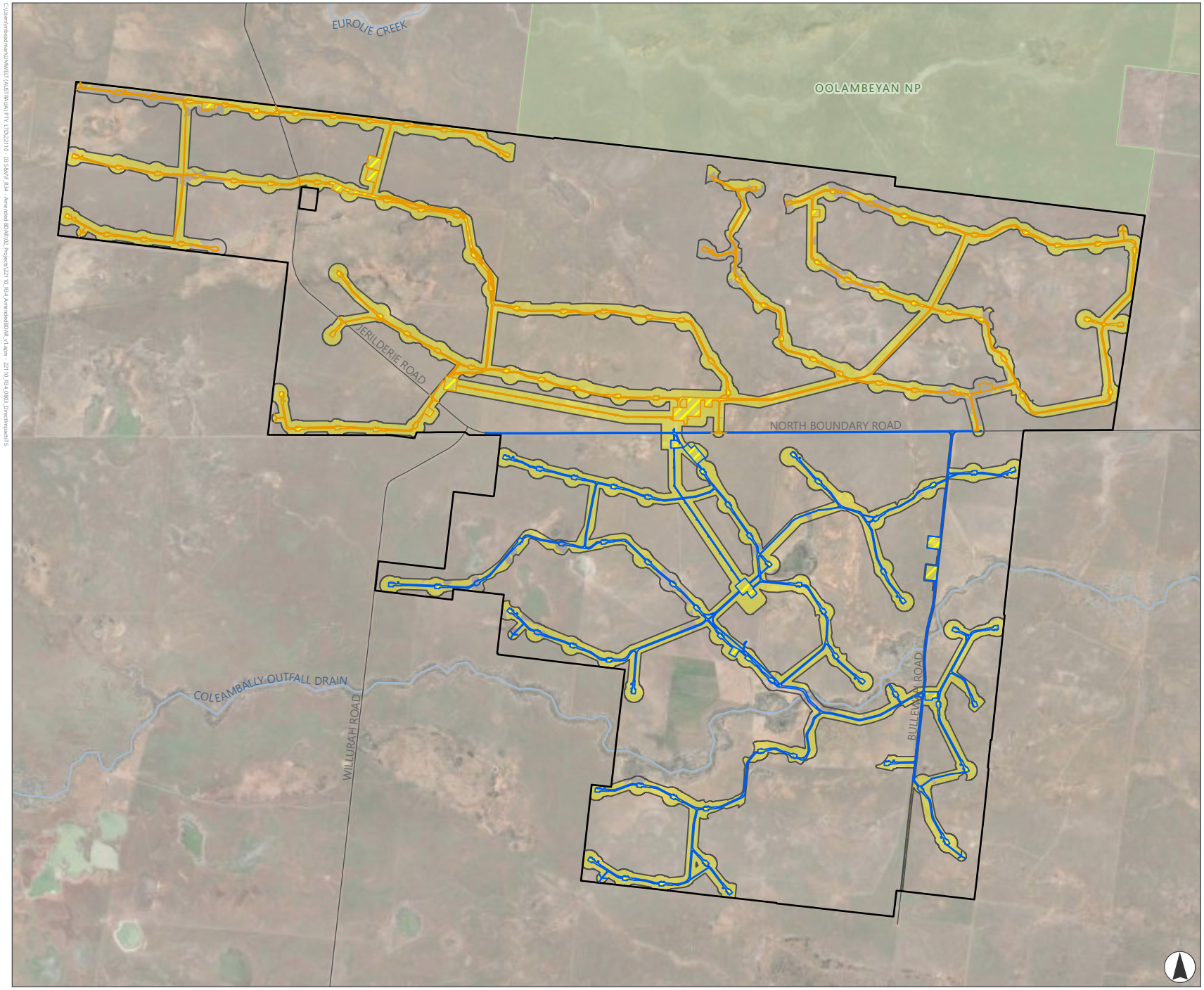


FIGURE 8.3.1

Direct Impacts to Threatened Species

Legend

- Project Boundary
- Subject Land
- Stage 1 (South) Development Footprint
- Stage 2 (North) Development Footprint
- NPWS Reserves
- Road
- Watercourse
- Area of Impact
- Threatened Species Polygon Combined Areas

0 1,000 2,000

Meters

Scale 1:110,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

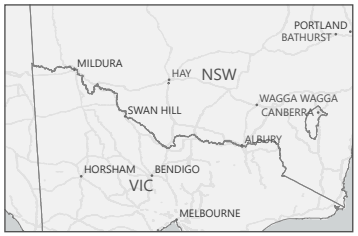
Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

FIGURE 8.3.2

Direct Impacts to Threatened Species

Legend

- Stage 1 (South) Development Footprint
- Road
- Area of Impact
- Threatened Species Polygon Combined Areas



0 60 120

Meters

Scale 1:5,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

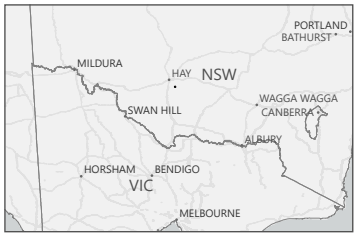
C:\Users\mbeadman\UMWELT (AUSTRALIA) PTY LTD\2110 - 03.SKNY..R34 - Amended BDAR\02. Projects\2110_R34 Amended BDAR_v1.aprx - 2110_R34_0803_DirectImpact15

FIGURE 8.3.3

Direct Impacts to Threatened Species

Legend

- Stage 1 (South) Development Footprint
- Road
- Area of Impact
- Threatened Species Polygon Combined Areas



0 60 120

Meters

Scale 1:5,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

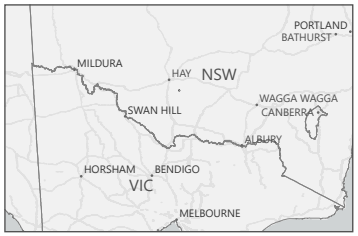
C:\Users\mbeadman\UMWELT (AUSTRALIA) PTY LTD\22110 - 03.SKKY..R34 - Amended BDAR\02. Projects\22110_R34_AmendedBDAR_v1.aprx - 22110_R34_0803_DirectImpact15

FIGURE 8.3.4

Direct Impacts to Threatened Species

Legend

- Stage 1 (South) Development Footprint
- Road
- Watercourse
- Area of Impact
- Threatened Species Polygon Combined Areas



0 60 120

Meters

Scale 1:5,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

C:\Users\mbeadman\UMWELT (AUSTRALIA) PTY LTD\22110 - 03.SKKY..R34 - Amended BDAR\02. Projects\22110_R34_AmendedBDAR_v1.aprx - 22110_R34_0303_DirectImpact15

8.2 Indirect Impacts

8.2.1 Indirect impacts

Indirect impacts are those 'that occur when the proposal affects native vegetation and threatened species habitat beyond the Subject Land or within retained areas. This includes impacts from activities related to the construction or operational phase of the proposal and prescribed impacts'.

A risk matrix (**Table 8.4** and **Table 8.5**) was applied to indirect impacts, as specified in the BAM Section 8.2, to assess the likelihood of each occurring following the implementation of all mitigation measures. The potential consequences to biodiversity during the construction and operational phases of the Project are described in **Table 8.6**.

Table 8.4 Risk Matrix Criteria

Score	Description
Likelihood of Impact	
Almost certain	Very high or certain probability that impact will occur or event is of continuous nature
Likely	Likely probability that impact will occur or event is frequent (1–5 years)
Possible	Moderate probability that the impact will occur or the event is infrequent (5–20 years)
Unlikely	Low probability that impact will occur or event is very infrequent (100+ years)
Remote	Very low probability that impact will occur or may occur under extenuating circumstances. Event is very rare and stochastic in nature (frequency 1000+ years)
Likelihood of Consequence	
Significant	An impact that is widespread, permanent and may result in large-scale loss of 'critical' habitat
Major	An impact that is widespread, long lasting and may result in large-scale loss of important habitat*
Moderate	Large-scale conversion of natural habitat or small-scale conversion of important habitat*
Minor	Temporary and localised impact to natural habitat
Insignificant	No measurable impact

** refers to general importance of habitat to biodiversity values, not necessarily 'Important Habitat' as defined within the BAM.*

Table 8.5 Risk Matrix

Risk Matrix		Likelihood of Consequence					
		Unknown	Insignificant	Minor	Moderate	Major	Significant
Likelihood of Impact	Remote	Unknown	Negligible (N)	Negligible (N)	Very Low (VL)	Low (L)	Medium (M)
	Unlikely	Unknown	Negligible (N)	Very Low (VL)	Low (L)	Medium (M)	High (H)
	Possible	Unknown	Very Low (VL)	Low (L)	Medium (M)	High (H)	Very High (VH)
	Likely	Unknown	Low (L)	Medium (M)	High (H)	Very High (VH)	Extreme (E)
	Almost certain	Unknown	Medium (M)	High (H)	Very High (VH)	Extreme (E)	Extreme (E)
	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown

Table 8.6 Potential indirect impacts to biodiversity including their extent, frequency, timing, duration and consequence

Indirect Impact	Impacted Biodiversity	Timing and Duration	Extent	Frequency	Likelihood of Impact	Likelihood of Consequence	Indirect Impact Level	Summary and Potential Consequences
Reduced viability of adjacent habitat due to edge effects	Native vegetation, including three Threatened Ecological Communities: • Sandhill Pine Woodland EEC • Myall Woodland EEC • Weeping Myall Woodlands EEC. Native fauna species, including: • Plains-wanderer • Southern Bell Frog • Native flora species, including: • *Maireana cheelii* • *Swainsona sericea* • *Swainsona murryana* • *Eleocharis obicis* • *Lepidium monoplocoides.*	Construction phase (short-term, permanent)	Zones 1–12	During clearing	Almost certain	Moderate	VH	• Earthworks, foot traffic, plant or vehicle movements may lead to introduction or spread of weed species that would reduce the quality and integrity of adjacent native vegetation, EECs and habitat. • Edge effects may result in increased competition between native fauna species for resources and displacement of native fauna species. • Installation of infrastructure including fencing may result in increased risk of predation on Plains-wanderer.
		Operational phase (long-term, permanent)	Unknown	Throughout operational phase	Almost certain	Moderate	VH	
Reduced viability of adjacent habitat due to noise, dust or light spill	Native vegetation, including three Threatened Ecological Communities: • Sandhill Pine Woodland EEC • Myall Woodland EEC • Weeping Myall Woodlands EEC. Native fauna species and their habitat, including: • Plains-wanderer • Southern Bell Frog • Barking Owl • Black Falcon, Little Eagle, Spotted Harrier and another non-threatened raptor species	Construction phase (short-term)	Zones 1–12	Throughout construction phase	Likely	Minor	M	Noise, light and dust will be managed during construction to relevant standards. There is potential for retained areas of habitat in close proximity to construction works to be affected by noise, dust and light spill as follows: • Noise and light spill may lead to altered behaviour in fauna species. • Increased dust may result in health impacts to fauna and reduced photosynthetic capacity for flora. Any residual noise, light and dust is likely to have negligible impacts on threatened and non-threatened fauna species.
		Operational phase (long-term)	Unknown	Throughout operational phase	Possible	Minor	L	
Transport of weeds and pathogens from the site to adjacent vegetation	Native vegetation, including three Threatened Ecological Communities: • Sandhill Pine Woodland EEC • Myall Woodland EEC • Weeping Myall Woodlands EEC. Native fauna species and their habitat, including: • Plains-wanderer • Southern Bell Frog.	Construction phase (short-term)	Unknown	Throughout construction phase	Almost certain	Moderate	VH	• Earthworks may result in the movement of weeds across the site and into adjacent vegetation. • Vehicle movement may lead to weeds being spread across the site or lead to the introduction of weed species to the site. • Increased weed and pathogens may reduce the quality of native vegetation, EECs, and habitat for native fauna species.
		Operational phase (long-term)	Unknown	Throughout operational phase	Possible	Moderate	M	

Indirect Impact	Impacted Biodiversity	Timing and Duration	Extent	Frequency	Likelihood of Impact	Likelihood of Consequence	Indirect Impact Level	Summary and Potential Consequences
	Native flora species, including: • *Maireana cheelii* • *Swainsona sericea* • *Swainsona murryana* • *Eleocharis obicis* • *Lepidium monoplocoides.*							
Increased risk of starvation or exposure, and loss of shade or shelter	Native fauna species and their habitat, including: • Plains-wanderer • Southern Bell Frog • Threatened birds (Southern Whiteface, White-fronted Chat, Flame Robin, Diamond Firetail, Blue-winged Parrot, Grey-crowned Babbler).	Construction phase (short-term, permanent)	Unknown	During clearance	Possible	Minor	L	• Loss of vegetation may increase the risk of exposure. • The removal of foraging habitat may increase competition between native fauna species for remaining resources. • Loss of sheltering or breeding habitat may lead to increased competition for remaining resources.
		Operational phase (long-term, permanent)	Unknown	Throughout operational phase	Unlikely	Minor	VL	
Loss of breeding habitat	Native fauna species and their habitat, including: • Plains-wanderer • Southern Bell Frog • Wedge-tailed Eagle • Barking Owl • Threatened birds (Southern Whiteface, White-fronted Chat, Flame Robin, Diamond Firetail, Blue-winged Parrot, Grey-crowned Babbler).	Construction phase (short-term, permanent)	Zones 1–12	During clearance	Almost certain	Significant	E	• Removal of breeding habitat may disrupt the breeding cycle of species, and potentially lead to displacement of affected species.
		Operational phase (long-term, permanent)	Unknown	Throughout operational phase	Possible	Major	H	
Trampling of threatened flora species	Native flora species, including: • *Eleocharis obicis* • *Lepidium monoplocoides* • *Swainsona murrayana* • *Swainsona sericea* • *Maireana cheelii*.	Construction phase (short-term)	Zones 1–12	Throughout construction phase	Likely	Moderate	H	• Trampling may result in the mortality of a threatened flora species, and therefore may decrease the size of threatened flora species populations.
		Operational phase (long-term)	Unknown	Throughout operational phase	Possible	Moderate	M	
Rubbish dumping	Native vegetation, including three Threatened Ecological Communities: • Sandhill Pine Woodland EEC • Myall Woodland EEC • Weeping Myall Woodlands EEC.	Construction phase (short-term)	Zones 1–12	Throughout construction phase	Almost certain	Moderate	VH	• The dumping of rubbish may reduce the quality of native vegetation. • May result in increasing predatory and pest animal species. • May result in injury or mortality to native fauna species.
		Operational phase (long-term)	Unknown	Throughout operational phase	Possible	Moderate	M	

Indirect Impact	Impacted Biodiversity	Timing and Duration	Extent	Frequency	Likelihood of Impact	Likelihood of Consequence	Indirect Impact Level	Summary and Potential Consequences
	Native fauna species and their habitat, including: • Plains-wanderer • Southern Bell Frog • Wedge-tailed Eagle • Barking Owl • Threatened birds (Southern Whiteface, White-fronted Chat, Flame Robin, Diamond Firetail, Blue-winged Parrot, Grey-crowned Babbler). Native flora species, including: • *Maireana cheelii* • *Swainsona sericea* • *Swainsona murryana* • *Eleocharis obicis* • *Lepidium monoplocoides.*							
Wood collection	Native fauna species and their habitat	Construction phase (short-term)	Unknown	Throughout construction phase	Unlikely	Minor	VL	• Unlawful harvesting of timber and fallen logs may reduce quality of native vegetation, EECs, and the amount of habitat available for native species. • Injury or mortality of native fauna species as a result of the removal.
		Operational phase (long-term)	Unknown	Throughout operational phase	Unlikely	Minor	VL	
Removal and disturbance of rocks, including bush rock	Native fauna species and their habitat	Construction phase (short-term)	Unknown	During clearance	Unlikely	Minor	VL	• Reduced availability of habitat or shelter for ground-dwelling native fauna. • Injury or mortality of native fauna species as a result of removal or disturbance.
		Operational phase (long-term)	Unknown	Throughout operational phase	Remote	Minor	N	
Increase in predatory and pest species populations	Native fauna species, including: • Plains-wanderer • Southern Bell Frog.	Construction phase (short-term)	Unknown	Throughout construction phase	Likely	Major	VH	• Increased human presence, and therefore increased presence of rubbish/food, may result in an increase in the presence of pest species, including predators, in the area. • Clearing of vegetation causing a reduction in the area available for fauna species to occupy, resulting in an increased concentration of pest species in an area. • Increased injury or morality of native fauna species as a result of increased competition and predation with pest species.
		Operational phase (long-term)	Unknown	Throughout operational phase	Possible	Major	H	
Increased fire risk	Native vegetation, including three Threatened Ecological Communities: • Sandhill Pine Woodland EEC • Myall Woodland EEC • Weeping Myall Woodlands EEC.	Construction phase (short-term)	Unknown	Throughout construction phase	Possible	Moderate	M	• The use of machinery, particularly in summer, can increase the risk of fire. • Storage and utilisation of flammable materials on site can increase fire risk. • Human-caused fires may be detrimental to native vegetation and cause injury or mortality to native fauna species.
		Operational phase (long-term)	Unknown	Throughout operational phase	Possible	Moderate	M	

Indirect Impact	Impacted Biodiversity	Timing and Duration	Extent	Frequency	Likelihood of Impact	Likelihood of Consequence	Indirect Impact Level	Summary and Potential Consequences
	Native fauna species, including: • Plains-wanderer • Southern Bell Frog. Native flora species, including: • *Maireana cheelii* • *Swainsona sericea* • *Swainsona murryana* • *Eleocharis obicis* • *Lepidium monoplocoides.*							
Disturbance to specialist breeding and foraging habitat	Native fauna species and their habitat, including: • Plains-wanderer • Southern Bell Frog.	Construction phase (short-term, permanent)	Unknown	Throughout construction phase	Possible	Moderate	M	• Potential disturbance of low-lying depressions that may be utilised as breeding sites by frogs species. • This disturbance may result in a disruption in the breeding cycle of frog species on the site.
		Operational phase (long-term, permanent)	Unknown	Throughout operational phase	Unlikely	Minor	VL	
Pollutant spills	Native vegetation, including three Threatened Ecological Communities: • Sandhill Pine Woodland EEC • Myall Woodland EEC • Weeping Myall Woodlands EEC. Native fauna species and their habitat, including: • Southern Bell Frog.	Construction phase (short-term)	Unknown	Throughout construction phase	Possible	Minor	L	• Pollutant spill may contaminate and change the composition of soils, resulting in detrimental impacts to native vegetation.
		Operational phase (long-term)	Unknown	Throughout operational phase	Possible	Minor	L	

8.2.2 Proximity of Wind Turbines to Large Intact Patches of Woody Vegetation

Given the proximity to of the Project to Oolambeyan National Park, this assessment has considered a EUROBAT Publication article by Rodrigues et al (2015) regarding the proximity of wind turbines to the National Parks Estate.

This article suggests that wind turbines should be located a minimum of 200 m away from woodlands and forests (or structures that would provide substantial habitat for microbats) to minimise potential turbine strike impacts to microbats. Importantly, the 200 m distance is to be measured from the tip of the wind turbine blade, not the wind turbine tower itself. In the case of this Project, with approximately 100 m long wind turbine blades, the recommended buffer is in the order of 300 m from the WTG locations.

8.2.2.1 Consideration of Oolambeyan National Park and Conservation Areas

The Rodrigues et al (2015) article focuses on the minimisation of impacts to microbats; however we have considered both bird and bat species known, likely or with the potential to inhabit Oolambeyan National Park.

Oolambeyan National Park provides high quality habitat for woodland and forest birds, and due to its size and lack of ongoing disturbances provides better habitat than the woodlands and forests within the Project Area. The National Park provides a large tract of suitable habitat for Barking Owl, which was heard calling during nocturnal surveys works.

It is likely that Oolambeyan National Park contains suitable breeding habitat for Barking Owl. Oolambeyan National Park may also provide suitable foraging and breeding habitat for hollow dependant microbats species, predicted to occur within the Subject Land. The habitat buffer described in the Rodrigues et al (2015) article was considered by BWF during the design phase of the Project.

Oolambeyan National Park also provides habitat for the Plains-wanderer and there are multiple species' records there. Conservation reserves and grazed lands play a complementary role. Conservation reserves are not grazed and therefore provide habitat during droughts when groundcover becomes reduced. Conversely, grazed lands are important during wet years as grazing reduces grass height and helps to maintain a more open groundcover (Nugent *et al.* 2022b). The Project may reduce connectivity between Oolambeyan National Park and areas of mapped important habitat, the two conservation areas and other suitable habitat within the study area.

No WTG are located within 300 m of Oolambeyan National Park. The closest WTG are located 450 to 600 m away from the boundary of the National Park, exceeding the recommended buffer by 150 to 200 m. Detailed consideration of appropriate buffers to the National Park are provided in Section 7.3.5.5 of the Project's EIS (Umwelt, 2024). **Figure 8.4** shows the proximity of the turbines to Oolambeyan National Park.

Oolambeyan National Park and the two conversation areas may also be impacted by other forms of indirect impacts, such as edge effects, increased predation, invasion of weeds and pathogens as a result of the construction works. These indirect impacts have the potential to reduce the integrity of vegetation and threatened species habitat present within these areas.

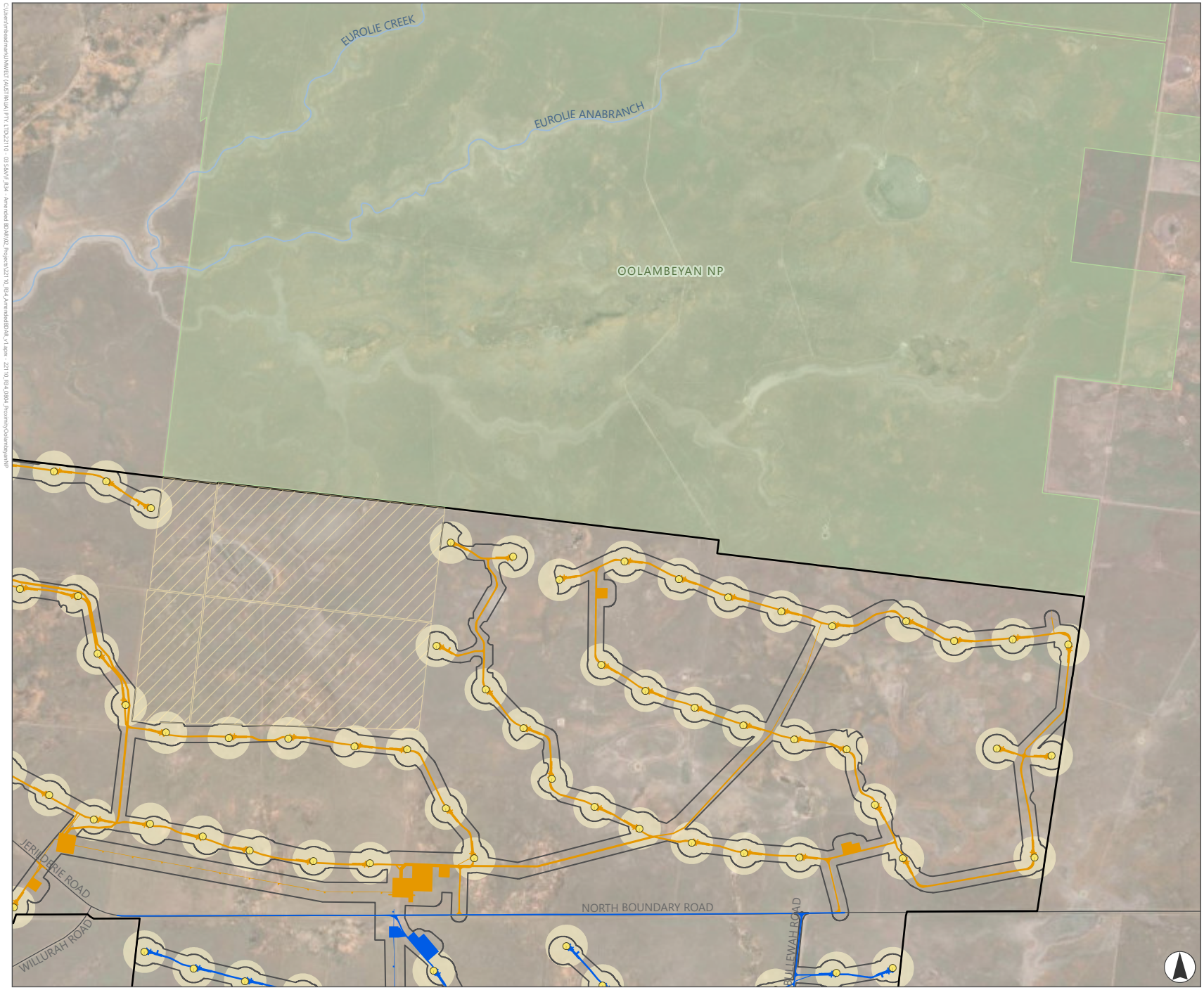


FIGURE 8.4

Proximity to Oolambeyan National Park

Legend

- Project Boundary
- Subject Land
- Stage 1 (South) Development Footprint
- Stage 2 (North) Development Footprint
- Wind Turbine Generators
- 300m Turbine Buffer
- Conservation Agreement Area
- NPWS Reserves
- Road
- Watercourse

0 870 1,740

Meters

Scale 1:75,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

8.3 Prescribed Biodiversity Impacts

Prescribed impacts are described in **Section 6.0** and **Section 7.1.2** and an assessment of prescribed impacts is provided in **Table 8.9**.

No threatened entities are considered likely to be dependent upon or may use habitat features associated with any of the prescribed impacts. The impacts of wind turbine strike on protected animals are considered in detail in **Appendix G**.

8.3.1 Human-Made Structures and Non-Native Vegetation

An assessment of the impacts on threatened entities associated with non-native vegetation is provided in **Table 8.7**.

Table 8.7 Potential Impacts on Threatened Entities Associated with Human-Made Structures and Non-Native Vegetation

Threatened entity	Human-made structures and/or non-native vegetation with potential to be habitat	Nature, extent and duration of short and long-term impacts due to removal of structures and/or non-native vegetation	Importance within the bioregion of the habitat to the threatened entity	Consequences of the impacts for the local and bioregional persistence
Southern bell Frog	The non-native vegetation consists of agricultural grazing land and cleared banks of the Coleambally Outfall Drain.	Approximately 4.95 ha of non-native vegetation and/or structures will be permanently removed during construction for the life of the Project.	Suitable native and non-native habitat for Southern bell frogs will remain within the Subject Land and surrounds. Given this, it is unlikely that the non-native vegetation to be removed within the Subject Land is significantly important to these threatened entities.	As the non-native vegetation within the Subject Land is not considered important to the threatened entities, it is unlikely that the removal will impact the local and bioregional persistence of these species.
Threatened microbats including Yellow-bellied Sheathtail-bat, Little Pied Bat, Inland Forest Bat	The bridges crossing Coleambally Outfall Drain have the potential to be habitat for microbats, however no bats were observed roosting under the structures. Southern Myotis was not recorded during targeted surveys.	There is currently no design work for be bridge upgrades, however, two options have been proposed. The upgrades will either involve strengthening the bridge by underpinning or building additional piers which would require excavation or drilling; or building an additional temporary road alongside the bridge to take the abnormal loads.	No microbat species were recorded frosting under the bridge during field surveys. The bridges are made of cement and currently possess limited habitat for roosting microbats. While possessing marginal rooting habitat, it is unlikely the two bridges are important to threatened bat species, such as Southern Myotis, or non-threatened bats species with the locality.	As the bridges over Coleambally Outfall Drain are not considered important to the threatened entities, it is unlikely that the removal will impact the local and bioregional persistence of these species.
Raptor species including Black Falcon, Little Eagle, and Wedge-tailed Eagle	The non-native vegetation consists of agricultural grazing land and cleared banks of the Coleambally Outfall Drain. Black Falcons nest on transmission towers within the Project Area.	Approximately 4.95 ha of non-native vegetation and/or structures will be permanently removed during construction for the life of the Project. No transmission towers will be removed as part of the Project.	Threatened and non-threatened raptor species, such as Black Falcon, Little Eagle, and White-bellied Sea-Eagle, forage over vast areas and a wide variety of habitat. Given this, it is unlikely that the non-native vegetation to be removed within the Subject Land is significantly important to these threatened entities.	As the non-native vegetation within the Subject Land is not considered important to the threatened entities, it is unlikely that the removal will impact the local and bioregional persistence of these species.

8.3.2 Habitat Connectivity

As assessment of the impacts of the Project on habitat connectivity, which facilitates the movement of threatened species across their range, within the Subject Land is provided in **Table 8.8**. Habitat connectivity is mapped in **Figure 3.4** and described in **Section 3.3**.

Table 8.8 Potential Impacts on Connectivity of Habitat of Threatened Entities

Threatened entity	Movement patterns key to the life cycle of the threatened entity	Nature, extent and duration of short and long-term impacts to connectivity	Importance of the area of connectivity within the bioregion and to the lifecycle of the species	Consequences of the impacts for the local and bioregional persistence
Threatened birds (Southern Whiteface, White-fronted Chat, Flame Robin, Diamond Firetail, Blue-winged Parrot, Grey-crowned Babbler)	The vegetation along Coleambally Outfall Drain may facilitate the movement of threatened birds, including Southern Whiteface, White-fronted Chat, Flame Robin, Diamond Firetail, Blue-winged Parrot, Grey-crowned Babbler through the Subject Land, and across the wider Project Area and locality.	During construction up to 638.01 ha of native vegetation, including 1.8 ha of vegetation along Coleambally Outfall Drain will be permanently removed.	Impacts to 1.8 ha of native vegetation surrounding Coleambally Outfall Drain would remove suitable foraging habitat for threatened bird species and fragment a key movement corridor through the Project Area. The removal of 638.01 ha of native vegetation connectivity for smaller threatened birds, however given the long linear nature of the development and mobility of these species, the impacts to would be expected to be negligible and unlikely affect connectivity at a bioregion scale.	The threatened birds recorded during field surveys are highly mobile and are unlikely to be impacted by the removal of 638.01 ha of native vegetation, including 1.8 ha of vegetation along the drain, such that the Project impacts local or bioregional persistence.
Threatened microbats including Yellow-bellied Sheathtail-bat, Little Pied Bat, Inland Forest Bat	The vegetation along Coleambally Outfall Drain may facilitate the movement of microbats, including Yellow-bellied Sheathtail-bat, Little Pied Bat, and Inland Forest Bat	During construction up to 638.01 ha of native vegetation, including 1.8 ha of vegetation along Coleambally Outfall Drain will be permanently removed.	Impacts to 1.8 ha of native vegetation surrounding Coleambally Outfall Drain would remove suitable foraging habitat for threatened microbats and fragment a key movement corridor through the Project Area.	The threatened microbats recorded during field surveys are highly mobile and are unlikely to be impacted by the removal of 638.01 ha of native vegetation, including 1.8 ha of vegetation along the drain, such that the Project impacts local or bioregional persistence.

Threatened entity	Movement patterns key to the life cycle of the threatened entity	Nature, extent and duration of short and long-term impacts to connectivity	Importance of the area of connectivity within the bioregion and to the lifecycle of the species	Consequences of the impacts for the local and bioregional persistence
			The removal of 638.01 ha of native vegetation connectivity for smaller threatened birds, however given the long linear nature of the development and mobility of these species, the impacts to would be expected to be negligible and unlikely affect connectivity at a bioregion scale.	
Southern Bell Frog	The vegetation along Coleambally Outfall Drain may facilitate the movement of threatened fauna, including Southern Bell Frog through the Subject Land, and across the wider Project Area and locality.	During construction up to 52.16 ha of Southern Bell Frog habitat, including 1.8 ha of vegetation along Coleambally Outfall Drain will be permanently removed.	The removal of 638.01 ha of native vegetation, including 1.8 ha of vegetation along Coleambally Outfall Drain, would fragment suitable habitat for Southern Bell Frog. However, given the long linear nature of the development and the extensive areas of native vegetation that would retained across the Project Area and wider locality, the removal of suitable habitat is unlikely to be important for connectivity within the bioregion or the lifecycle of the species.	Southern Bell Frogs are mobile and are unlikely to be impacted by the removal of 638.01 ha of native vegetation, including 1.8 ha of vegetation along the drain, such that the Project impacts local or bioregional persistence.

Threatened entity	Movement patterns key to the life cycle of the threatened entity	Nature, extent and duration of short and long-term impacts to connectivity	Importance of the area of connectivity within the bioregion and to the lifecycle of the species	Consequences of the impacts for the local and bioregional persistence
Plains-wanderer	The Project would result in the fragmentation native vegetation between areas of Plains-wanderer Important Habitat across the Project Area. The Project may also result in the fragmentation of Plains-wanderer home-ranges, potentially disrupting movements between denser nesting habitat and more open foraging habitat.	The Project has completely avoided mapped Important Habitat within the Project Area. Notwithstanding, during construction up to 20.89 ha of supplementary Plains-wanderer habitat would be permanently removed. This total extent of impact comprises 2.61 ha of existing mapping of infrastructure, non-native vegetation and/or waterbodies.	The Project has completely avoided mapped Important Habitat within the Project Area. The removal of 638.01 ha would fragment native vegetation and connectivity between areas of mapped Important Habitat for Plains-wanderer. It would also fragment the native vegetation connecting suitable habitat for Southern Bell Frog.	Plains-wanderers are generally a sedentary species which make movements in response to changes in habitat suitability. The removal of native vegetation may impede movement of the species between areas of suitable habitat at multiple spatial scales and reduce breeding success by fragmenting individual home-ranges and disrupting dispersal between habitat patches.

8.3.2.1 Plains-wanderer

Habitat fragmentation for the Plains-wanderer may occur due to access tracks, cable trenches, turbine pads and other infrastructure due to the avoid of habitat near structures (e.g. buildings and fences) and transmission lines that allow perching by raptors (predator avoidance). Habitat fragmentation may occur at several spatial scales. Project infrastructure may fragment individual home-ranges, resulting in reduced rates of movement between habitat with structural variation required for different activities including foraging, roosting and reproduction (see Nugent *et al.* 2022a). At an intermediate scale, project infrastructure may isolate areas of important habitat and BCT conservation areas within the study area (**Figure 8.4** and **Figure 8.5**). This may potentially isolate and sterilise areas of occupied habitat. At a landscape scale, the project may inhibit or reduce with the movement of the Plains-wanderer between conservation areas in the study area and Oolambeyan National Park. This may interfere with metapopulation dynamics and the ability of the species to move in response to variation in climatic conditions (Nugent *et al.* 2022b).

Given the Plains-wanderer's ability to use open habitat for roosting, narrow and infrequently used access tracks and cable trenches are not likely to significantly reduce movement in the longer-term, but may cause short-term impacts during and immediately following construction due to ground surface disturbance. Of greater concern is the avoidance of habitat due to the installation of infrastructure such as buildings, fences and powerlines that allow perching by raptors. Plains-wanderers are known to avoid trees for a distance of up to 300 m. However, the height of tree influence the avoidance distance (Department of the Environment and South Australian Department of Environment, Water and Natural Resources 2016). It is assumed infrastructure would have a similar effect. Wind turbines are very tall structures but offer limited perching opportunities and may often be avoided due to the rotation of the blades. As such, it is unclear how the Plains-wanderer would react to wind turbines.

8.3.3 Water Bodies, Water Quality and Hydrological Processes

An assessment of the impact threatened entities associated with water bodies or hydrological processes is provided in **Table 8.9**. A Water Resources Impact Assessment (WRM, 2024) prepared for the EIS (Appendix 13) considered the potential impacts and appropriate measures to mitigate any potential impacts on water resources associated with the Project. The Water Resources Impact Assessment provides an assessment of the potential impacts of the Project on the water resources in the vicinity of the Project Area. The assessment considers surface water, groundwater, water quality and hydrology impacts associated with the construction and operation of the Project.

The Water Resources Impact Assessment found that the Project will have minimal impact on water resources as it involves limited ground disturbance, does not involve the storage or handling of large volumes of pollutants, and once constructed does not consume significant quantities of water. Key potential issues relevant to the water resources impacts of the Project are as follows:

- Potential impacts to surface water resources are primarily limited to the construction and decommissioning phases of the Project. These potential impacts can be mitigated to represent negligible risk.
- The operational phase of the Project presents minimal risk provided that by the conclusion of the construction phase appropriate groundcover and drainage is established.

- The Project will not interact with the groundwater table and therefore, no impacts to groundwater resources or GDEs are expected.
- The Project Area does not contain any areas of major flood hazard.
- The large extent of the Project Area and distributed nature of minor impacts (if any) does not pose a risk to drainage features, downstream watercourses or receiving waters.

For these reasons, the key potential risks to surface water are only associated with the Project's construction. These risks can be adequately managed through the application of well-established construction environmental and safety management practices and appropriate design.

Table 8.9 Potential Impacts to Water Quality, Water Bodies and Hydrological Processes that Sustain Threatened Entities

Threatened entity	Waterbodies impacted	Nature, extent and duration of short and long-term impacts on water quality and hydrological process	Nature, extent and duration of short and long-term impacts on habitat and life cycle	Importance within the bioregion of the waterbody or hydrological process	Consequences of the impacts for the local and bioregional persistence
Southern bell frog	Coleambally Outfall Drain	The Project has the potential to cause short-term minor reduction in water quality during construction phase. However, potential impacts to surface water resources are primarily limited to the construction and decommissioning phases of the Project and can mitigated to represent negligible risk. The operational phase of the Project presents minimal risk. Furthermore, the modelling prepared for the Project found that the large extent of the Project Area and distributed nature of minor impacts (if any) does not pose a risk to drainage features, downstream watercourses or receiving waters.	Short-term reduction in the quality of habitat, which may affect the life cycle of threatened entities during the construction phase. This potential impact can be mitigated to represent negligible risk to Southern Bell Frog habitat and life cycle.	The Murray and Murrumbidgee Rivers and their major tributaries occur within the Riverina Bioregion. Given how prominent natural watercourses are within the Bioregion, it is unlikely that the Coleambally Outfall Drain is significantly important to fauna species within the area.	Farm dams that provide habitat for Southern Bell Frogs will remain within the Project Area, and risks associated with a short-term reduction in water quality through sedimentation can be readily mitigated. More broadly there are many watercourses within the Bioregion. Hence, it is unlikely that there will be a significant impact to the local and bioregional persistence of threatened entities. The Project does not pose a risk to drainage features, downstream watercourses or receiving waters.
Migratory birds and waterbirds including Australasian Bittern, Australian Painted Snipe, Blue-billed Duck, Brolga, Magpie Goose	Ephemeral Wetlands	The Project would result in the permanent removal 0.06 ha of ephemeral wetlands across the Subject Land. The disturbance of the ground surface during construction poses the risk of erosion and sediment transport and deposition during significant rainfall events.	Short-term reduction in the quality of habitat, which may affect the life cycle of threatened entities during the construction phase. This potential impact can be mitigated to represent negligible risk to migratory and waterbird habitat and life cycle.	The Riverina Bioregion is dominated by river channels, floodplains, backplains, swamps and lakes. There are also extensive areas of PCTs associated with ephemeral wetlands throughout out the Bioregion.	The ephemeral wetlands within the Subject Land likely provide habitat for threatened entities. However, given the extent of similar habitat throughout the Bioregion the removal is unlikely to impact on the local and bioregional persistence of the threatened entities.

Threatened entity	Waterbodies impacted	Nature, extent and duration of short and long-term impacts on water quality and hydrological process	Nature, extent and duration of short and long-term impacts on habitat and life cycle	Importance within the bioregion of the waterbody or hydrological process	Consequences of the impacts for the local and bioregional persistence
		Additional areas of ephemeral wetlands may be affected by sedimentation. The Project has the potential to cause short-term minor reduction in water quality during construction phase. However, potential impacts to surface water resources are primarily limited to the construction and decommissioning phases of the Project and can mitigated to represent negligible risk. The operational phase of the Project presents minimal risk. Furthermore, the modelling prepared for the Project found that the large extent of the Project Area and distributed nature of minor impacts (if any) does not pose a risk to drainage features, downstream watercourses or receiving waters.		It is therefore unlikely that the ephemeral wetlands within the Subject Land are significantly important.	The Project does not pose a risk to drainage features, downstream watercourses or receiving waters.

Threatened entity	Waterbodies impacted	Nature, extent and duration of short and long-term impacts on water quality and hydrological process	Nature, extent and duration of short and long-term impacts on habitat and life cycle	Importance within the bioregion of the waterbody or hydrological process	Consequences of the impacts for the local and bioregional persistence
Plains-wanderer	Ephemeral pools within habitat	Short-term and potentially long-term changes to hydrology and sediment transport. The Project has the potential to cause short-term minor reduction in water quality during construction phase. However, potential impacts to surface water resources are primarily limited to the construction and decommissioning phases of the Project and can mitigated to represent negligible risk. The operational phase of the Project presents minimal risk.	Short-term and potentially long-term changes to the extent, distribution and quality of open grassland habitat. This could be due to the creation or expansion of ephemeral wetlands. The Plains-wanderer does not use wetland habitat. However, the study area is very flat and therefore, small variations in elevation and slope affect landscape drainage patterns. Thus, hydrological processes affect the distribution of various habitat types, including those used by the Plains-wanderer. However, the Water Resources Impact Assessment found that potential impacts to drainage features and downstream watercourses as a result of Project infrastructure are considered as imperceptible due to the relative size of the Project Area in relation to the size of the receiving catchments, and the distributed nature of minor impacts.	The Riverina Bioregion is dominated by river channels, floodplains, backplains, swamps and lakes. There are also extensive areas of PCTs associated with ephemeral wetlands throughout out the Bioregion. It is therefore unlikely that the ephemeral pools within the Subject Land are significantly important.	The loss of open groundcover vegetation due to altered hydrological processes may result in the loss of individual home-ranges and reduce the regional population size. However, the Water Resources Impact Assessment found that potential impacts to drainage features and downstream watercourses as a result of Project infrastructure are considered as imperceptible due to the relative size of the Project Area in relation to the size of the receiving catchments, and the distributed nature of minor impacts.

8.3.4 Wind Turbine Strikes

Umwelt has prepared detailed Prescribed Impact Assessments to consider the potential impacts from turbine strikes on significant bird and bat species. These assessments have been prepared to address Section 6.1.5 and 8.3.5 of the BAM (DPE 2020a). The prescribed impacts assessment is provided in full in **Appendix D**.

Two turbine sizes are proposed for this Project. These have been analysed for the purpose of interpreting observations and species flight behaviour in relation to collision risk. The measurements detailed below:

8.3.4.1 Type A (Larger)

- up to 143 wind turbine generators (WTGs)
- maximum blade tip height of 300 metres (m) above ground level (AGL)
- lowermost blade tip height of up to 100 m AGL up to 200 m rotor diameter
- tower (hub) height of up to 200 m AGL.

The rotor swept area (RSA) – that is, the area swept by the rotating blades during turbine operation – using the maximum estimate of 200 m rotor diameter (or 100 m radius), equates to an area of approximately 23,235 m squared (m2) per turbine or approximately 272 h of total aerial space for the maximum number of wind turbines being proposed, being 143.

8.3.4.2 Type B (Smaller)

- up to 143 wind turbine generators (WTGs)
- maximum blade tip height of 233 metres (m) above ground level (AGL)
- lowermost blade tip height of up to 66.5 m AGL up to 163 m rotor diameter
- tower (hub) height of up to 148 m AGL.

The rotor swept area (RSA) – that is, the area swept by the rotating blades during turbine operation – using the maximum estimate of 163 m rotor diameter (or 81.5 m radius), equates to an area of approximately 20,867 m squared (m^2) per turbine or approximately 298 h of total aerial space for the maximum number of wind turbines being proposed, being 143.

The following data sources were examined to assess which species, in addition to those recorded in the Project Area in 2022 – 2024, may occur in the Project Area:

- Ecosystem credit predicted species database (BAM-C).
- Protection Matters Search Tool (PMST) for Matters of National Environmental Significance (MNES) (DAWE 2023).
- BioNet Atlas Threatened Biodiversity Profile Data Collection (DPE 2022a).

Candidate bird and bat species lists comprising species that were either recorded or are predicted to occur in the vicinity of the Bullawah Wind Farm are provided in Section 3.0 of **Appendix D**. The candidate bird and bat lists comprise 144 and 18 species respectively. Of these a total of 122 bird and 12 bat species were considered for further assessment due to their known presence in the Project Area or their likelihood of occurrence being low-moderate, moderate or high. A summary of recorded threatened or key bird and bat species is provided in this BDAR (refer to **Table 8.10**). This includes 12 bird and 12 bat species. Details on the additional 110 bird species that were assessed are provided in Table 8.21 and Table 8.22 of **Appendix D**.

Umwelt has prepared the prescribed impact assessment in a consistent approach to the assessment of turbine strike that Umwelt prepared for the Rye Park Wind Farm project which was granted approval to modify the Development Consent in April 2021 (SSD6693). In addition, the method has been used for the Approved Thunderbolt Wind Farm (SSD-10807896), Liverpool Range Wind Farm (SSD-6696-Mod-1) and Spicers Creek Wind Farm (SSD-41134610), both of which have been publicly exhibited and are currently in their response to submission phases. The approach was designed in consultation with the South East office of CPHR. While we recognise that this Project is under assessment from the South West office of CPHR, we believe that consistency in the preparation of assessment material is critical to ensuring consistent assessment of projects throughout NSW. The methodology adopted to complete the qualitative collision risk assessment, including an explanation of the likelihood and consequence scores and overall risk rating matrix, is set out in **Appendix D**.

Table 8.10 Potential Impacts of Wind Turbine Strikes on Threatened and other Specified Fauna

Common Name	Species Name	Likelihood	Consequence	Risk Rating
Birds				
barking owl*	*Ninox connivens*	Low	Moderate	Minor
black falcon*	*Falco subniger*	High	Moderate	High
blue-winged parrot*	*Neophema chrysostoma*	Moderate	Moderate	Moderate
diamond firetail*	*Stagonopleura guttata*	Low	Low	Negligible
flame robin*	*Petroica phoenicea*	Low	Low	Negligible
grey-crowned babbler*	*Pomatostomus temporalis*	Low	Low	Negligible
little eagle*	*Hieraaetus morphnoides*	High	Moderate	High
plains-wanderer*	*Pedionomus torquatus*	Low	High	Moderate
southern whiteface*	*Aphelocephala leucopsis*	Low	Low	Negligible
spotted harrier*	*Circus assimilis*	Moderate	Moderate	Moderate
white-fronted chat*	*Epthianura albifrons*	Low	Low	Negligible
wedge-tailed eagle	*Aquila audax*	High	Low	Moderate
Bats				
white-striped freetail-bat	*Austronomus australis*	High	Moderate	High
inland free-tailed bat	*Ozimops petersi*	Moderate	Moderate	Moderate
southern free-tailed bat	*Ozimops planiceps*	Moderate	Moderate	Moderate
Ride's free-tailed bat	*Ozimops ridei*	Moderate	Moderate	Moderate
chocolate wattled bat	*Chalinolobus morio*	Moderate	Low	Minor

Common Name	Species Name	Likelihood	Consequence	Risk Rating
Gould's wattle bat	*Chalinolobus gouldii*	High	Low	Moderate
little forest bat	*Vespadelus vulturnus*	Moderate	Low	Minor
lesser long-eared bat	*Nyctophilus geoffroyi*	Moderate	Low	Minor
large forest bat	*Vespadelus darlingtoni*	Low	Low	Negligible
southern forest bat	*Vespadelus regulus*	Low	Low	Negligible
yellow-bellied sheathtail bat*	*Saccolaimus flaviventris*	High	Moderate	High
Corben's long-eared bat*	*Nyctophilus corbeni*	Moderate	Moderate	Moderate
inland forest bat*	*Vespadelus baverstocki*	Moderate	Moderate	Moderate
little pied bat*	*Chalinolobus picatus*	Low	Moderate	Minor
Gould's long-eared bat	*Nyctophilus gouldi*	Moderate	Low	Minor
inland broad-nosed bat	*Scotorepens balstoni*	Moderate	Low	Minor
little broad-nosed bat	*Scotorepens greyii*	Moderate	Low	Minor

The prescribed impact assessment for turbine strike, assessed those aerial species considered to have a Moderate or High risk rating further in the context of mitigation measures that would be considered and applied in the event of an impact trigger. In the event of such an impact trigger, through the BBAMP, the Project will be required to implement species-specific mitigation measures to manage the risk of turbine strike on the species. The intended result of implementing species specific mitigation measures is that the risk rating for the species is reduced, i.e. residual risk rating. Full detail of the impact trigger thresholds, post trigger responses and mitigation measures will be prepared and finalised in the BBAMP through consultation with BCS and/or Commonwealth DCCEEW.

The residual risk rating is presented below in **Table 8.11**.

Table 8.11 Residual Risk Ratings

Common Name	Species Name	Likelihood	Consequence	Unmitigated Risk Rating	Residual Risk Rating
Birds					
barking owl	*Ninox connivens*	Low	Moderate	Minor	Minor
black falcon	*Falco subniger*	High	Moderate	High	Moderate
blue-winged parrot	*Neophema chrysostoma*	Moderate	Moderate	Moderate	Minor
diamond firetail	*Stagonopleura guttata*	Low	Low	Negligible	Negligible
flame robin	*Petroica phoenicea*	Low	Low	Negligible	Negligible
grey-crowned babbler	*Pomatostomus temporalis*	Low	Low	Negligible	Negligible
little eagle	*Hieraaetus morphnoides*	High	Moderate	High	Moderate
plains-wanderer	*Pedionomus torquatus*	Low	High	Moderate	Minor
southern whiteface	*Aphelocephala leucopsis*	Low	Low	Negligible	Negligible

Common Name	Species Name	Likelihood	Consequence	Unmitigated Risk Rating	Residual Risk Rating
spotted harrier	*Circus assimilis*	Moderate	Moderate	Moderate	Minor
white-fronted chat	*Epthianura albifrons*	Low	Low	Negligible	Negligible
Wedge-tailed eagle	*Aquila audax*	High	Low	Moderate	Minor
Bats					
white-striped freetail-bat	*Austronomus australis*	High	Moderate	High	Moderate
inland free-tailed bat	*Ozimops petersi*	Moderate	Moderate	Moderate	Minor
southern free-tailed bat	*Ozimops planiceps*	Moderate	Moderate	Moderate	Minor
Ride's free-tailed bat	*Ozimops ridei*	Moderate	Moderate	Moderate	Minor
chocolate wattled bat	*Chalinolobus morio*	Moderate	Low	Minor	Minor
Gould's wattle bat	*Chalinolobus gouldii*	High	Low	Moderate	Minor
little forest bat	*Vespadelus vulturnus*	Moderate	Low	Minor	Minor
lesser long-eared bat	*Nyctophilus geoffroyi*	Moderate	Low	Minor	Minor
large forest bat	*Vespadelus darlingtoni*	Low	Low	Negligible	Negligible
southern forest bat	*Vespadelus regulus*	Low	Low	Minor	Minor
yellow-bellied sheathtail-bat	*Saccolaimus flaviventris*	High	Moderate	High	Moderate
Corben's long-eared bat	*Nyctophilus corbeni*	Moderate	Moderate	Moderate	Minor
Inland forest bat	*Vespadelus baverstocki*	Moderate	Moderate	Moderate	Minor
Little pied bat	*Chalinolobus picatus*	Low	Moderate	Minor	Minor
Gould's long-eared bat	*Nyctophilus gouldi*	Moderate	Low	Minor	Minor
Inland broad-nosed bat	*Scotorepens balstoni*	Moderate	Low	Moderate	Minor
Little broad-nosed bat	*Scotorepens greyii*	Moderate	Low	Minor	Minor

8.3.5 Vehicle Strike

As assessment of the impacts of the Project on habitat connectivity, which facilitates the movement of threatened species across their range, within the Subject Land is provided in **Table 8.12**. The Southern Bell Frog is most vulnerable to vehicle strike during wet periods associated with breeding activity and dispersal, however this would only occur at night when the species is active. The potential for vehicle strike is considered likely to occur where roads separate habitat dams from their nearest neighbouring wetland. The Little Eagle and Wedge-tailed Eagle would be at risk when feeding on carrion along access roads. The Plains-wanderer is vulnerable to strike from vehicles and other machinery whenever it is operating in occupied habitat as the species is well-camouflaged and tends to freeze when disturbed, making it difficult to see.

Table 8.12 Potential Impacts of Vehicle Strikes on Threatened and other Specified Fauna

Common Name Species Name	BC Act	EPBC Act	Likelihood	Consequence	Risk Rating
Amphibians					
Southern Bell Frog *Litoria raniformis*	E	V	Possible	Moderate	Medium
Birds					
Barking Owl *Ninox connivens*	V	-	Possible	Minor	Low
Black Falcon *Falco subniger*	V	-	Possible	Minor	Low
Blue-winged Parrot *Neophema chrysostoma*	V	V	Likely	Minor	Medium
Diamon Firetail *Stagonopleura guttata*	V	V	Likely	Minor	Medium
Flame Robin *Petroica phoenicea*	V	-	Possible	Minor	Low
Grey-crowned Babbler *Pomatostomus temporalis*	V	-	Possible	Minor	Low
Little Eagle *Hieraaetus morphnoides*	V	-	Likely	Moderate	High
Plains-wanderer *Pedionomus torquatus*	E	CE	Likely	Major	Very High
Southern Whiteface *Aphelocephala leucopsis*	V	V	Likely	Minor	Medium
Spotted Harrier *Circus assimilis*	V		Possible	Moderate	Medium
White-fronted Chat Epthianura albifrons	V	-	Possible	Minor	Low
Wedge-tailed Eagle *Aquila audax*	-	-	Likely	Moderate	High
Bats					
White-striped Freetail-bat *Austronomus australis*	-	-	Unlikely	Insignificant	Negligible
Inland Free-tailed Bat *Ozimops petersi*	-	-	Unlikely	Insignificant	Negligible
Southern Free-tailed Bat *Ozimops planiceps*	-	-	Unlikely	Insignificant	Negligible
Ride's Free-tailed Bat *Ozimops ridei*	-	-	Unlikely	Insignificant	Negligible

Common Name Species Name	BC Act	EPBC Act	Likelihood	Consequence	Risk Rating
Chocolate Wattle Bat *Chalinolobus morio*	-	-	Unlikely	Insignificant	Negligible
Gould's Wattle Bat *Chalinolobus gouldii*	-	-	Unlikely	Insignificant	Negligible
Little Forest Bat *Vespadelus vulturnus*	-	-	Unlikely	Insignificant	Negligible
Lesser long-eared Bat *Nyctophilus geoffroyi*	-	-	Unlikely	Insignificant	Negligible
Large Forest Bat *Vespadelus darlingtoni*	-	-	Unlikely	Insignificant	Negligible
Southern Forest Bat *Vespadelus regulus*	-	-	Unlikely	Insignificant	Negligible
Little broad-nosed bat *Scotorepens greyii*	-	-	Unlikely	Insignificant	Negligible
Inland Broad-nosed Bat *Scotorepens balstoni*	-	-	Unlikely	Insignificant	Negligible
Gould's Long-eared Bat *Nyctophilus gouldi*	-	-	Unlikely	Insignificant	Negligible
Yellow-bellied Sheathtail-bat *Saccolaimus flaviventris*	V	-	Unlikely	Insignificant	Negligible
Corben's Long-eared Bat *Nyctophilus corbeni*	V	V	Unlikely	Insignificant	Negligible
Little Pied Bat *Chalinolobus picatus*	V	-	Unlikely	Insignificant	Negligible
Inland forest bat *Vespadelus baverstocki*	V	-	Unlikely	Insignificant	Negligible

8.4 Serious and Irreversible Impacts (SAII)

8.4.1 Assessment for Serious and Irreversible Impacts on Biodiversity Values

The determination of a Serious and Irreversible Impact (SAII) is to be made by the decision maker in accordance with the principles set out in the BC Regulation 2017. Under Clause 6.7 (2) of the BC Regulation 2017. An impact is to be regarded as serious and irreversible if it is likely to contribute significantly to the risk of a threatened species or ecological community becoming extinct because of one of the following four principles:

- Principle 1: The impact 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, or

- Principle 2: the impact 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, or
- Principle 3: it is an impact on the habitat of the species or ecological community that is currently observed, estimated, inferred or reasonably suspected to have a very limited geographic distribution, or
- Principle 4: the impacted species or ecological community is unlikely to respond to measures to improve its habitat and vegetation integrity and therefore its members are not replaceable.

The *Guidance to Assist a Decision-Maker to Determine a Serious and Irreversible Impact* (DPIE 2019b) and the Threatened Biodiversity Profile Data Collection was reviewed to determine the SAII candidates relevant to the assessment.

8.4.2 Additional Impact Assessment Provisions for TECs at Risk of an SAII

No TECs present in the Subject Land are listed as SAII entities.

8.4.3 Additional Impact Assessment Provisions for Threatened Species at Risk of an SAII

One threatened fauna species, the Plains-wanderer, is a SAII entity recorded on the Subject Land.

The additional impact assessment provisions for threatened species at risk of an SAII have been addressed for the Plains Wanderer in **Table 8.13**. This species is listed as endangered under the BC Act and critically endangered under the EPBC Act. The location of the SAII in relation to the Subject Land and Development Footprint is shown on **Figure 8.5**.

Table 8.13 SAII Impact Assessment – Plains Wanderer

Response to BAM Section 9.1.2 Criteria	
1. The assessor is required to provide further information in the BDAR or BCAR for any species at risk of an SAII, including the action and measures taken to avoid the direct and indirect impact on the species at risk of an SAII. Where these have been addressed elsewhere the assessor can refer to the relevant sections of the BDAR or BCAR.	
Measures proposed to avoid direct and indirect impacts on this species are documented in **Section 7.0** of this report. Impact and impact avoidance areas for areas of mapped Important Plains Wanderer Habitat are shown in **Figure 8.5.**	
2. The assessor must consult the TBDC and/or other sources to report on the current population of the species including:	
a. Evidence of rapid decline (Principle 1, clause 6.7(2)(a) BC Regulation) presented by an estimate of the: **i. Decline in population of the species in NSW in the past 10 years or three generations (whichever is longer), or** **ii. Decline in population of the species in NSW in the past 10 years or three generations (whichever is longer) as indicated by: an index of abundance appropriate to the species; decline in geographic distribution and/or habitat quality; exploitation; effect of introduced species, hybridisation, pathogens, pollutants, competitors or parasites**	The TBDC identifies that this species meets the criterion for Principle 1: a population reduction of >80% in 10 years or three generations. A generation time of 7.3 years was estimated by extrapolation from related Charadriiformes of similar size and ecology based on the age of first breeding (one year) and a maximum longevity on the wild of 13.5 years (Garnett et al. 2011; Department of the Environment 2015). The Plains Wanderer National Recovery Plan (Department of the Environment and the Government of South Australia Department of Environment, Water and Natural Resources 2016) confirms that significant population declines occurred in the species' two main strongholds (northern Victorian plains and the Riverina in NSW) due to above average rainfall (see also Baker-Gabb 2016). This follows declines in the Riverina in 2002 due to drought. Combined, the Plains Wanderer declined by 93% in the Riverina between 2001 and 2014. Previously, Plains Wanderer populations have recovered from drought but recently have remained historically low (Department of the Environment and the Government of South Australia Department of Environment, Water and Natural Resources 2016). There is concern that the small size of the current population and regular population fluctuations makes it vulnerable to extinction. The current population size is estimated to be 200 in the Riverina and 50 in northern Victoria (Department of the Environment 2015), but the total number of mature individuals may be up to 1,000 (Baker-Gabb 2015).
b. Evidence of small population size (Principle 2, clause 6.7(2)(b) BC Regulation) presented by: **i. An estimate of the species' current population size in NSW, and** **ii. An estimate of the decline in the species' population size in NSW in three years or one generation (whichever is longer), and**	b. The Plains Wanderer's population size declined by 93% between 2001 and 2014. The size of its Riverina/northern Victoria stronghold population is estimated to be 250 individuals, but the total number of mature individuals may be up to 1,000 (Baker-Gabb 2015). The species is known to undergo extreme population fluctuation and declines of 80% may occur over a couple of years during droughts (Department of the Environment and the Government of South Australia Department of Environment, Water and Natural Resources 2016).

Response to BAM Section 9.1.2 Criteria	
iii. Where such data is available, an estimate of the number of mature individuals in each subpopulation, or the percentage of mature individuals in each subpopulation, or whether the species is likely to undergo extreme fluctuations	
c. Evidence of limited geographic range for the threatened species (Principle 3, clause 6.7(2)(c) BC Regulation) presented by: **i. Extent of occurrence** **ii. Area of occupancy** **iii. Number of threat-defined locations (geographically or ecologically distinct areas in which a single threatening event may rapidly affect all species occurrences), and** **iv. Whether the species' population is likely to undergo extreme fluctuations**	The Plains Wanderer's total extent of occurrence is estimated to be 35,000 km^2, with an area of occupancy of 1,000 km^2. The respective values for NSW are 13,000 km^2 and 650 km^2 (NSW Scientific Committee 2009). The Plains Wanderer's population undergo extreme fluctuations due to drought. Drought may affect large areas of the species' range simultaneously. Given the relatively small area occupied by its stronghold populations in NSW and Victoria, it is particularly likely that these populations would be simultaneously affected by drought.
d. Evidence that the species is unlikely to respond to management (Principle 4, clause 6.7(2)(d) BC Regulation) because: **i. Known reproductive characteristics severely limit the ability to increase the existing population on, or occupy new habitat (e.g., Species is clonal) on, a biodiversity stewardship site** **ii. The species is reliant on abiotic habitats which cannot be restored or replaced (e.g., Karst systems) on a biodiversity stewardship site, or** **iii. Life history traits and/or ecology is known but the ability to control key threatening processes at a biodiversity stewardship site is currently negligible (e.g., Frogs severely impacted by chytrid fungus).**	The Plains Wanderer is sexually mature at one year and produces clutches of two to four offspring. The species is known to undergo large fluctuations in population size in response to climatic conditions. In the absence of heavy grazing, it is capable of rapid population recovery (Baker-Gabb et al. 1990; 2016). Baker-Gabb et al. (2016) described the Plains Wanderer as an r-selected species (i.e. a species in which reproduction is prioritised over survival). The Plains Wanderer is not reliant on abiotic habitat that cannot be easily replaced. The life history traits of the Plains Wanderer are relatively well known. While drought cannot be controlled at a BSS, grazing pressure, feral animal control and tree establishment (which facilitates predation by native raptors) can. These are the major threats to the Plains Wanderer (Department of the Environment and the Government of South Australia Department of Environment, Water and Natural Resources 2016).
3. Where the TBDC indicates data is 'unknown' or 'data deficient' for a species for a criterion listed in Subsection 9.1.2(2.), the assessor must record this in the BDAR or BCAR.	
The TBDC does not specifically indicate that data is unknown or deficient for this species.	

Response to BAM Section 9.1.2 Criteria	
4. In relation to the impacts from the proposal on the species at risk of an SAII, the assessor must include data and information on:	
a. The impact on the species' population (Principles 1 and 2) presented by: **i. An estimate of the number of individuals (mature and immature) present in the subpopulation on the Development Footprint (the site may intersect or encompass the subpopulation) and as a percentage of the total NSW population, and** ii. **An estimate of the number of individuals (mature and immature) to be impacted by the proposal and as a percentage of the total NSW population, or** **iii. If the species' unit of measure is area, provide data on the number of individuals on the site, and the estimated number that will be impacted, along with the area of habitat to be impacted by the proposal**	The species' unit of area specified by the TBDC is area. The estimated number of birds in the Riverina population is 200 (Department of the Environment 2015). Population densities reported for the Plains Wanderer are about 0.11 ha^{-1} (Baker-Gabb at al. 1990). There is an estimated 3,263.9 ha of habitat on the Project Site, suggesting 359 birds are present. This appears to be an over-estimate given the total Hay population may only be 200 birds. The Project would remove 505.68 ha of habitat (PCTs 44 and 46). Based on the density estimate, up to 56 birds may be directly impacted (15% of the site's population). The NSW population is estimated to be about 200 birds. This suggests 28% of the NSW population may be indirectly impacted.
b. Impact on geographic range (Principles 1 and 3) presented by: **i. The area of the species' geographic range to be impacted by the proposal in hectares, and a percentage of the total AOO, or EOO within NSW** **ii. The impact on the subpopulation as either: all individuals will be impacted (subpopulation eliminated); OR impact will affect some individuals and habitat; OR impact will affect some habitat, but no individuals of the species will be directly impacted** **iii. To determine if the persisting subpopulation that is fragmented will remain viable, estimate (based on published and unpublished sources such as scientific publications, technical reports, databases or documented field observations) the habitat area required to support the remaining population, and habitat available within dispersal distance, and distance over which genetic exchange can occur (e.g., Seed dispersal) and pollination distance for the species**	b. The Plains Wanderer's total extent of occurrence is estimated to be 35,000 km^2, with an area of occupancy of 1,000 km^2. The respective values for NSW are 13,000 km^2 (37% of the total) and 650 km^2 (65% of the total) (NSW Scientific Committee 2009). The Development Footprint has completely avoided all extents of mapped important habitat for the Plains-wanderer. This habitat would not be directly cleared by the Project but may be indirectly impacted during the construction and operation of BWF. However, there is 3,309.68 ha of habitat within the Project Boundary (PCTs 44 and 46), representing 0.33% of the species' national area of occupancy. The Project would require 505.68 ha (15% of that within the Project Boundary and 0.51% of its total area of occupancy) this habitat to be cleared for turbine pads, access roads and other infrastructure. The presence of turbines, noise impacts and partial clearing of adjacent habitat for turbine pads, ancillary structures that may be used as perches and access tracks may affect the presence of raptors and feral predators (foxes, cats, dogs) and the vulnerability of the Plains Wanderer to them. The Plains Wanderer is unlikely to fly at heights that would result in turbine collisions. The grassland habitat is already fairly open and feral predators are currently unlikely to have difficulty moving throughout the entire site. The Plains-wanderer is vulnerable to death, injury and nest destruction during clearing operations. It is also vulnerable to vehicle strike across the Project Area, mostly

Response to BAM Section 9.1.2 Criteria	
iv. To determine changes in threats affecting remaining subpopulations and habitat if the proposed impact proceeds, estimate changes in environmental factors including changes to fire regimes (frequency, severity); hydrology, pollutants; species interactions (increased competition and effects on pollinators or dispersal); fragmentation, increased edge effects, likelihood of disturbance; and disease, pathogens and parasites. Where these factors have been considered elsewhere in relation to the target species, the assessor may refer to the relevant sections.	during construction when vehicle movements will be highest. Some residual risk of vehicle strike would remain during the operation of the Project. The Project is unlikely to fragment the habitat of the Plains Wanderer as no mapped important habitat would be removed. Access roads may represent partial barriers to movement but are not expected to be absolute barriers as they would only be several metres wide (i.e. slow down rates of movement rather than prevent it). The TBDC indicates the minimum patch size able to be occupied by the Plains Wanderer is less than 5 ha. However, it should be noted that mean home-range areas reported ranged from 12 ha (Baker-Gabb et al. 1990) to 32 ha (Nugent et al. 2022a). The Plains Wanderer was historically regarded as occupying open grassland habitat on red soils. Recently, radio-tracking studies have suggested that the Plains Wanderer requires a mosaic of landscape elements including denser grass swards (Nugent et al. 2022a). Denser habitats may have previously been overlooked as the detection probability would be lower in these areas relative to open habitats as visual searching (either diurnal searches or nocturnal spotlighting) was used. This suggests that suitable habitat is more connected than previously assumed. The Plains Baker-Gabb et al. (1990) suggest that 450 ha of habitat may be required to maintain viable sub-populations that maintain some connection to other sub-populations. The proposed development may affect fire regimes at a local scale by requiring fire management in the vicinity of turbines (e.g. increased frequency but reduced severity). The formation of pads and access tracks may affect surface water flows and sub-surface hydrology. There may be some risk of pollution during construction (e.g. fuel spills) but this would be minimal during operation. The Project may alter species interactions (e.g. perch sites for raptors on suitable ancillary structures) (Baker-Gabb 2014 cited in Department of the Environment and South Australian Department of Environment, Water and Natural Resources 2016). Noise during construction and/or operation may have a localised effect on habitat use by the Plains Wanderer. The Project would not result in habitat/population fragmentation, increase edge effects or introduce disease, pathogens or parasites.
5. **The assessor may also provide new information that can be used to demonstrate that the principle identifying the species as at risk of an SAII, is inaccurate.**	
Not applicable.	

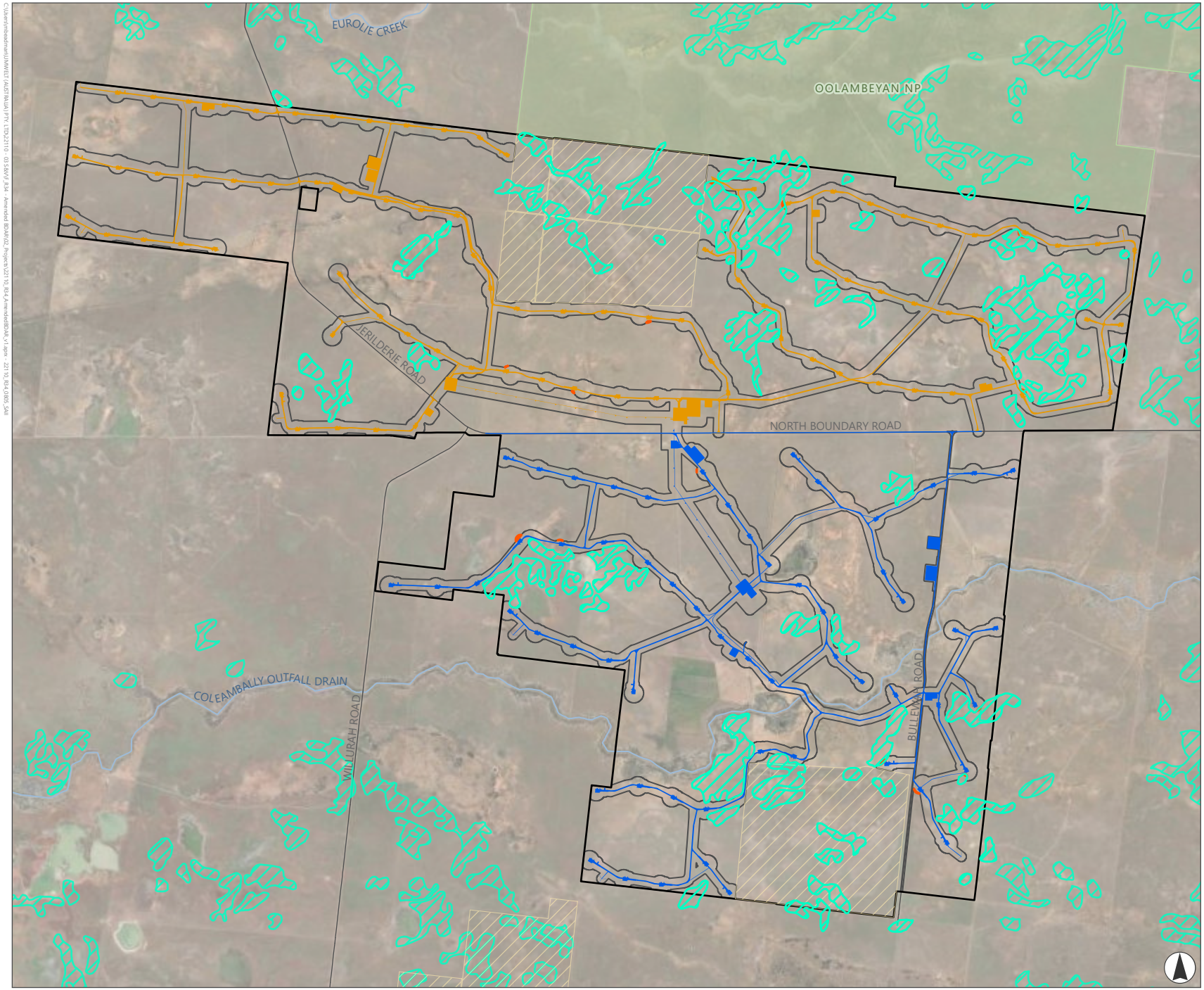


FIGURE 8.5.1

Location of Serious and Irreversible Impacts

Legend

- Project Boundary
- Subject Land
- Stage 1 (South) Development Footprint
- Stage 2 (North) Development Footprint
- Conservation Agreement Area
- NPWS Reserves
- Road
- Watercourse
- Plains Wanderer Important Habitat Mapping
- Blade Overhang Area

0 1,000 2,000

Meters

Scale 1:110,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

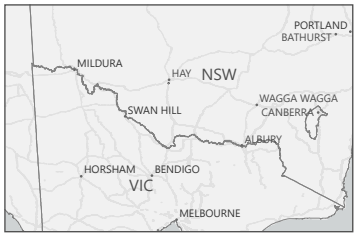
Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

FIGURE 8.5.2

Location of Serious and Irreversible Impacts

Legend

- Stage 1 (South) Development Footprint
- Road
- Plains Wanderer Important Habitat Mapping



0 60 120

Meters

Scale 1:5,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

FIGURE 8.5.3

Location of Serious and Irreversible Impacts

Legend

- Stage 1 (South) Development Footprint
- Road

0 60 120

Meters

Scale 1:5,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

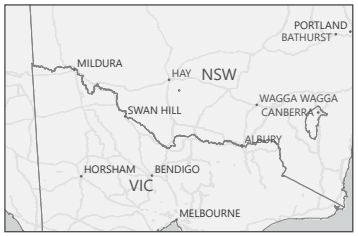
Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

FIGURE 8.5.4

Location of Serious and Irreversible Impacts

Legend

- Stage 1 (South) Development Footprint
- Road
- Watercourse



0 60 120

Meters

Scale 1:5,000 at A4

GDA2020 MGA Zone 55

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt.This document and the information are solely for the use of the authorized recipient and this document may not be used,copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt.Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** NSW DFSI (2023)

8.5 Matters of National Environmental Significance

As discussed in **Section 1.3.2**, the Project requires approval under the Commonwealth Environment EPBC Act and has been declared a controlled action requiring approval from the Commonwealth Minister for the Environment and Water. To meet the requirements of the Supplementary SEARs, a detailed MNES Report for threatened and migratory entities listed under the EPBC Act is provided in **Appendix E**. The MNES Report has been prepared in accordance with '*BCD recommendations for MNES assessments in an Environmental Impact Statement (EIS) or Biodiversity Development Assessment Report (BDAR)'*. Species included for assessment in the report include those that are listed within the supplementary SEARs as being potentially impacted by the Project, and any others that have a moderate to high likelihood of occurrence.

Assessments of Significance for threatened and migratory entities were undertaken for threatened entities and is contained within Appendix 2 of the MNES Report (**Appendix E**).

A summary of the MNES recorded within the Subject Land during field surveys is provided in **Section 8.5.1** to **Section 8.5.3** below.

8.5.1 Threatened Ecological Communities

One TEC, Weeping Myall Woodland, listed under the EPBC Act was recorded in the Subject Land. **Table 8.14** details the potential impacts of the Project on this TEC.

Table 8.14 Threatened Ecological Communities Recorded in the Subject Land

Community Name	Threat Category	Associated PCTs	Area Directly Impacted (ha)	Indirect Impacts
Weeping Myall Woodlands	E	PCT 26: Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion (Mod-Good, Zone 6)	4.92	• Transport of weed species. • Edge effects. • Increased fire risk. • Pollutant spills.

8.5.2 Threatened Species

Nine threatened species listed under the EPBC Act were recorded within the Subject Land or Project Area during field surveys. Of these, four are threatened flora species and five are threatened fauna species. **Table 8.15** and **Table 8.16** details the potential impacts of the Project on these threatened species.

Table 8.15 Summary of Direct and Indirect Impacts on Threatened Flora Species and the Likelihood of a Significant Impact

Species Name	Common Name	EPBC Threat Category	Area Directly Impacted (ha)	Direct/Indirect Impacts
Chariot Wheels ***Maireana cheelii***	Chariot Wheels	V	4.67	• Altered hydrology resulting in land salinity. • Degradation and destruction of habitat by weed invasion.
Eleocharis obcis	A Spike-rush	V	7.31	• Removal of habitat.

Species Name	Common Name	EPBC Threat Category	Area Directly Impacted (ha)	Direct/Indirect Impacts
				• Direct loss of species through clearing. • Degradation and destruction of habitat by weed invasion. • Potential increase in direct grazing pressure from stock and rabbits. • Altered hydrology resulting in land salinity. •
Slender Darling Pea ***Swainsona murrayana***	Slender Darling Pea	V	123.09	• Removal of habitat. • Direct loss of species through clearing. • Degradation and destruction of habitat by weed invasion. • Potential increase in direct grazing pressure from stock and rabbits. • Increased fire regimes.
Winged Pepper-cress ***Lepidium monoplocoides***	Winged Peppercress	E	3.52	• Removal of habitat. • Change in agricultural practices increasing trampling. • Increase in off road vehicle movement disturbing habitat. • Potential increase in direct grazing pressure from rabbits.

Table 8.16 Summary of Direct and Indirect Impacts on Threatened Fauna Species and the Likelihood of a Significant Impact

Species Name	Common Name	EPBC Threat Category	Area Directly Impacted (ha)	Direct/Indirect Impacts
Neophema chrysostoma	Blue-winged Parrot	V	638.01	• Loss of foraging and potential breeding habitat. • Potential vehicle strike during construction. • Potential weed impacts on habitat.
Pedionomus torquatus	Plains-wanderer[1]	CE	20.89 (No mapped Important Habitat impacted), comprising 2.61 ha of existing mapping of infrastructure, non-native vegetation and/or waterbodies	• Loss of foraging and potential breeding habitat with secondary habitat for the species (i.e. non-mapped Important Habitat).

Species Name	Common Name	EPBC Threat Category	Area Directly Impacted (ha)	Direct/Indirect Impacts
				• Potential injury and mortality during clearing. • Potential vehicle strike during construction. • Potential weed impacts on habitat.
Aphelocephala leucopsis	Southern Whiteface	V	638.01	• Loss of foraging and potential breeding habitat. • Potential vehicle strike during construction. • Potential weed impacts on habitat.
Litoria raniformis	Southern Bell Frog	V	52.16	Loss of foraging and disturbance to potential breeding habitat. • Potential injury and mortality during clearing. • Vehicle strike during construction. • Altered hydrology. • Potential altered water quality. • Potential weed impacts to aquatic habitat.
Stagonopleura guttata	Diamond Firetail	V	638.01	• Loss of foraging and potential breeding habitat. • Potential vehicle strike during construction.

[1] Impacts presented for Plains-wanderer are based on the assessment of supplementary habitat, it does not include any impacts to NSW identified Important Habitat Mapping as all of that critical species habitat mapping was avoided by the Project.

8.5.3 Migratory Species

No migratory species were recorded during surveys and none were considered to have a high likelihood of occurrence.

8.5.4 Consideration of Obstacle Lighting Impacts to Wildlife

In developing the Project Obstacle Lighting Plan (OLP) for the Project BWF has considered the requirements of Australian Government – Department of Climate Change, Energy, the Environment and Water (Cth DCCEEW) - National Light Pollution Guidelines for Wildlife (May 2023, V2.0). The implementation of the National Light Pollution Guidelines for Wildlife was supported by Umwelt with specialist inputs sought from Moir Studio with regard to landscape character and visual impact assessment. This assessment is included as Appendix 3 of the MNES Report (**Appendix E** of this Amended BDAR) and provides an environmental assessment of the effects of artificial light on wildlife as per the six (6) steps outlined in the National Light Pollution Guidelines for Wildlife, including the adaptive management of artificial light process.

It concludes that the risk of indirect impacts to wildlife from artificial light associated with the OLP are not significant but provides additional mitigation measures to ensure a lighting audit occurs, and then review and improvement measures are allowed for as required.

8.6 Aquatic Impacts

8.6.1 Threatened Species

Areas of aquatic habitat, including Eurolie Creek, Nyangay Creek and Abercrombie Creek have been considered to provide moderate likelihood of occurrence for one threatened species listed under the FM Act; the Silver Perch (*Bidyanus bidyanus*) listed as vulnerable under the FM Act.

Under the FM Act, a '7 part test' is carried out to assess the likelihood of significant impact upon a threatened entity. Appendix F contains these assessments of significance, which conclude that due to the negligible aquatic impacts to the Coleambally Outfall Drain, a significant impact is unlikely to occur.

8.7 Cumulative Impacts

NSW Government – EnergyCo seeks to maximise opportunities created by the transformation of the NSW electricity system by coordinating investment in REZs across NSW. A REZ is the equivalent of modern-day power stations, combing new renewable energy infrastructure, including generators (such as solar and wind farms), storage (such as batteries and pumped hydro) and then high-voltage transmission infrastructure. Five dedicated REZs have already been identified in NSW. As discussed in **Section 2.0**, the Project is located wholly within the South West REZ.

Because of this, and the REZ benefits anticipated by NSW Government – EnergyCo, the South West REZ has the potential to see strong interest for renewable energy development. Cumulative impacts occur when the impacts from multiple projects or developments combine and the compounding effects are larger than any one of the projects itself has quantified and assessed.

The project will contribute to cumulative impacts on biodiversity during construction and operation from all clean energy projects (operational, under construction, approved and proposed) in the vicinity within the South West REZ. It is considered likely that cumulative impacts will increase the loss of similar native vegetation and threatened species habitat to the project in the region.

A review of publicly available relevant clean energy projects known at the time of finalisation of this BDAR and within the South West REZ has been undertaken. Potential cumulative biodiversity impacts are provided in **Table 8.17**.

The final composition of renewable energy development in the South West REZ will largely be determined by the NSW Government allocation of access rights to the limited transmission infrastructure present. The intended capacity of the South West REZ is 2.5 GW with registered interest well in excess of this. It is therefore expected that there will be more proposed projects than the intended capacity and cumulative impacts required to build the South West REZ to its maximum capacity will potentially be less than that predicted for the full extent of all projects currently proposed.

Impact information compiled from projects in initial planning stages are not accurate and the final impacts may be more or less than the data presented.

Table 8.17 Past, Present and Future Projects

Project	Distance	Biodiversity value impacted			Construction impacts	Operational impacts
		PCTs and TECs	Threatened flora	Threatened fauna		
Bullawah Wind Farm (RtS stage) – this project	0 km	10 PCTs identified in the Subject Land with estimated impacts to 638.01 ha of native vegetation. Impacts to three TECs: • Weeping Myall Woodlands. • Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions. • Sandhill Pine Woodland.	Four threatened flora species were recorded within the Project Area: • *Maireana cheelii* • *Swainsona sericea* • *Swainsona murrayana* • *Lepidium monoplocoides* • *Eleocharis obicis.*	14 threatened fauna species were recorded within the Subject Land: • Plains-wanderer • Black Falcon • Southern Whiteface • Little Eagle • Spotted Harrier • Blue-winged Parrot • Barking Owl • Diamond Firetail • Flame Robin • Grey-crowned Babbler • White-fronted Chat • Yellow-bellied Sheathtail-bat • Southern Bell Frog.	Construction of up to 143 wind turbines and approximately 815.1 MW capacity.	Includes up to 143 wind turbines and approximately 815.1 MW capacity.
Pottinger Wind Farm (RtS stage)	<1 km	Estimated impacts to 1,004.60 ha of native vegetation comprised of 19 PCTs identified in the Project Area. Three TECs (BC Act) and one TEC (EPBC Act) recorded in the Subject Land, including: • Weeping Myall Woodland. • Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions. • Sandhill Pine Woodland.	Four threatened flora species were recorded: • *Maireana cheelii* • *Swainsona sericea* • *Swainsona murrayana* • *Brachyscome papillosa.*	Fifteen threatened fauna species were recorded or assumed present including: • Southern Bell Frog • Southern Whiteface • Black Falcon • Grey-crowned Babbler • Spotted Harrier • White-fronted Chat. One threatened fauna species has been assumed present: • Plains-wanderer.	Construction of up to 247 wind turbines with approximately 1.3 GW capacity. Up to six substations and 13 transformers. One BESS and an internal electrical reticulation network. Construction impact area of 379 ha.	Operation of 247 wind turbines impact area of 688 ha.
Pottinger Solar Farm (EIS stage)	<1 km	Impacts to approximately 600 ha of native vegetation, including potential impacts to Weeping Myall Woodland and Sandhill Pine Woodland	Impacts expected to a similar suite of species as Pottinger Wind Farm.	Impacts expected to potential Plains-wanderer habitat.	Construction of 300 MW solar farm and 500 MW BESS, across approximately 1,600 ha.	Operation of 300 MW solar farm and 500 MW BESS, across approximately 1,600 ha.
Project EnergyConnect (Approved project)	<1 km	Direct impacts to 1,615.20 ha of native vegetation comprised of 38 PCTs. Impacts 232.16 ha of TECs, including: • Weeping Myall Woodlands. • Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions. • Sandhill Pine Woodland.	Ten threatened flora species were recorded including: • *Lepidium monoplocoides* • *Brachyscome papillosa* • *Swainsona murrayana* • *Maireana cheelii.* One threatened flora species was assumed present: • *Cullen parvum.*	Direct impacts to six threatened fauna species, including: • Plains-wanderer • Pink Cockatoo • Southern Myotis • Superb Parrot).	Construction of 330 kV and 500 kV transmission line and Dinawan Substation.	Operation of 330 kV and 500 kV transmission line and Dinawan Substation.

Project	Distance	Biodiversity value impacted			Construction impacts	Operational impacts
		PCTs and TECs	Threatened flora	Threatened fauna		
The Plains Solar Farm and BESS (RtS stage)	<1 km	Impacts to ~1,000 ha of native vegetation comprised of six PCTs.	Three threatened flora species were recorded: • *Lepidium monoplocoides* • *Maireana cheelii* • *Swainsona murrayana.* Eight threatened flora species were assumed present, including: • *Austrostipa wakoolica* • *Brachyscome papillosa* • *Cullen parvum* • *Swainsona sericea.*	Three threatened fauna species were recorded: • Black Falcon • White-fronted Chat. One threatened fauna species was assumed present: • Plains-wanderer.	Includes 900,900 PV panels, 400 MW capacity and BESS.	Includes 900,900 PV panels, 400 MW capacity and BESS.
The Plains Wind Farm (RtS stage)	<1 km	Impacts to 1,997.03 ha of native vegetation comprised of 10 PCTs. Impacts to one TEC: • Sandhill Pine Woodland.	Four threatened flora species are present, including: • *Maireana cheelii* • *Swainsona murrayana* • *Lepidium monoplocoides.* Four threatened flora species are assumed present, including: • *Austrostipa wakoolica* • *Brachyscome papillosa* • *Cullen parvum.*	Five threatened fauna species were recorded, including: • Black falcon • Southern Whiteface • White-fronted Chat. Two species are assumed to be present, including: • Plains-wanderer.	Includes up to 188 wind turbines and approximately 1,350 MW capacity.	Includes up to 188 wind turbines and approximately 1,350 MW capacity.
Romani Solar Farm (EIS stage)	Nearest boundary is approximately 44 km away	Potential impacts to an estimated 900 ha, however an estimated 60% occur on Category 1 - Exempt land. Nine PCTs noted as potentially present.	Suitable habitat potentially present for 12 threatened flora species.	Suitable habitat potentially present for 10 threatened fauna species.	Construction of a 250 MW solar farm with 150 MW/300 MWh BESS.	Operation of a 250 MW solar farm with 150 MW/300 MWh BESS.
Dinawan Wind Farm (RtS stage)	Nearest boundary is approximately 9 km away	Estimated impacts to 780 ha of native vegetation, including nine PCTs and three TECs. Weeping Myall and Natural Grasslands impacts are anticipated.	Suitable habitat potentially present for 11 threatened flora species.	Suitable habitat potentially present for 16 threatened fauna species.	Construction of 1.5 GW wind farm, comprising of up to 250 WTGs, on approximately 22,000 ha.	Operation of 1.5 GW wind farm, comprising of up to 250 WTGs, on approximately 22,000 ha.
Dinawan Solar Farm (Assessment stage)	Nearest boundary is approximately 9 km away	Impacts to 2,477 ha of native vegetation, including: • 1571 ha of Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions. • 137 ha Weeping Myall Woodland.	Two threatened flora species were recorded: • *Swainsona* murrayana (5.5 ha) • *Swainsona sericea* (5.5 ha). Two threatened flora species are assumed present: • *Austrostipa wakoolica* (220.5 ha) • *Pilularia novae-hollandiae* (229.5 ha).	Twelve threatened fauna species were recorded, including: • Southern Bell Frog • Plains Wanderer • Black Falcon • Spotted Harrier • Southern Whiteface • Grey-crowned Babbler. One threatened fauna species is assumed present: • Plains-wanderer.	Construction of 800 MW solar farm, 300 MW BESS on approximately 2,500 ha.	Operation of 800 MW solar farm, 300 MW BESS on approximately 2,500 ha.
Argoon Wind Farm (EIS Stage)	Nearest boundary is approximately 30 km away	Potential impacts to up to native vegetation comprised of 19 PCTs. Up to nine TECs listed under both the BC Act and EPBC Act may be present within the Project Area.	Suitable habitat potentially present for 18 threatened flora species.	Suitable habitat potentially present for 55 threatened fauna species.	Construction of 901 MW wind farm, 460 MW/2300 MWh BESS with a Project Area of approximately 10,885 ha.	Operation of 901 MW solar farm, 460 MW/2300 MWh BESS with a Project Area of approximately 10,885 ha.

Project	Distance	Biodiversity value impacted			Construction impacts	Operational impacts
		PCTs and TECs	Threatened flora	Threatened fauna		
Yanco Delta Wind Farm (Approved)	Nearest boundary is approximately 17.7 km away	Impacts to 173.39 ha of native vegetation, including four TECs: • Weeping Myall Woodlands • Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions • Sandhill Pine Woodland • Natural Grasslands of the Murray Valley Plains.	Two threatened flora species were recorded: • *Swainsona murrayana* • *Swainsona sericea.* Twelve threatened flora species are assumed present, including: • *Austrostipa wakoolica* • *Lepidium monoplocoides* • *Cullen parvum* • *Maireana cheelii.*	Eleven threatened fauna species recording, including: • Spotted Harrier • White-fronted Chat • Little Eagle • Grey-crowned Babbler • Diamond Firetail • Flame Robin • Black Falcon. Three threatened fauna species are assumed present, including: • Plains Wanderer.	Construction of 208 WTGs, 800 MW/800 MWh BESS with a disturbance of approximately 238 ha.	Operation of 208 WTGs, 800 MW/800 MWh BESS with a disturbance of approximately 238 ha.
Tchelery Wind Farm (EIS Stage)	Nearest boundary is approximately 60 km away	Potential impacts to up to native vegetation comprised of 16 PCTs. Four BC Act listed TECs are potentially within the project site.	Potential impacts to seven threatened flora species identified within the Project Area including: • *Swainsona murrayana* • *Brachyscome papillosa* • *Maireana cheelii* • *Lepidium monoplocoides* • *Cullen parvum.*	Potential impacts to seven threatened fauna species identified within the Project Area including: • Southern Bell Frog • Plains-wanderer • Little Eagle.	Construction of 120 WTGs with a total capacity of 800 MW across a 27,400 ha Project Area.	Operation of 120 WTGs with a total capacity of 800 MW across a 27,400 ha Project Area.

8.7.1 Off-site Road Works Areas

The off-site road works areas and road modifications along the Port to Hay Transport Routes are required to enable the safe transport of Project components using OSOM vehicles.

- These road works and modifications are proposed to be undertaken by BWF, in which instance other renewable energy developers would benefit from their construction and use (where their design elements permit). Similarly, if undertaken by others then BWF would benefit also (where their design elements permit). Accordingly, these works would only be undertaken by a single developer and do not require disturbance and impacts by multiple renewable energy developers.
- A detailed review of all proposed SSD transport routes to the South West REZ has not been undertaken however there is generally a correlation of the routes proposed by various developers given the use of the National Heavy Vehicle Route (NVHR) and other logistics constraints. Accordingly, wider spread and cumulative impacts are not anticipated to occur to the same biodiversity values considered in this assessment. Where alternate routes are proposed by others, the large spatial boundaries and separation of these areas suggests that cumulative impacts to biodiversity values would not occur as those values vary depending on the location of impact and the context within NSW IBRA regions.
- Works might be required at a later time to augment the proposed road works and modifications (e.g. if another developer has a larger WTG proposed) but that is beyond the control of BWF.
- Preliminary consultation with Councils at the respective locations has identified that there are no other significant road construction works planned to occur that might increase cumulative impacts beyond that assessed for the Project.

On this basis, because disturbance associated with these off-site works areas is comparatively minor, and the impacts to biodiversity values negligible, cumulative impacts to biodiversity values are not predicted to affect the outcomes for the Project. As such, there is no change in the outcome of potential cumulative impacts to biodiversity, when compared with previously assessed impacts in the Project EIS and associated BDAR.

9.0 Mitigation

BWF has committed to the design and implementation of a comprehensive biodiversity mitigation strategy to minimise the residual impacts of the Project. A CEMP, Operational Environmental Management Plan (OEMP), Plains Wanderer Management Plan, and BBAMP will be prepared for the Project. All plans will describe the avoidance, mitigation and management measures that will be undertaken to manage potential environmental impacts of the Project. They will be prepared to meet the specific requirements of the Project to avoid and minimise impacts on biodiversity values, in accordance with best practice.

The following specific control measures are recommended for the mitigation of impacts on the biodiversity features of the Development Footprint:

- Salvage of biodiversity features, including habitat resources (e.g., hollow logs, tree hollows, fallen timber and rocks/boulders).
- A pre-clearing procedure will be implemented to minimise the potential for impacts on native fauna species (focusing on threatened species) as a result of the clearing of hollow-bearing trees. The pre-clearing procedure is designed to minimise impacts to hollow-dependent and ground-dwelling fauna.
- Weed management including biosecurity controls to prevent importation weeds and weed management measures.
- Fencing and access control.
- Bushfire management.
- Erosion and sedimentation control.
- Workforce education and training.

Each of these minimisation measures will be included in the CEMP and where relevant, OEMP.

9.1 Mitigation Measures

Proposed mitigation measures are summarised in **Table 9.1**.

Table 9.1 Mitigation Measures

Impact	Action ID	Mitigation measure	Outcome	Timing and frequency	Likely efficacy of mitigation	Responsibility
Removal of native vegetation and threatened species habitat during the construction of the Project.	BIO1	Native vegetation removal, habitat and fauna displacement will be minimised through detailed design. The design that includes access roads crossing waterways will provide an option that allows the stream flow to be unaffected. Additionally, breeding habitat for fauna, threatened species, and habitat trees with be avoided and minimised with the design of the access tracks. Buffers of threatened species habitat and nest trees show the areas of potential and known threatened species habitat to be avoided and minimised in the detailed design. These buffers will aid in informing the plans of construction and operational management to the relevant future construction teams. To avoid and minimise further clearing of vegetation, utilising existing tracks for cabling corridors and access tracks will be established and considered.	The avoidance and minimisation of vegetation and habitat clearing during the project planning.	Detailed design, the project surveys, and pre-construction	Proven effective	The Proponent
	BIO2	Buffer mapping for habitats aid in providing the construction and maintenance teams with the information necessary for the OEMP and the CEMP.		Pre-construction	Proven effective	The Proponent
	BIO3	The design that includes access roads crossing waterways will provide an option that allows the stream flow to be unaffected.		Detailed design		
The clearing of habitat, native vegetation and TECs	BIO4	The preparation and approval of a Biodiversity Management Plan (BMP) prior to construction which will be prepared by a qualified ecologist with CPHR consultation. Prior to clearing, the operational management component will be approved with CPHR consultation. The BMP will include but not limited to: • Implementing mitigation measures. • Evaluating mitigation measures. • Objectives for monitoring. • Performance of proposed measures. • Informing an adaptive management method for additional offsets which further impacts are identified. • Remedial action. The BMP will also include Plains-wanderer subplan to manage potential impact to Plains-wanderer and its habitat adjacent to the Survey Corridor.	Planning and management to avoid, minimise and mitigate biodiversity impacts.	Pre-clearing, pre-construction, construction and operation	Proven effective	The Proponent and contractors
	BIO5	If any unexpected threatened species (flora or fauna) are found during construction, work should be halted immediately in the vicinity of the discovery, and the onsite manager should be notified.		Pre-clearing, pre-construction, construction and operation	Proven effective	The Proponent and contractors
	BIO6	Barbed wire will be avoided for fencing to avoid entrapment of fauna on fences. Fences will be designed to ensure that fauna are not funnelled toward dead ends or to create barriers between areas of habitat across the Project Area.		Detailed design	Proven effective	The Proponent and contractors
	BIO7	The preparation and approval of a Rehabilitation Plan (RP) prior to clearing will be prepared in consultation with CPHR. The RP will detail the implementation of rehabilitation in areas of the Development Footprint. The detailed design will include areas requiring rehabilitation and areas of disturbance during the construction that do not require maintenance or clearance for the operation of the Project. The RP will include but is not limited to: • Soil erosion preventative measures, re-establishing local PCTs, local native flora, habitat and detailed rehabilitation objectives which measure the outcomes for the success over the locations, target landforms and PCTs.	The avoidance and minimisation of soil erosion, weeds in disturbed areas and the spread to adjoining edges of native vegetation.	Pre-construction, pre-clearing, during and post construction	Proven effective	The Proponent and contractors

Impact	Action ID	Mitigation measure	Outcome	Timing and frequency	Likely efficacy of mitigation	Responsibility
		• Restoring vegetation in riparian areas implementation measures to protect and improve areas of key habitat. • Remedial actions that have been triggered that includes notifying CPHR through a Trigger Action Response Plan (TARP) with an agreement about the response. • Native indigenous species used for landscaping on pervious surfaces. • Stabilisation of exposed surfaces to prevent soil loss. • Ongoing maintenance which includes but is not limited to weed and pathogen management on rehabilitated areas. • During construction, the topsoil and subsoil generated will be used for rehabilitation and stored on-site.				
	BIO8	Mitigation measures for harm to threatened hollow dependent fauna and live animals during pre-clearing surveys and translocation activities will be detailed in the BMP. This includes, but is not limited to: • Validation and mapping of all hollow bearing trees within the Development Footprint will be undertaken at least one month prior to vegetation removal. • Qualified and licenced ecologist or wildlife handler to rescue and re-located fauna during the pre-clearing surveys. • Protocols in place when hollow bearing trees and stick nests are being removed. Furthermore, mitigation protocols for mitigating harm to hollow or stick nest dependent threatened fauna or dependent habitat known in the Development Footprint.	Mitigating, avoiding and minimising impacts to biodiversity.	Pre-clearance	Proven effective	The Proponent and contractors
	BIO9	Exclusion zones within the Development Footprint will be marked by a qualified surveyor on site with the boundary of clearing limits. There will be specific exclusion zones included of known areas of threatened flora and fauna habitat, including known Plains-wanderer habitat.	Mitigating, avoiding and minimising impacts to biodiversity.	Pre-clearance, during construction and early operation	Proven effective	The Proponent and contractors
	BIO10	Staged habitat removal is required to remove habitat such as hollow-bearing trees, stick nests and habitat trees. It minimises the direct impact on fauna by allowing the fauna an opportunity to leave hollows and relocate naturally. The process is detailed in the BMP which will also include a '**Fauna handling and rescue procedure'** and a '**Unexpected threatened species finds procedure**'.	Avoiding and minimising impacts to fauna during the clearing and construction processes.	Construction	Proven effective	The Proponent and contractors
	BIO11	During vegetation and habitat clearance work a qualified ecologist will conduct on-foot pre-clearance surveys at the start of each day prior to daily construction. This is to confirm there is no wildlife present in the area to be cleared. A qualified ecologist or qualified wildlife handler will also be present during vegetation and habitat clearing works including habitat, near all waterbodies, to rescue and relocate fauna if required in the event individuals are present at the time of clearing. Additionally: • Contracted environmental representatives are to regularly conduct sweeping by regular driving through areas of the planned construction in the Development Footprint prior to planned clearance works to disturb the area and deter fauna from utilising these areas. • In the situation that an animal or threatened species is located in the construction area during other construction works, the Project Management Site Representative and Delivery Manager are to be immediately notified. Work must immediately stop within the construction area with an ecologist or a local wildlife rescuer to be brought on-site for handling and to follow the rescue procedures listed in the BMP.	Avoiding and minimising impacts to fauna during the clearing and construction processes.	During construction	Proven effective	The Proponent and contractors
	BIO12	Measures to mitigate the impacts associated with construction activities on native vegetation and habitat will include: • Prior to all vegetation removal, pre-clearance inspections will be undertaken by a qualified ecologist within one month of planned removal.	Avoiding and minimising impacts to fauna during the clearing and construction processes.	During construction	Proven effective	The Proponent and contractors

Impact	Action ID	Mitigation measure	Outcome	Timing and frequency	Likely efficacy of mitigation	Responsibility
		• Where possible, trim vegetation rather than clear or removal whole plants within the Development Footprint, inspecting vegetation in pre-clearance inspections one month prior to removal. • Micro-siting will be used to minimise the construction of access roads, stockpiles, vehicle parking, site compounds, hardstands and WTGs to avoid unnecessary removal or impacts to native vegetation and/or fauna habitat. This will be incorporated into the daily pre-clearance surveys a qualified ecologist conducts during construction stage. • During construction, retain tree roots where the tree roots do not impact the construction required, or the tree is to be retained outside of the Development Footprint. • Retain dead trees and tree trunks where they are regarded as integral habitat for native fauna, inspecting vegetation in pre-clearance inspections within one-month of planned removal.				
Increase in weeds and disease pathogens in adjacent vegetation	BIO13	Weed monitoring and control programs are to be documented in the BMP and Trigger Action Response Plan as part of a Construction Soil and Water Manager Plan (CSWMP) detailed in the CEMP and implemented in consultation with CPHR. Any deviation from measures approved by DPHI are to be raised and approved. Additional monitoring and control measures for introduced plant establishment and spread should be implemented at and around locations utilised for sediment control structures. Monitoring of exotic plants with waterborne propagules and a Trigger Action Response Plan for control must be undertaken along drainage lines outside of the Project Area. Monitoring of locations where runoff drains from the construction site, and from locations where sediment control has failed. Weed monitoring and control programs will include adaptive management strategies for priority weed species during construction, and early operational phase. Details of the monitoring program will be established during the preparation of the BMP and follow principles outlined in **Section 9.2.1**.	Spreading of weed controls from the Project.	Pre-clearance, construction and operation	Proven effective	The Proponent and contractors
	BIO14	All weeds will be identified, mapped and removed before pre-construction clearance. Locations of weeds and sprayed areas for use in ongoing weed management and monitoring programs, particularly for *Lycium ferocissimum.*				
	BIO15	Preparation of a vehicle and machinery hygiene strategy protocol as part of the BMP, will be implemented during construction and operation. The strategy will include site specific locations, timings, and methods for removing soil and plant matter from vehicles and machinery. Hygiene measures stated in the strategy protocol must be applied during construction and operation to ensure vehicle and machinery hygiene.				
	BIO16	Weeds will be disposed and managed appropriately during clearing works, to stop the spread of invasive weed species.				
	BIO17	Construction of wash down stations will occur at suitable locations to wash down vehicles and employee shoes to stop the spread of weeds, pathogens (including *Phytophthora cinnamomi*, amphibian chytrid fungus, agricultural weeds, and exotic rust fungi) and the introduction of new species to the site.				
Increase in predatory and pest species	BIO18	Refuse and personal waste generated throughout the construction and operational phases will be stored in bins and discarded in a suitable waste storage facility.	Controlled action to mitigate, avoid and minimise introduced predators and pests to the area of construction.	During construction and operation	Proven effective	The Proponent and contractors

Impact	Action ID	Mitigation measure	Outcome	Timing and frequency	Likely efficacy of mitigation	Responsibility
	BIO19	Implementation of a monitoring program for feral animals which is based on performance triggers for adaptive management. If an increase in predator activity is identified, it will trigger the need for a control program based on measures related to performance. This will be outlined in the BMP with control done in consultation of host landowners.				
Impacts on protected animals from wind farm strikes	BIO20	To measure impacts on bird and bat species, a Bird and Bat Adaptive Management Plan (BBAMP) will be prepared as part of the BMP. Further details are provided below in **Section 9.2.2**.	Monitoring fauna blade strike collision.	During construction and operation	Effectiveness with an adaptive response method and management	The Proponent
	BIO21	Measures taken to protect birds include: • Nests within 200 m of the Development Footprint will be mapped and validated prior to the erection and operation of WTGs. • Nests will be inspected prior to removal for juvenile birds and avoidance or relocation to be undertaken under the guidance of a qualified ecologist. • Regular carcass removal will be undertaken to prevent raptors being attracted to the Project Area. • Reduction of potential perching locations where possible will be a consideration of the Project design. • Power lines will be fitted with species specific measures to avoid unnecessary collisions.	Monitoring fauna blade strike collision.	During construction and operation	Effectiveness with an adaptive response method and management	The Proponent
Fragmentation resulting in reduced connectivity	BIO22	Clearing/works will be contained within approved areas.	No reduction in connectivity.	During Construction	Proven effective	Contractor
Wildlife impacts from vehicle strikes	BIO23	40 km/h speed limits on newly formed access tracks to reduce the risk of vehicle strikes to fauna specifically in areas surrounding permanent water bodies and close to farm dams, particularly after periods of rain.	No wildlife vehicle strikes.	During construction and operation	Proven effective	The Proponent and contractor
Surface runoff changes resulting in sedimentation changes due to the removal of habitat and vegetation. **Impacts on water quality and hydrological processes that sustain threatened species.** **Contaminant pollution.**	BIO24	A Construction Soil and Water Management Plan (CSWMP) will be prepared as a part of the CEMP. This will include but not limited to: • Procedures to minimise and manage erosion and sediment transport within the project site and offsite. • The preparation of Erosion and Sediment Control Plan (ESCP) for construction. • Procedures to manage accidental spills with the requirement to maintain spill kits. • Procedures to manage the potential of any acid sulfate soils (ASS) in accordance with the NSW Acid Sulfate Soil Guidelines (Ahern et al. 1998). • Procedures to manage potential tannin leachate. • Procedures to manage stockpiles. • Details of surface water quality monitoring procedures.	Avoiding and minimising impacts to aquatic habitats and threatened fish species.	Pre-construction, during construction and decommissioning	Proven effective	The Proponent and contractor
	BIO25	As part of the CSWMP, a construction ESCP will be prepared. This will detail erosion and sediment control procedures that will be implemented within the Project Area in accordance with the principles and requirements of Managing Urban Stormwater – Soils and Construction, Volume 1 (Landcom, 2004).		Pre-construction and during construction		

Impact	Action ID	Mitigation measure	Outcome	Timing and frequency	Likely efficacy of mitigation	Responsibility
	BIO26	To minimise and avoid any impacts threatened species and water quality, the following procedure will be implemented: • The total bare earth exposed at any time will be minimised. • Rehabilitation strategies to be implemented to minimise dust regeneration, soil erosion and weed incursion. • Rehabilitate all areas of the Project Area that are not proposed for future disturbance post construction and when decommissioning.	Avoiding and minimising impacts to aquatic habitats and threatened fish species.	During construction and decommissioning	Proven effective	The Proponent and contractor
	BIO27	Prior to, during and following construction and decommissioning, a surface water monitoring program will be prepared and implemented as part of the CSWMP. The monitoring program will include, but is not limited to: • Routine monitoring of physico-chemical parameters and contaminants at downstream SREs during construction and decommissioning. • Weekly visual assessments of surface water quality control structures including after heavy rainfall during construction and decommissioning.		Pre-construction, during construction and decommissioning		
	BIO28	As part of the CSWMP, Project specific procedures and controls will be prepared and implemented. This is to minimise the risk of spills, litter and leaks entering downstream waterways and/ or leaking into the soil and groundwater table. The CSWMP will include, but is not limited to: • All liquids, chemicals and fuels to be stored in a sealed bunded area and stored on level ground within the construction compound. • Appropriate storage of equipment and hazardous substances during construction and operation. • Designated areas with spill capture and management controls for refuelling and minor activities. • An emergency spill response procedure will be prepared in the CSWMP. • Regular water quality checks to be carried out at waterways within proximity to work being carried out. • Installation and maintenance of control measures such as gross pollutant traps and silt fencing.		During construction and decommissioning		
	BIO29	The management of stockpiles to minimise the transport of dust, sediment and leachate runoff. This will include, but is not limited to: • Minimising time that the stockpiles are left exposed, the number of stockpiles and the areas used for stockpiles. • Designating stockpiles away from waterways, drainage lines and areas where they would be susceptible to wind erosion. • Establishing appropriate controls for sediment, stabilising stockpiles and supressing dust as required.		During construction		
	BIO30	A concrete slab adjacent to the construction compound will locate all batch plants. Avoiding ingress from concrete waste into downstream waterways will be outlined with measures in the CEMP.		Pre-construction and during construction		

Impact	Action ID	Mitigation measure	Outcome	Timing and frequency	Likely efficacy of mitigation	Responsibility
	BIO31	Stormwater runoff increases during the Project operation will be managed through, but not limited to: • The design of permanent drainage and water management to meet the Project performance outcomes of no pollution of water. • Control procedures and maintenance of access tracks and scour protection to minimise erosion and impacts on water quality. • Potential impacts on channel erosion and scour to be monitored at receiving drainage channels and waterways downstream.		During operation		
	BIO32	Within the Detailed design, if the Project excavation exceeds the proposed maximum depth below ground level, potential impacts to GDEs will need to be re-assessed by a qualified hydrogeologist.	Avoiding impacts to GDE's.	Detailed design and during construction		
Fire risk during operation	BIO33	The Project will implement the following permanent bush fire protections: • Asset Protection Zones (APZs) around each WTG. • APZs around the BESS and substations. • An APZ around the operation and maintenance facility (to be constructed to a BAL-12.5 standard). • Ongoing vegetation management. • Access for emergency response vehicles. • A permanent, dedicated firefighting water source. • Controls on Project actions to prevent bush fire ignition. • Fire suppression systems in substations, BESS and WTGs.	Mitigate risks to biodiversity.	During construction and operation	Effective	The Proponent
	BIO34	Construction and Operation Bush Fire Emergency Management Plans will be developed in accordance with Planning for Bush Fire Protection (PBP) (NSW Rural Fire Service (RFS), 2019) and in consultation with the NSW RFS (including any requirements in relation to aerial firefighting). These plans will identify all pertinent bush fire risk and mitigation strategies relating to the construction and operation of the Project, including those listed in B29 and: • Actions to prevent bush fire ignition or spread from Project activities. • Work that will not be conducted during total fire bans. • Appropriate safety procedures and storage location for any fuels or other hazardous or flammable materials. • Protocols in place to alert NSW RFS regarding work with the potential to cause a fire to the surrounding vegetation. • Protocols and triggers to shut down WTGs with an approaching fire. • Measures relating to the requirements of NSW RFS or other authorities regarding the management risk to aerial firefighting in the region. • Escalation notifying protocols with contact details for the local NSW RFS Fire Control Centre, local fire brigades, CASA, Air Services Australia, and all other relevant people and / or organisations who will be notified of an emergency at the Project Area. • The locations of any firefighting water along with alternative water supplies that may be available in the case of an emergency (including any other fire suppression equipment held on and off site). • Bush fire emergency planning that includes evacuation routes, evacuation triggers and when and where to take refuge.				

Impact	Action ID	Mitigation measure	Outcome	Timing and frequency	Likely efficacy of mitigation	Responsibility
Light and noise vibration impacts during night works	BIO35	To address noise that is likely to exceed acceptable noise management levels (NMLs) a Construction Noise Management Plan will be implemented as a component of the CEMP.	Mitigate risks to biodiversity.	During construction and operation	Effective	The Proponent and Contractor
	BIO36	Standard noise mitigation measures will be implemented where reasonably practicable, including the following: • Work limited to standard hours of construction unless permitted by the development consent. • Adopt low-noise and plant equipment, where feasible plant and equipment to be fitted out with silencing devices. • Consider using less intrusive alternatives to reverse beepers such as 'squawker' or broadband' alarms. • All plant and equipment to be well maintained. • Warrant equipment mufflers are functioning correctly and effectively. • When feasible, employ construction techniques that produce less vibration and are quieter. • Equipment that is on-site be turn-off when not in use. • Only have necessary equipment on-site, including only having necessary size and powered equipment for tasks. • Noisy activities will be concentrated at one location and relocate as soon as possible. • Vehicle movements limited and avoided whenever feasible. • Provide training to acquaint employees with noise sensitivity. • For concentrated, noise-intensive activities implemented temporary construction noise barriers or earth mounds. • Install enclosures around noisy mobile and fixed equipment were reasonably practicable. • Were reasonably practicable avoid coincide operation of two or more noisy plants close to receivers. • Optimise the offset distance between sensitive receivers and noisy plants. • Implement parking, loading/unloading areas and traffic flow management to minimise reversing movements. • Implement routinely monitoring of construction noise levels ensure effectiveness of mitigation measures and whether revision of measures in required.				
	BIO37	Standard vibration mitigation measures from the *Assessing Vibration: a technical guideline* (DECC, 2006) will be implemented were reasonably practicable, including the following: • Were reasonably practicable selecting lower-impact equipment or techniques were feasible. • Operating vibration-causing plant and equipment during the least sensitive time of day were reasonably practicable. • Avoid coincide operation of vibration-causing operations. • High-vibration activities to be located as far away from sensitive receiver areas as possible. • All plant and equipment to be well maintained. • Intensive vibration operation to not occur within the recommended safe set back distances. • Receivers to be notified regarding the nature of construction phases and vibrations-generating operations.	Mitigate risks to biodiversity.	During construction and operation	Effective	The Proponent

Impact	Action ID	Mitigation measure	Outcome	Timing and frequency	Likely efficacy of mitigation	Responsibility
Dust pollution	BIO38	Air quality management measures will be implemented and include but is not limited to: • Haul routes clearly marked. • Maintenance and watering of haul routes. • Vehicle speed restriction. • Immediate clean-up of any material spillage. • During adverse weather conditions e.g. during hot and windy conditions weather will be monitored.	Avoid, minimise and mitigate impacts from dust pollution.	During construction	Effective	The Proponent and Contractor
Edge effects on adjacent native vegetation and habitat	BIO39	Exclusion zones will be set up at the limit of clearing.	Identify residual edge effects.	During construction	Effective	The Proponent and Contractor
Obstacle lighting impacts to wildlife	BIO40	Implementation of the measures outlined in Appendix 3 of the MNES Report (Appendix E of this Amended BDAR) defined as per Step 4 to Step 6 of the National Light Pollution Guidelines for Wildlife.	Confirm obstacle lighting is installed as per design; the Project's lighting objectives have been met.	During operation	Effective	The Proponent and Contractor

9.2 Adaptive Management for Uncertain Impacts

Some impacts, typically indirect and prescribed, are difficult to predict or assess prior to the commencement of a development (BAM Section 8.5). The adaptive management plan identifies uncertain impacts and can be used to quantify and respond to these throughout construction and operation.

Table 9.2 provides a suggested framework for the Adaptive Management Plan which includes the uncertain impacts and the potential monitoring activities, examples of appropriate methods to be used and example performance criteria required for each. This plan should be reviewed periodically and adjusted when necessary.

9.2.1 Monitoring Program and Adaptive Management

Table 9.2 Proposed monitoring and adaptive management measures

Impact being mitigated	Monitoring schedule	Example methods and triggers to be applied	Example performance criteria
Removal of native vegetation and habitat	During construction	Vegetation clearing reports to verify the area of native vegetation and threatened species habitat cleared. Trigger for compliance should clearing occur outside of Development Footprint.	No clearing outside of approved Development Footprint.
	Operation - over the life of the project set at 5 yearly intervals	Monitor the impacts of edge effects on TEC and threatened flora species outside of the Development Footprint. Carry out floristic plots in adjacent vegetation, at a feasible distance from the Development Footprint, and compare with baseline data collected prior to construction. Trigger for compliance action and revision of mitigation measures should vegetation integrity scores show any reduction.	No negative change in vegetation integrity scores compared with baseline data.
Changes to surface water runoff regimes due to habitat removal	During construction	After heavy rainfall events, sediment controls will be monitored. Should sediment controls be considered ineffective, mitigation measures will be revised.	Implemented sediment controls are deemed to be effective.
Impacts on water bodies, water quality and hydrological processes	During construction	Testing of water quality indicators (e.g., pH, turbidity) in aquatic habitats occurring downstream of the development. Should a decline in water quality be detected, work will be ceased or scaled back until additional mitigation measures are implemented and considered effective.	No detected decrease in water quality within downstream aquatic habitats.
Increase in weeds and pathogens within adjacent vegetation	During construction and operation – annually, until no corrective actions have been triggered for three consecutive years	Carry out floristic plots in adjacent vegetation, at a feasible distance from the Development Footprint, and compare with baseline data collected prior to construction. Should an acceptable limit of weed cover be exceeded, weed control and monitoring will be implemented as per the CEMP.	Set an acceptable limit of weed cover. Measures will be considered effective after meeting the performance criteria for three consecutive years post-construction.

Impact being mitigated	Monitoring schedule	Example methods and triggers to be applied	Example performance criteria
Increase in predator and pest species populations	During construction and operation - annually, until no corrective actions have been triggered for three consecutive years	Monitoring of predator and pest species using remote cameras, focusing on areas where there is a potential for increased pest activity i.e. compound sites.	Should an increase in predator and pest species be observed during monitoring, controls will be implemented. Appropriate triggers to be decided in consultation with CPHR and landholders.
Increase in vehicle strikes	During construction and operation	Monitoring of tracks/roads for evidence of fauna collision. Reporting of vehicle strikes on fauna by site personnel. Set a threshold for an acceptable number of vehicle strikes on fauna, based on relevant literature, which will trigger revision of mitigation measures.	The acceptable threshold of vehicle strikes on fauna is not exceeded.

9.2.2 Adaptive Management of Bird and Bat Strike

Being a wind energy Project, the realised impacts that the Project will have on avifauna species can only be predicated during the impact assessment. The accuracy of these predictions relies on extensive and repetitive surveys relating to bird and bat utilisation which have been undertaken for this Project. Across all wind energy projects, it is considered that some impacts relating to bird and bat strike and barotrauma may be uncertain and therefore, further consideration and an adaptive management strategy is warranted.

All other impacts associated with the Project are considered to be well known.

A BBAMP will be prepared to measure any impacts on aerial fauna by the Project. The development and implementation of the BBAMP is an integral part of managing impacts to bat and bird species and a key mitigation measure to address the prescribed impacts associated with turbine strike outlined in **Section 8.3** and **Appendix D**.

The plan will develop trigger levels and mitigation measures designed to manage such impacts through Project operation, in consultation with CPHR. The BBAMP will provide guidance to develop a framework for monitoring such impacts. This will include baseline monitoring and ongoing monitoring. The BBAMP will be prepared following approval of the Project, however, detail on the likely components of the plan is provided in **Section 7.4.1**.

An adaptive management strategy will be prepared as part of the BBAMP, which will provide a framework for establishing whether the Project has any impacts that were not predicted as an outcome of this assessment. Additional mitigation measures to address any new, uncertain or residual impact may include consideration of the following, in consultation with CPHR:

- Carrion removal program.
- Pest animal control.
- Raptor perch management.
- Lighting and deterrents.
- Alteration of cut-in speeds.
- Temporary shutdown of turbines.
- Acoustic deterrents.
- Radar consideration.
- Additional offset requirements.

10.0 Impact Summary

10.1 Determining an Offset Requirement for Impacts

10.1.1 Impacts on Native Vegetation and TECs (Ecosystem Credits)

The PCTs and associated vegetation zones that require ecosystem credits are described in **Table 10.1**. There are no PCTs and associated vegetation zones that do not require an offset as per Section 9.2.1(1) of the BAM.

Table 10.1 Ecosystem Credits for Impacts to Native Vegetation and TECs which Require an Offset

VZ ID	PCT	Condition	TEC	Area (ha) Impacted			Total Area Impacted	Current VI Score	Future VI Score	Change in VI Score	Biodiversity Risk Weighting	Number of Ecosystem Credits Required			Total Number of Ecosystem Credits Required
				Stage 1 – Linear	Stage 2 – Site based	Stage 2 – Linear						Stage 1 – Linear	Stage 1 – Site based	Stage 2 – Linear	
1	PCT 10: River Red Gum - Black Box woodland wetland of the semi-arid (warm) climatic zone (mainly Riverina Bioregion and Murray Darling Depression Bioregion)[1]	Moderate-good	-	2.23	0.00	0.00	2.23	34.9	0	-34.9	1.50	19	0	0	19
2	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)[1]	Moderate-good	-	0.08	0.00	0.00	0.08	66.4	0	-66.4	1.75	2	0	0	2
3	PCT 17: Lignum shrubland wetland of the semi-arid (warm) plains (mainly Riverina Bioregion and Murray Darling Depression Bioregion)[1]	Moderate-good	-	2.05	0.00	0.00	2.05	85.4	0	-85.4	1.75	55	0	0	55
4	PCT 24: Canegrass swamp tall grassland wetland of drainage depressions: lakes and pans of the inland plains[1]	Moderate-good	-	1.97	0.00	0.00	1.97	37.2	0	-37.2	1.50	18	0	0	18
5	PCT 26: open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion[1]	DNG	Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions	17.88	0.00	0.00	17.88	34.3	0	-34.3	2.00	230	0	0	230
6	PCT 26: Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion[1]	Moderate-good	Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions Weeping Myall Woodlands	4.92	0.00	0.00	4.92	54.7	0	-54.7	2.00	101	0	0	101
7	PCT 28: White Cypress Pine open woodland of sand plains, prior streams and dunes mainly of the semi-arid (warm) climate zone[1]	DNG	Sandhill Pine Woodland in the Riverina, Murray-Darling Depression and NSW South Western Slopes bioregion	20.44	0.53	38.74	59.70	49.2	0	-49.2	2.00	377	10	715	1,102
9	PCT 44: Forb-rich Speargrass - Windmill Grass - White Top grassland of the Riverina Bioregion[1]	Moderate-good	-	76.46	0.00	92.79	169.25	48.2	0	-48.2	2.00	1,381	0	1,676	3,057
10	PCT 46: Curly Windmill Grass - speargrass - wallaby grass grassland on alluvial clay and loam on the Hay Plain: Riverina Bioregion[1]	Moderate-good	-	138.83	0.00	197.59	336.43	68.4	0	68.4	1.50	2,374	0	3,379	5,753
11	PCT 160: Nitre Goosefoot shrubland wetland on clays of the inland floodplains[2]	Moderate-good	-	0.91	0.00	1.63	2.55	58.4	0	58.4	1.50	13	0	24	37
12	PCT 164: Cotton Bush open shrubland of the semi-arid (warm) zone[1]	Moderate-good	-	3.91	0.38	36.65	40.95	48.6	0	-48.6	1.50	48	5	446	499
Total												**4,618**	**15**	**6,240**	**10,873**

[1] WET Benchmarks; [2] AVERAGE Benchmarks.

Table 10.2 Ecosystem Credits for Impacts to Native Vegetation and TECs which Require an Offset as a result of the Amended Project (removal of WTG 37 and 38)

VZ ID	PCT	Condition	TEC	Existing Area (ha) Impacted			Existing Total Area Impacted	Amended Area (ha) Impacted			Amended Project Total Area Impacts	Existing Number of Ecosystem Credits Required			Existing Total Number of Ecosystem Credits Required	Amended Number of Ecosystem Credits Required			Amended Total Number of Ecosystem Credits Required
				Stage 1 – Linear	Stage 2 – Site based	Stage 2 – Linear		Stage 1 – Linear	Stage 2 – Site based	Stage 2 – Linear		Stage 1 – Linear	Stage 1 – Site based	Stage 2 – Linear		Stage 1 – Linear	Stage 2 – Site based	Stage 2 – Linear	
1	PCT 10: River Red Gum - Black Box woodland wetland of the semi-arid (warm) climatic zone (mainly Riverina Bioregion and Murray Darling Depression Bioregion)	Moderate-good	-	2.23	0.00	0.00	2.23	2.23	0.00	0.00	2.23	19	0	0	19	19	0	0	19
2	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)	Moderate-good	-	0.08	0.00	0.00	0.08	0.08	0.00	0.00	0.08	2	0	0	2	2	0	0	2
3	PCT 17: Lignum shrubland wetland of the semi-arid (warm) plains (mainly Riverina Bioregion and Murray Darling Depression Bioregion)	Moderate-good	-	2.05	0.00	0.00	2.05	2.05	0.00	0.00	2.05	55	0	0	55	55	0	0	55
4	PCT 24: Canegrass swamp tall grassland wetland of drainage depressions: lakes and pans of the inland plains	Moderate-good	-	1.97	0.00	0.00	1.97	1.97	0.00	0.00	1.97	18	0	0	18	18	0	0	18
5	PCT 26: open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion	DNG	Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions	17.88	0.00	0.00	17.88	17.88	0.00	0.00	17.88	230	0	0	230	230	0	0	230

VZ ID	PCT	Condition	TEC	Existing Area (ha) Impacted			Existing Total Area Impacted	Amended Area (ha) Impacted			Amended Project Total Area Impacts	Existing Number of Ecosystem Credits Required			Existing Total Number of Ecosystem Credits Required	Amended Number of Ecosystem Credits Required			Amended Total Number of Ecosystem Credits Required
				Stage 1 – Linear	Stage 2 – Site based	Stage 2 – Linear		Stage 1 – Linear	Stage 2 – Site based	Stage 2 – Linear		Stage 1 – Linear	Stage 1 – Site based	Stage 2 – Linear		Stage 1 – Linear	Stage 2 – Site based	Stage 2 – Linear	
6	PCT 26: Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion	Moderate-good	Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions Weeping Myall Woodlands	4.92	0.00	0.00	4.92	4.92	0.00	0.00	4.92	101	0	0	101	101	0	0	101
7	PCT 28: White Cypress Pine open woodland of sand plains, prior streams and dunes mainly of the semi-arid (warm) climate zone	DNG	Sandhill Pine Woodland in the Riverina, Murray-Darling Depression and NSW South Western Slopes bioregion	20.44	0.53	38.74	59.70	20.44	0.53	36.64	57.61 (-2.09)	377	10	715	1,102	377	10	676 (-39)	1,063 (-39)
9	PCT 44: Forb-rich Speargrass - Windmill Grass - White Top grassland of the Riverina Bioregion	Moderate-good	-	76.46	0.00	92.79	169.25	76.46	0.00	92.79	169.25	1,381	0	1,676	3,057	1,381	0	1,676	3,057
10	PCT 46: Curly Windmill Grass - speargrass - wallaby grass grassland on alluvial clay and loam on the Hay Plain: Riverina Bioregion	Moderate-good	-	138.83	0.00	197.59	336.43	138.83	0.00	194.32	333.15 (-3.28)	2,374	0	3,379	5,753	2,374	0	3,323 (-56)	5,697 (-56)
11	PCT 160: Nitre Goosefoot shrubland wetland on clays of the inland floodplains	Moderate-good	-	0.91	0.00	1.63	2.55	0.91	0.00	1.63	2.55	13	0	24	37	13	0	24	37
12	PCT 164: Cotton Bush open shrubland of the semi-arid (warm) zone	Moderate-good	-	3.91	0.38	36.65	40.95	3.91	0.38	36.65	40.95	48	5	446	499	48	5	446	499
Totals												**4618**	**15**	**6240**	**10873**	**4618**	**15**	**6145 (-95)**	**10,778 (-95)**

10.1.2 Impacts on Threatened Species and Their Habitat (Species Credits)

Table 10.3 provides a summary of the species credit threatened species that require an offset as per Section 9.2.2(2) of the BAM and identifies the number of credits required. The species polygons are shown on to **Figure 5.32**.

Table 10.3 Species Credits for Impacts to Threatened Species which Require an Offset

Common Name *Scientific Name*	BC Act	EPBC Act	SAII	Loss of habitat (ha)			Total loss of habitat (ha)	Biodiversity risk weighting	Species Credits Required			Total Species Credits Required
				Stage 1 – Linear	Stage 1 – Site based	Stage 2 – Linear			Stage 1 – Linear	Stage 1 – Site based	Stage 2 – Linear	
Flora												
Chariot Wheels *Maireana cheelii*	V	V	No	2.01	0.0	2.66	4.67	2.00	51	0	65	116
Silky Swainson-pea *Swainsona sericea*	V	-	No	4.18	0.0	5.60	9.78	2.00	117	0	165	282
Slender Darling Pea *Swainsona murrayana*	V	V	No	52.23	0.0	70.86	123.09	2.00	1,473	0	2,058	3,531
Spike-rush *Eleocharis obicis*	V	V	No	0.0	0.0	7.31	7.31	2.00	0	0	193	193
Winged Pepper-cress *Lepidium monoplocoides*	E	E	No	3.52	0.0	0.0	3.52	2.00	88	0	0	88
Fauna												
Little Eagle *Hieraaetus morphnoides*	V	-	No	20.46	0.0	15.35	35.81	1.50	386	0	281	667
Barking Owl *Ninox connivens*	V		No	2.8	0.0	0.0	2.8	2.00	49	0	0	49
Southern Bell Frog *Litoria raniformis*	E	V	No	34.87	0.0	17.29	52.16	2.00	934	0	492	1,426
Fauna (Additional and Appropriate Measures)												
Plains-wanderer[1] *Pedionomus torquatus*	E	CE	Yes	20.20	0.0	0.69	20.89*	3.00	708	0	25	733
Total									**3,806**	**0**	**3,279**	**7,085**

[1] Impacts presented for Plains-wanderer are based on the assessment of supplementary habitat, it does not include any impacts to NSW identified Important Habitat Mapping as all of that critical species habitat mapping was avoided by the Project.

** comprising 2.61 ha of existing mapping of infrastructure, non-native vegetation and/or waterbodies.*

Table 10.4 Species Credits for Impacts to Threatened Species which Require an Offset as a result of the Amended Project (removal of WTG 37 and 38)

Common Name *Scientific Name*	BC Act	EPBC Act	SAII	Existing Loss of habitat (ha)			Existing Total loss of habitat (ha)	Amended Loss of habitat (ha)			Amended Total loss of habitat (ha) (reduction)	Existing Species Credits Required			Existing Total Species Credits Required	Amended Species Credits Required			Amended Total Species Credits Required (reduction)
				Stage 1 – Linear	Stage 1 – Site based	Stage 2 – Linear		Stage 1 – Linear	Stage 1 – Site based	Stage 2 – Linear		Stage 1 – Linear	Stage 1 – Site based	Stage 2 – Linear		Stage 1 – Linear	Stage 1 – Site based	Stage 2 – Linear	
Flora																			
Chariot Wheels *Maireana cheelii*	V	V	No	2.01	0.0	2.66	4.67	2.01	0.0	2.66	4.67	51	0	65	116	51	0	65	116
Silky Swainson-pea *Swainsona sericea*	V	-	No	4.18	0.0	5.60	9.78	4.18	0.0	5.60	9.78	117	0	165	282	117	0	165	282
Slender Darling Pea *Swainsona murrayana*	V	V	No	52.23	0.0	70.86	123.09	52.23	0.0	70.86	123.09	1,473	0	2,058	3,531	1,473	0	2,058	3,531
Spike-rush *Eleocharis obicis*	V	V	No	0.0	0.0	7.31	7.31	0.0	0.0	7.31	7.31	0	0	193	193	0	0	193	193
Winged Pepper-cress *Lepidium monoplocoides*	E	E	No	3.52	0.0	0.0	3.52	3.52	0.0	0.00	3.52	88	0	0	88	88	0	0	88
Fauna																			
Little Eagle *Hieraaetus morphnoides*	V	-	No	20.46	0.0	15.35	35.81	20.46	0.0	14.17	34.63 (-1.18)	386	0	281	667	386	0	257 (-24)	643 (-24)
Barking Owl *Ninox connivens*	V	V	No	2.8	0.0	0.0	2.8	2.8	0.0	0.0	2.8	49	0	0	49	49	0	0	49
Southern Bell Frog *Litoria raniformis*	E	V	No	34.87	0.0	17.29	52.16	34.87	0.0	17.29	52.16	934	0	492	1,426	934	0	492	1,426
Fauna (Additional and Appropriate Measures)																			
Plains-wanderer[1] *Pedionomus torquatus*	E	CE	Yes	20.20	0.0	0.69	20.89	20.20	0.0	0.69	20.89	708	0	25	733	708	0	25	733
Total												**3,806**	**0**	**3,279**	**7,085**	**3,806**	**0**	**3,255**	**7,061**

[1] Impacts presented for Plains-wanderer are based on the assessment of supplementary habitat, it does not include any impacts to NSW identified Important Habitat Mapping as all of that critical species habitat mapping was avoided by the Project.

10.1.3 Indirect Impacts

No offsets are proposed for indirect impacts.

10.1.4 Prescribed impacts

10.1.4.1 Prescribed Impacts Requiring Offsets

Based on the assessment of prescribed impacts summarised in **Section 8.3** and detailed in **Appendix G**, offsets are proposed for one prescribed impact, that being turbine strike on protected animals.

Umwelt does not believe that the biodiversity credit scheme is a suitable mechanism to offset unavoidable prescribed impacts relating to turbine strike that may occur as a result of the Project as described below:

- The credit system does not allow for an equitable credit calculation between species-credit species and ecosystem-credit species. For example, the quantum of credits calculated for two species both listed as vulnerable would vary depending on whether the species is an ecosystem credit species or species credit species.
- The BAM-C does not currently have the necessary functions to generate a credit liability for a Project for each occurrence of a threatened species impacted by turbine strike or barotrauma.
    - For example, the BAM-C does not allow for a specific number of credits to be allocated for a particular species. Rather, impacts to threatened species are calculated based on whether the unit of measure is number of individuals or area. For species assessed by area, the area needs to be linked to a vegetation zone(s) and respective VI scores.
    - The BAM-C does not allow for impacts to be calculated for species in the absence of all other components of the BAM (DPE 2020) e.g., landscape features, PCTs and respective condition classes. Therefore, the only way that credits could be calculated and linked for these impacts would be through the existing BAM-C assessment for the Project, or a new one. Furthermore, each time additional impacts were recorded, either a new version or child case of the BAM-C assessment would be required.
    - The BAM-C does not allow for potentially ongoing or regular (if that were to eventuate) credits to be generated regularly while still being linked to the existing Project assessment.
    - The impacts, should they occur, are likely to be sporadic and offsetting through the credit scheme is not considered likely to result in meaningful outcomes for the impacted species.

As such, Umwelt recommends these impacts are offset through other mechanisms available under the Biodiversity Conservation Regulation 2017 (BC Regulation 2017) which are not credit based. Specifically, this includes *'funding of a biodiversity conservation action that would benefit the relevant threatened species or ecological community and that is equivalent to the cost of acquiring the required like-for-like biodiversity credits as determined by the offsets payment calculator referred to in section 6.32 of the Act'* as per Section 6.2 (2c) BC Regulation 2017.

Ancillary Rules have been published in accordance with clause 6.5 of the BC Regulation so that assessors can interpret and apply the 'like-for-like' and variation offset rules. The Ancillary Rules also prescribe a suite of species for which biodiversity conservation actions are an option to meet an offset obligation instead of, or in combination with, the retirement of species credits for a threatened species. As of June 2024, the list of species and prescribed conservations actions do not provide for offsetting impacts associated with turbine strike. Approval of the use of conservation actions which are not currently prescribed by the Ancillary Rules would be required through consultation with the BAM policy team who have ownership over the list of prescribed conservation actions.

The listed biodiversity conservation actions target threatened species that are difficult to effectively manage at a biodiversity stewardship site due to limited understanding of their ecology, threats or management requirements or threatened species with a limited known distribution where research to find more locations where the entity is present will be beneficial. In this instance, we believe the species at risk satisfy the requirements above.

The use of biodiversity conservation actions is considered to be a more appropriate mechanism of offsetting impacts associated with turbine strike than the BAM-C, and given the complexities associated with the BAM-C and credit generation, is considered to result in better conservation outcome for impacted threatened species.

If adopted as an offset mechanism, any biodiversity conservation action proposed would be agreed to through consultation with both CPHR, the Nature Markets and Offsets Division, and DCCEEW where necessary. Examples of biodiversity conservation actions may be suitable to offset impacts from turbine strike include:

- Funding of a PhD Project.
- Funding of existing research programs, such as the Difficult Bird Research Group.
- Funding of Saving our Species conservation projects.
- Funding of breeding programs.
- Funding of local habitat enhancements programs.
- Funding the implementation and monitoring of operational mitigation measures (such as curtailment) to assess the interaction with birds and bats.

A proposed approach to implementing this mechanism is identified below:

- Impacts to a threatened bird and/or bat species listed under the BC Act and/or EPBC Act are recorded on the Project through the implementation of the BBAMP.
- Costs of the particular biodiversity conservation action will be based on the listing status of the impacted species in consultation with the relevant agencies. Consultation is to be sought within three weeks of impact confirmation. An example process is identified below; however, costs have not been identified as this needs to occur in consultation with state and/or federal agencies:

- A monetary contribution (indexed in line with CPI for each year) to the biodiversity conservation action per year for five years for a species listed as critically endangered under the BC Act and/or EPBC Act.
- A monetary contribution (indexed in line with CPI for each year), less than the cost of an impact on a critically endangered species, to the biodiversity conservation action per year for five years for a species listed as endangered under the BC Act and/or EPBC Act.

- A monetary contribution (indexed in line with CPI for each year), less than the cost of an impact on an endangered species, to the biodiversity conservation action per year for five years for a species listed as vulnerable under the BC Act and/or EPBC Act.

The above-described offset mechanism for prescribed impacts is not based on the number individuals but

- Critically endangered under the BC Act and/or EPBC Act: a single impact event.
- Endangered under the BC Act and/or EPBC Act: two impact events.
- Vulnerable under the BC Act and/or EPBC Act: three impact events.

Once this offset mechanism is triggered for a species there is no subsequent triggering of the mechanism should additional impacts occur. No offset mechanism is proposed for impacts of turbine strike and/or barotrauma on protected bird or bat species that are not threatened under the BC Act or EPBC Act. It is considered suitable that the generation of ecosystem credit liabilities on the Project through the application of the BAM (DPE 2020) adequately accounts for any such impacts.

10.1.4.2 Prescribed Impacts Not Requiring Offsets

No offsets are proposed for prescribed impacts relating to non-native vegetation, habitat connectivity, and waterbodies, water quality and hydrological processes.

10.2 Additional and Appropriate Measures

The following outlines the Projects approach to providing additional and appropriate management measures for the Plains-wanderer (a SAII entity) and Black falcon.

10.2.1 Determining Offset Requirements for Impacts to Plains-wanderer Supplementary Habitat

As detailed in **Section 7.1** and **Section 7.2**, the Project has avoided all impacts to the NSW Important Habitat Mapping for the Plains-wanderer. As such, the Project does not have a species credit offset liability for the Plains-wanderer associated with the NSW Important Habitat Mapping.

In consultation with Commonwealth DCCEEW, a detailed analysis of habitat within the Subject Land has been undertaken to identify supplementary habitat present and that would be impacted by the Project. Details of this analysis are provided in **Section 5.4.3.10**.

The analysis identified 94.99 ha of supplementary habitat for the Plains-wanderer within the Subject Land (84.61 ha Stage 1 – Linear and 10.38 Stage 2 – Linear), of which 7.01 ha is associated with infrastructure, non-native vegetation and water. The Project proposes to impact 20.89 ha of the supplementary habitat for the species (20.20 ha Stage 1 – Linear and 0.69 ha Stage 2 – Linear), of which 2.61 ha is associated with infrastructure, non-native vegetation and water.

These proposed impacts to supplementary habitat for the species have been entered into the NSW Biodiversity Assessment Method (BAM) Credit Calculator for Stage 1 – Linear and Stage 2 – Linear to generate a species credit liability for the Plains-wanderer. For the purposes of entering these impacts into the BAM Credit Calculator, only native vegetation of the supplementary habitat was included, i.e. impacts to infrastructure, non-native vegetation and water was excluded. This is listed below:

- Stage 1 – Linear: 708 credits
- Stage 2 – Linear: 25 credits.

The offset liability above relating to impacts of the Project on identified supplementary habitat for the Plains-wanderer will be offset in accordance with the overarching offset liability for the Project.

This species-specific offset liability is considered to result in a Nature Positive outcome for the Plains-wanderer when considered in combination with the factors below:

- Avoidance of all NSW Important Habitat Mapping for the species by the Project.
- Commitment to the additional and appropriate measures for the species that are detailed directly below.

10.2.2 Additional and Appropriate Measures – Plains-wanderer and Black Falcon

10.2.2.1 Measures in relation to SAII – Plains-wanderer

One (1) SAII entity, the Plains-wanderer, has been recorded or assumed present in the Subject Land. **Section 8.4.3** provides an assessment of impacts to Plains-wanderer, having regard to the requirements of BC Regulation 2017, relevant criteria under Section 9.1.2 of the BAM and Guidance to Assist a Decision-Maker to Determine a Serious and Irreversible Impact (DPIE 2019b).

The Project has been designed and progressively refined to avoid all impacts to the NSW Important Habitat Mapping for the Plains-wanderer. Notwithstanding, there is 3,309.68 ha of habitat within the Project Boundary (PCTs 44 and 46), representing 0.33% of the species' national area of occupancy. The Project would require 505.68 ha (15% of that within the Project Boundary and 0.51% of its total area of occupancy) of this habitat to be cleared for turbine pads, access roads and other infrastructure. It is estimated that up to 56 birds may be directly impacted (15% of the site's population) as a result of the Project.

In consultation with Cwth DCCEEW, a detailed analysis of habitat within the Subject Land has been undertaken to identify supplementary habitat present and that would be impacted by the Project.
As detailed above, a species credit liability (Stage 1 – Linear: 708 credits, Stage 2 – Linear: 25 credits) has been generated to offset the disturbance to supplementary habitat. These species credits would be retired as part of the overarching Biodiversity Offset Strategy for the Project.

In addition, while there is no policy framework for such matters, BWF has proposed additional and appropriate measures, being a proposed partnership with Riverina Local Land Services to support pest and weed management, as well as contributions to local land management, as detailed in the subsections below.

It is noted that feral predators including feral cats, pigs and foxes are identified as key threats to the recovery of the Plains-wanderer, as identified in the National Recovery Plan for the Plains-wanderer (*Pedionomus torquatus*) (Australian Government, 2016) and relevant threat abatement plans including the Threat abatement plan for predation by feral cats 2024 (Commonwealth of Australia), Threat abatement plan for predation, habitat degradation, competition and disease transmission by feral pigs (Sus scrofa) (2017) and Threat abatement plan for predation by the European red fox (Commonwealth Department of the Environment, Water, Heritage and the Arts, 2008).

Additionally, the National Recovery Plan for the Plains-wanderer states that that a key strategy to mitigate the threat of climate change is to build resilience into the grasslands upon which Plains-wanderers rely, through weed management.

With respect to mitigation for offsetting potential impact to Plains-wanderer, BWF is of the view that it has:

- made all reasonable efforts to avoid and reduce impacts to Plains-wanderer
- proposed offsets in accordance with relevant offset policies, and
- proposed additional and appropriate measures beyond the requirements of the BAM to offset all impacts to the Plains-wanderer.

10.2.2.2 Measures in relation to Black Falcon

Umwelt has prepared detailed Prescribed Impact Assessments to consider the potential impacts from turbine strikes on significant bird and bat species. These assessments have been prepared in accordance with Section 6.1.5 and 8.3.5 of the BAM.

To assess the likelihood and consequence of impacts on aerial species, a qualitative risk-based assessment based on an assessment methodology developed by the Arthur Rylah Institute (Lumsden et al. 2019) has been conducted. The assessment approach comprises consideration of the likelihood of blade strike based on a species' recorded flight behaviour and status in the Project Area, as well as consideration of existing turbine strike data from Australia. The relative consequence of potential collisions and/or barotrauma is assessed with consideration of a species' total population size and degree of concentration in certain areas, conservation status and demographic resilience.

The Black falcon was assigned an unmitigated risk rating of high. This species was frequently observed foraging within the Project Area and Disturbance Footprint during field surveys including BBUS surveys, vegetation assessment and targeted threatened species surveys. Potential nests for the species were observed on the existing transmission towers present within the Project Area, with potentially two (2) breeding pairs present within the Project Area.

Turbine strike risks will be adaptively managed under a BBAMP which would include consideration of ongoing monitoring, pest animal control, raptor perch management, lighting and deterrents, alteration of cut-in speeds and temporary shutdown of turbines. With the application of the BBAMP framework, the species has been assigned a mitigated risk rating of moderate.

Section 10.2.1 above outlines a proposed offsetting approach to be implemented where impacts to a threatened bird and/or bat species listed under the Biodiversity Conservation Act 2016 (BC Act) and/or Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) are recorded on the Project through the implementation of the BBAMP. In summary, this would involve the funding of a biodiversity conservation action, as permitted under the Biodiversity Conservation Regulation 2017. Any biodiversity conservation action proposed would be agreed to through consultation with both NSW CPHR, the Nature Markets and Offsets Division, and DCCEEW, where necessary.

In addition, while there is no policy framework for such matters, BWF has proposed additional and appropriate measures, being a proposed partnership with Riverina Local Land Services to support pest and weed management, as well as contributions to local land management, as detailed in the subsections below.

The proposed BBAMP framework, offsetting approach and additional and appropriate measures proposed by BWF relating to Black falcon are considered to more than adequately mitigate and, where impacts cannot be avoided, offset the prescribed impacts to species. The proposed additional and appropriate measures seek to manage key threats to the black falcon at the regional level and are considered to represent a Nature Positive outcome.

10.2.2.3 Riverina Local Land Services Partnership

Riverina Local Land Services (LLS) is currently leading conservations programs within the Riverina Region aimed at safeguarding vulnerable and endangered species and their habitat. Relevantly, current LLS programs include:

- *Bringing the Plains-wanderer back from the Brink*: In collaboration with the NSW DCCEEW, and with funding from the Australian Government's National Landcare Program/Natural Heritage Trust and the NSW Government's Saving Our Species Program, LLS successfully implemented a conservation program for the Plains-wanderer. The program, commenced in 2017 and involves working with seven (7) landholders in the Murray and Riverina area to improve grazing management practices on areas of Plains-wanderer grassland habitat. Additionally, the program supports landholders in managing paddocks for both livestock production and Plains-wanderer conservation, by offering incentives for pest and weed control, fencing, water points, saltbush plantations, stock management areas, and feeding infrastructure.

- *Securing the Black Falcon in the Riverina:* With funding from the Natural Heritage Trust, LLS has partnered with 12 landholders in the Riverina area to protect and enhance native active nest sites, as well as establishing new artificial nest sites. The program has also included pest animal control and targeted box thorn removal within habitat areas.

To ensure the ongoing success of these two (2) programs, effective pest animal control and management of African boxthorn (*Lycium ferocissimum*) is critical in safeguarding the Plains-wander, Black falcon, and their respective suitable habitat areas:

- Feral animal night-shooting: Night shooting is a key strategy to reduce predation pressure on native species like the Plains-wanderer and Black falcon. While existing methods like baiting, trapping, and fencing help control foxes and feral cats, additional night shooting is needed.
- Target Bait-Resistant and Trap-Shy Predators: Some foxes and feral cats learn to avoid baits or don't take them due to alternative food sources. Night shooting targets these survivors, ensuring they don't continue hunting endangered wildlife.
- Immediate Response to Threats: If a managed habitat site has a sudden increase in predator activity, night shooting can rapidly remove the threat.
- Reducing Predator Numbers Before Bird Releases: to support existing programs such as the release of captive-bred Plains-wanderers, intensive predator control is needed. Night shooting can help to ensure the success of bird release programs.
- African boxthorn removal: African boxthorn creates dense thickets which reduce suitable habitat and foraging areas while providing shelter for pest animals.

Through ongoing engagement, BWF has identified an opportunity to partner with Riverina LLS to support the above activities. The control measures will target conservation sites established through the Bringing the Plains-wanderer back from the Brink and Securing the Black Falcon in the Riverina Programs. BWF has committed to provide monetary support for feral animal night shooting and African boxthorn removal to a total value of $300,000. Nominally, this would equate to $60,000 per year for five (5) years, beginning at the commencement of Project construction.

10.2.2.4 Contributions to Local Land Management

BWF has committed to provide funding to Hay Local Aboriginal Land Council (LALC) to support ongoing land management, with a focus on weed and pest control, in the vicinity of the Oolambeyan National Park boundary. This support is valued at $10,000 per year and forms part of the BWF's overarching commitments to First Nations collaboration and participation under the South West REZ Access Rights Benefits Scheme.

10.3 Impacts That Do Not Need Further Assessment

Areas within the Development Footprint that do not contain native vegetation do not need to be assessed for ecosystem credits as per Section 9.3 of the BAM. Areas assessed as not containing native vegetation are limited to waterbodies, particularly farm dams, land which is totally cleared of all vegetation such as frequently used existing vehicle tracks and a small area of exotic vegetation around the existing dwelling.

11.0 Biodiversity Credit Reports

Biodiversity Credit Reports which identify the like-for-like and variation credit requirements are provided in **Appendix E**.

11.1 Ecosystem Credits

The ecosystem credit requirements and those that could be retired in accordance with the offset rules are listed in **Table 11.1**.

Table 11.1 Like-for-like Offset Options for Ecosystem Credits

Ecosystem Credit	Condition	Rule Type	Attributes shared with matching credits						
			PCT	PCT vegetation formation	PCT vegetation class	Associated TEC	Offset trading group	HBT	IBRA Region (in which the Project is located)
PCT 10: River Red Gum - Black Box woodland wetland of the semi-arid (warm) climatic zone (mainly Riverina Bioregion and Murray Darling Depression Bioregion) (29 credits)	Moderate-good	Like for like	2, 5, 7, 8, 9, 10, 11, 36, 78, 79, 112, 233, 234, 249, 356, 362, 4088, 4089	Forested Wetlands	Inland Riverine Forests	-	Inland Riverine Forests <50%	Yes	Murrumbidgee, Darling Depression, Lachlan, Lachlan Plains, Lower Slopes, Murray Fans, Robinvale Plains and South Olary Plain. or Any IBRA subregion that is within 100 km of the outer edge of the impacted site.
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) (3 credits)	Moderate-good	Like for like	13, 15, 16, 83, 438, 454, 630	Semi-arid Woodlands (Grassy sub-formation)	Inland Floodplain Woodlands	-	Inland Floodplain Woodlands >=50% and <70%	Yes	Murrumbidgee, Darling Depression, Lachlan, Lachlan Plains, Lower Slopes, Murray Fans, Robinvale Plains and South Olary Plain. or Any IBRA subregion that is within 100 km of the outer edge of the impacted site.
PCT 17: Lignum shrubland wetland of the semi-arid (warm) plains (mainly Riverina Bioregion and Murray Darling Depression Bioregion) (77 credits)	Moderate-good	Like for like	17, 115, 161, 241, 247, 375	Freshwater Wetlands	Inland Floodplain Shrublands	-	Inland Floodplain Shrublands >=50% and <70%	No	Murrumbidgee, Darling Depression, Lachlan, Lachlan Plains, Lower Slopes, Murray Fans, Robinvale Plains and South Olary Plain. or Any IBRA subregion that is within 100 km of the outer edge of the impacted site.
PCT 24: Canegrass swamp tall grassland wetland of drainage depressions: lakes and pans of the inland plains (27 credits)	Moderate-good	Like for like	17, 24, 25, 115, 160, 161, 240, 241, 247, 261, 271, 375	Freshwater Wetlands	Inland Floodplain Shrublands	-	Inland Floodplain Shrublands <50%	No	Murrumbidgee, Darling Depression, Lachlan, Lachlan Plains, Lower Slopes, Murray Fans, Robinvale Plains and South Olary Plain. or Any IBRA subregion that is within 100 km of the outer edge of the impacted site.
PCT 26: Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion (442 credits)	DNG	Like for like	26, 27, 37, 43, 49, 55, 145, 159, 1766	Semi-arid Woodlands (Grassy sub-formation)	Riverine Plain Woodlands	Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions	Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions	No	Murrumbidgee, Darling Depression, Lachlan, Lachlan Plains, Lower Slopes, Murray Fans, Robinvale Plains and South Olary Plain. or Any IBRA subregion that is within 100 km of the outer edge of the impacted site.
	Moderate-good					Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions Weeping Myall Woodlands			

Ecosystem Credit	Condition	Rule Type	Attributes shared with matching credits						
			PCT	PCT vegetation formation	PCT vegetation class	Associated TEC	Offset trading group	HBT	IBRA Region (in which the Project is located)
PCT 28: White Cypress Pine open woodland of sand plains, prior streams and dunes mainly of the semi-arid (warm) climate zone (1,470 credits)	Moderate-good	Like for like	19, 21, 28, 48, 75	Semi-arid Woodlands (Shrubby sub-formation)	Riverine Sandhill Woodlands	Sandhill Pine Woodland in the Riverina, Murray-Darling Depression and NSW South Western Slopes bioregions	-	No	Murrumbidgee, Darling Depression, Lachlan, Lachlan Plains, Lower Slopes, Murray Fans, Robinvale Plains and South Olary Plain. or Any IBRA subregion that is within 100 km of the outer edge of the impacted site.
PCT 44: Forb-rich Speargrass - Windmill Grass - White Top grassland of the Riverina Bioregion (4,123 credits)	Moderate-good	Like for like	44	Grasslands	Riverine Plain Grasslands	-	Riverine Plain Grasslands <50%	No	Murrumbidgee, Darling Depression, Lachlan, Lachlan Plains, Lower Slopes, Murray Fans, Robinvale Plains and South Olary Plain. or Any IBRA subregion that is within 100 km of the outer edge of the impacted site.
PCT 46: Curly Windmill Grass - speargrass - wallaby grass grassland on alluvial clay and loam on the Hay Plain: Riverina Bioregion (8,735 credits)	Moderate-good	Like for like	44, 45, 46, 165, 1203	Grasslands	Riverine Plain Grasslands	-	Riverine Plain Grasslands <50%	No	Murrumbidgee, Darling Depression, Lachlan, Lachlan Plains, Lower Slopes, Murray Fans, Robinvale Plains and South Olary Plain. or Any IBRA subregion that is within 100 km of the outer edge of the impacted site.
PCT 160: Nitre Goosefoot shrubland wetland on clays of the inland floodplains (52 credits)	Moderate-good	Like for like	17, 24, 25, 115, 160, 161, 240, 241, 247, 261, 271, 375	Freshwater Wetlands	Inland Floodplain Shrublands	-	Inland Floodplain Shrublands <50%	No	Murrumbidgee, Darling Depression, Lachlan, Lachlan Plains, Lower Slopes, Murray Fans, Robinvale Plains and South Olary Plain. or Any IBRA subregion that is within 100 km of the outer edge of the impacted site.
PCT 164: Cotton Bush open shrubland of the semi-arid (warm) zone (745 credits)	Moderate-good	Like for like	157, 158, 159, 163, 164, 168, 195, 196, 211, 212, 216, 236, 254, 377, 466	Arid Shrublands (Chenopod sub-formation)	Riverine Chenopod Shrublands	-	Riverine Chenopod Shrublands <50%	No	Murrumbidgee, Darling Depression, Lachlan, Lachlan Plains, Lower Slopes, Murray Fans, Robinvale Plains and South Olary Plain. or Any IBRA subregion that is within 100 km of the outer edge of the impacted site.

11.2 Species Credits

The species credit requirements and those that could be retired in accordance with the offset rules are listed in **Table 11.2**.

Table 11.2 Species Credit Class and Matching Credit Profiles

Species Credit	Attributes shared with matching credits				
	Name of threatened species	Kingdom	BC Act	EPBC Act	IBRA region
Flora					
Chariot Wheels *Maireana cheelii*	Like for Like Rules: *Maireana cheelii*	Flora	V	V	Like for Like Rules: Any in NSW
Silky Swainson-pea *Swainsona sericea*	Like for Like Rules: *Swainsona sericea*	Flora	V	-	Like for Like Rules: Any in NSW
Slender Darling Pea *Swainsona murrayana*	Like for Like Rules: *Swainsona murrayana*	Flora	V	V	Like for Like Rules: Any in NSW
Spike-rush *Eleocharis obicis*	Like for Like Rules: Eleocharis obicis	Flora	V	V	Like for Like Rules: Any in NSW
Winged Pepper-cress *Lepidium monoplocoides*	Like for Like Rules: *Lepidium monoplocoides*	Flora	E	E	Like for Like Rules: Any in NSW
Fauna					
Barking Owl *Ninox connivens*	Like for Like Rules: Barking Owl	Fauna	V	V	Like for Like Rules: Any in NSW
Little Eagle *Hieraaetus morphnoides*	Like for Like Rules: Little Eagle	Fauna	V	-	Like for Like Rules: Any in NSW
Southern Bell Frog *Litoria raniformis*	Like for Like Rules: Southern Bell Frog	Fauna	E	V	Like for Like Rules: Any in NSW
Plains-wanderer *Pedionomus torquatus*	Like for Like Rules: Plains-wanderer	Fauna	E	CE	Like for Like Rules: Any in NSW

12.0 Biodiversity Offset Strategy

12.1 Biodiversity Offset Strategy

BWF is committed to delivering a biodiversity offset strategy that appropriately compensates for the unavoidable loss of ecological values as a result of the Project.

As discussed in **Section 7.0**, BWF has, wherever practicable, optimised the Project to avoid and minimise ecological impacts in the planning and design stages.

Additionally, the impacts will be finalised following the completion of the detailed design and micro-siting of turbines and associated infrastructure. In doing so, BWF will seek to further minimise impacts to biodiversity values. A range of impact mitigation strategies are proposed to mitigate the impact on ecological values prior to the consideration of offsetting requirements. The offset requirements for the Project, as calculated in accordance with the BAM are identified in **Section 10.0**.

The offset strategy will be implemented in consideration of the process outlined in the BC Act and the final composition of the offset strategy may evolve as the Project progresses.

BWF will retire the credits required to offset the impacts of the Project as specified in **Section 10.1**. BWF is seeking flexibility to retire the required credits on a staged basis. As discussed in **Section 2.3**, for the purposes of assessment in this Amended BDAR, it has been assumed that the Project will be constructed and operated in two (2) stages. However, final staging would be determined post development consent and subject to detailed design and procurement processes. The applicable credits for each stage would be confirmed during detailed design and the requisite credits retired prior to commencing vegetation clearing in each stage. BWF is also seeking flexibility to utilise one or more of the offset options available under the BC Act and BC Regulation including:

- Land based offsets through the establishment of new Stewardship Sites (and subsequent retirement of credits) or by retiring credits from existing Stewardship Sites. BWF would retire the required number and class of credits determined in accordance with the BDAR and the offset rules in the BC Regulation.
- Securing (purchasing) credits through the open credit market. And/or
- Paying into to the Biodiversity Conservation Fund (BCF).

The current base case option for credit retirement will be the establishment of Biodiversity Stewardship Agreements (BSA) within the local area. During the EIS BWF conducted a desktop feasibility assessment to determine potentially suitable Stewardship Sites based on regionally mapped PCT (SVTM). This feasibility assessment identified extensive areas of PCT 46 and PCT 44, as well as smaller areas of PCT 160, PCT 17, PCT 28 and PCT 24 which correlate to PCT impacted most by the Project. BWF has actively consulted with landholders identified during the feasibility study, and others, in the locality about the potential to establish Stewardship Sites for the purpose of generating suitable ecosystem and species credits to retire for the Project through the available like-for-like and variation rules. This consultation has confirmed potential interest in hosting Stewardship Sites on their land and land access permissions for survey. Surveys have subsequently occurred on candidate Stewardship Sites, and will continue during 2025, alongside ongoing engagement activities, to confirm the suitable ecosystem and species credits that would be generated on these candidate sites and be available to retire for the Project.

If the option of a local Stewardship Site is pursued, any surplus ecosystem and/or species credit liability for the Project will be done so through the other approved offsetting options within NSW.

12.2 Bilateral Agreement

The Assessment Bilateral Agreement between the NSW and Commonwealth governments covers major Projects; and streamlines benefits for all NSW proponents that use the NSW Biodiversity Offsets Scheme (BOS) and need approval under the EPBC Act, under the EPBC Act Condition-setting Policy. This means a NSW proponent who needs an EPBC Act approval can use the NSW BOS to assess and meet their biodiversity offset requirements.

Biodiversity assessments for the Project have been designed and executed in accordance with the NSW BAM. The biodiversity assessment has surveyed and mapped all vegetation communities in the Development Corridor and has assigned them to the relevant PCT and, where relevant determined whether the communities conform to any NSW and Commonwealth TEC final determinations. Under the BAM, all PCT and component TECs generate impact credits that need to be retired in accordance with the BOS and all Commonwealth listed entities must be offset in a 'like-for-like' manner.

Threatened species are predicted by the BAM and subject to targeted surveys in accordance with NSW and Commonwealth guidelines. Species-credits are generated for impacts on habitat for threatened species recorded or predicted to occur which are then retired in a 'like-for-like' in accordance with the BOS.

The impacts to MNES associated with the Project will be offset in accordance with the BOS.

13.0 References

Ahern, C.R., Stone, Y. and Blunden, B. (1998). Acid Sulfate Soils Assessment Guidelines, Acid Sulfate Soil Management Advisory Committee, Wollongbar, NSW, Australia.

Antos, M. and Schultz, L.N. (2020). Climate-mediated changes to grassland structure determine habitat suitability for the critically endangered plains-wanderer (*Pedionomus torquatus*), Emu - *Austral Ornithology*, 120:1, 2-10. Band, W., Madders, M. and Whitfield, D.P. (2007). Developing field and analytical methods to assess avian collision risk at wind farms. – In: De Lucas, M., Janss, G.F.E. and Ferrer, M., eds. Birds and Wind Farms. Risk Assessment and Mitigation. Servicios Informativos Ambien-tales/Quercus, Madrid. Pp. 259–275.

Baker-Gabb, D.J. (2014). 'Not happy wanderers'. *Australian Birdlife* June 2014: 6–7.

Baker-Gabb, D.J., Benshemesh, J.S. and Maher, P.N. (1990). A Revision of the distribution, status and management of the plains-wanderer Pedionomus torquatus. Emu 90, 161–168.

Baker-Gabb, D., Antos, M.and Brown, G. (2016). Recent decline of the critically endangered Plains-wanderer (*Pedionomus torquatus*), and the application of a simple method for assessing its cause: major changes in grassland structure. *Ecological Management & Restoration* 17, 235–242.

Benson, J.S., Ashby, E.M. and Porteners, M.F. (1997). The native grasslands of the Riverine Plain, New South Wales. Cunninghamia 5(1): 1–48.

BOM (2019). Riverina Climate Guide, Australian Government, Canberra (http://www.bom.gov.au/climate/climate-guides/guides/03-Riverina-NSW-Climate-Guide.pdf).

BOM (2023). Groundwater Dependent Ecosystems Atlas, Australian Government, Canberra.

BOM (2017). Groundwater Dependent Ecosystems Atlas, Australian Government, Canberra.

BOM (2024). Climate Classification Maps, Australian Government, Canberra. Accessed March 2024 (http://www.bom.gov.au/climate/maps/averages/climate-classification/).

Belbin L, Wallis E, Hobern D. and Zerger, A. (2021). The Atlas of Living Australia: History, current state and future directions. Biodiversity Data Journal 9: e65023.

Campbell, S. (2009). So long as it's near water: variable roosting behaviour of the large-footed myotis (*Myotis macropus*). *Australian Journal of Zoology* 57, 89–98.

Commonwealth of Australia (2010a). Survey guidelines for Australia's threatened bats: Guidelines for detecting bats listed as threatened under the EPBC Act – DCCEEW.

Commonwealth of Australia (2010b). Survey guidelines for Australia's threatened birds (awe.gov.au).

Commonwealth of Australia (2011a). Survey Guidelines for Australia's threatened frogs (awe.gov.au).

Commonwealth of Australia (2011b). Survey guidelines for Australia's threatened mammals (awe.gov.au).

Commonwealth of Australia (2011c). Survey guidelines for Australia's threatened reptiles (awe.gov.au).

Commonwealth of Australia (2011d). Survey guidelines for Australia's threatened fish (awe.gov.au).

Commonwealth of Australia (2013a). Matters of National Environmental Significance: Significant Impact Guidelines 1.1 (awe.gov.au), Environment Protection and Biodiversity Conservation Act 1999.

Commonwealth of Australia (2013b). Draft survey guidelines for Australia's threatened orchids (awe.gov.au).

Commonwealth of Australia (2021). *National Recovery Plan for the Superb Parrot (Polytelis swainsonii*. Commonwealth of Australia (awe.gov.au).

Debus, S.J.S. (2008). Biology and diet of the White-bellied Sea-eagle *Haliaeetus leucogaster* breeding in northern inland New South Wales. *Australian Field Ornithology* 25, 165–193.

Debus, S.J.S., Baker, G., Owner, D. and Nottidge, B. (2014). Response of White-bellied Sea-*eagles Haliaeetus leucogaster* to encroaching human activities at nest sites. *Corella* 38, 53–62.

Dennis, H., Detmar, A., Brooks, A. and Dennis, H. (2011). Distribution and status of White-bellied Sea-eagle, *Haliaeetus leucogaster*, and Eastern Osprey, *Pandion cristatus*, populations in South Australia. *South Australian Ornithologist* 37, 53–62.

Debus, S.J.S. and Soderquist, T.R. (2008). Report for Review of Species for the NSW Scientific Committee: Little Eagle *Hieraaetus morphnoides*.

Department of Agriculture, Water and the Environment (2022). Conservation Advice for *Lophochroa leadbeateri leadbeateri* (eastern Major Mitchell's cockatoo). Department of Agriculture, Water and the Environment, Canberra.

Department of Climate Change, Energy, the Environment and Watter (DCCEEW) (2024a). Protected Matters Search Tool, found at http://environment.gov.au/epbc/protected-matters-search-tool, last accessed January 2025.

Department of Climate Change, Energy, the Environment and Water (DCCEEW). National Flying-fox Viewer, found at https://www.environment.gov.au/webgis-framework/apps/ffc-wide/ffc-wide.jsf, last accessed Jan 2025.

Department of the Environment (2015). Conservation Advice: *Pedionomus torquatus* plains-wanderer. Australian Government, Canberra.

Department of the Environment (2016). Draft EPBC Act referral guidelines for the vulnerable Murray cod (*Maccullochella peelii*), Commonwealth of Australia, Canberra.

Department of the Environment and the Government of South Australia Department of Environment, Water and Natural Resources (2016). *National Recovery Plan for the Plains-wanderer (Pedionomus torquatus)*. Commonwealth of Australia, Canberra. Available from: http://www.environment.gov.au/biodiversity/threatened/recovery-plans/plains-wanderer-2016. In effect under the EPBC Act from 28-Jun-2016.

Department of the Environment and South Australian Department of Environment, Water and Natural Resources (2016). *National Recovery Plan for the Plains-wanderer (Pedionomus torquatus)*. Commonwealth of Australia, Canberra.

Department of Environment and Climate Change (2007). Threatened Species Assessment Guidelines - Assessment of Significance (nsw.gov.au).

Department of Environment and Climate Change (2009). Threatened species survey and assessment guidelines: field survey methods for fauna. Amphibians. (nsw.gov.au).

Department of Environment and Conservation (2004). Threatened biodiversity survey and assessment guidelines for developments and activities (working draft).

Department of the Environment, Water, Heritage and the Arts (DEWHA) (2013). Matters of National Environmental Significance – Significant Impact Guidelines 1.1. Environment Protection and Biodiversity Conservation Act 1999, Commonwealth of Australia, Canberra.

Department of Sustainability, Environment, Water, Population and Communities, Canberra (2012). *Approved Conservation Advice for Natural Grasslands of the Murray Valley Plains ecological community.* Department of Sustainability, Environment, Water, Population and Communities, Canberra.

Department of the Environment, Water, Heritage and the Arts (2008). *Approved Conservation Advice for Weeping Myall Woodlands ecological community*. Department of the Environment, Water, Heritage and the Arts, Canberra.

Department of Planning and Environment (DPE) (2022a). Biodiversity Assessment Method 2020 Operational Manual – Stage 1 (nsw.gov.au).

Department of Planning and Environment (DPE) (2022b). Koala (Phascolarctos cinereus) Biodiversity Assessment Method Survey Guide. State of NSW, Sydney.

Department of Planning and Environment (DPE) (2022c). Threatened reptiles: Biodiversity Assessment Method Survey Guide | NSW Environment and Heritage.

Department of Planning, Industry and Environment (DPIE) (2020a). Biodiversity Assessment Method (BAM).

Department of Planning, Industry and Environment (DPIE) (2020b). NSW Survey Guide for Threatened Frogs: A guide for the survey of threatened frogs and their habitats for the Biodiversity Assessment Method.

Department of Planning, Industry and Environment (DPIE) (2020c). Surveying threatened plants and their habitats: NSW survey guide for the Biodiversity Assessment Method.

Department of Planning, Industry and Environment (DPE) (2020d). Guidance for assessors and decision-makers in applying modified benchmarks to assessments of vegetation integrity – Biodiversity Assessment Method.

Department of Planning, Industry and Environment (DPIE) (2021a). 'Species credit' threatened bats and their habitats: NSW guide for the Biodiversity Assessment Method. State of NSW, Sydney.

Department of Primary Industries (DPI) (2007). Endangered Ecological Community – Lowland Murray River Aquatic Ecological Community, Primefact 172.

Department of Primary Industries (DPI) (2008). Galaxias rostratus – *flathead galaxias Final Determination.* Fisheries Scientific Committee.

Department of Primary Industries (DPI) (2012). Risk Assessment Guidelines for Groundwater Dependent Ecosystems. Available for download from Researchgate.

Department of Primary Industries (DPI) (2024). Combined Drought Indicator - Powheep Parish, Townsend County. NSW Government.

Department of Planning, Industry and the Environment (DPIE) (2019a). Biodiversity Assessment Method Operational Manual – Stage 2 (nsw.gov.au).

Department of Planning, Industry and the Environment (DPIE) (2019b). Guidance to assist a decisionmaker to determine a serious and irreversible impact.

Garnett, S.T., Szabo, J.K. and Dutson, G. (2011). *The Action Plan for Australian Birds 2010.* CSIRO Publishing, Melbourne.

Kent, K., Earl, G., Mullins, B., Lunt, I., and Webster, R. (2002). *Native Vegetation Guide for the Riverina; notes for land managers on its management and revegetation*. Johnstone Centre, Charles Sturt University NSW.
Landcom (2004). Managing Urban Stormwater: Soils and Construction, 4th ed. National Library of Australia, New South Wales.

Law, B. and Urquhart, C.A. (2000). Diet of the Large-footed Myotis *Myotis macropus* at a forest stream roost in northern New South Wales. *Australian Mammalogy* 22, 121–124.

Marchant, S., Higgins, P., and Davies, S. (1999). Handbook of Australian, New Zealand and Antarctic Birds. Volume 4: Parrots to Dollarbird. Melbourne: Oxford University Press.

Michael, D. R., Bourke, G, Paris, D and Wassens, S (2020). A range extension for the endangered Grey snake Hemiaspis damelii (Günther 1876) in the Murrumbidgee catchment, southern NSW. Australian Zoologist 40(4): 652–655.

Michael, D. R., Nimmo, D. G., Stevens, E., Schlen, T., and Wassens, S. (2023). Finding Ngabi (Hemiaspis damelii): factors affecting the use of modified floodplain wetlands by an endangered snake. Wildlife Research, 50(12), 1131–1140. Accessed April 2024: (https://doi.org/10.1071/WR22147).

NSW Department of Climate Change, Energy, the Environment and Water (NSW DCCEW (2025). Biodiversity Assessment Method Calculator, last accessed March 2025.

NSW Department of Climate Change, Energy, the Environment and Water (NSW DCCEEW) (2023). NSW Landuse v1.5.

NSW Department of Climate Change, Energy, the Environment and Water (NSW DCCEEW) (2024). Important Areas Map, last accessed February 2025.

NSW Department of Climate Change, Energy, the Environment and Water (NSW DCCEEW) (2024). NSW BioNet Vegetation Classification, last accessed February 2025.

NSW Department of Climate Change, Energy, the Environment and Water (NSW DCCEEW) (2024). Threatened Biodiversity Data Collection (TBDC), last accessed February 2025.

NSW Department of Climate Change, Energy, the Environment and Water (NSW DCCEEW) (2025). BioNet Atlas of NSW Wildlife database and mapping tool. Last Accessed February 2025

NSW Department of Climate Change, Energy, the Environment and Water (DCCEEW) (2024). Flora species with specific survey requirements (XLS).NSW Department of Planning and Environment (NSW DPE) (2015), NVMP Hay Vegetation Map. VIS_ID 4153.

NSW Department of Climate Change, Energy, the Environment and Water (NSW DCCEEW) (2025). Draft Native Vegetation Regulatory Map Viewer. Last accessed February 2025.

NSW Department of Climate Change, Energy, the Environment and Water (NSW DCCEEW) (2022). Transitional Native Vegetation Regulatory Map Viewer. Last accessed February 2025.

NSW Department of Climate Change, Energy, the Environment and Water (NSW DCCEEW) (2025). Biodiversity Values Map and Threshold Tool. Last accessed February 2025.

NSW Department of Climate Change, Energy, the Environment and Water (NSW DCCEEW) (2025). Seed – The Central Resource for Sharing and Enabling Data.

NSW Department of Planning and Environment (NSW DPE) (2019). State Vegetation Type Map: Riverina v1.1.0. VIS_ID 4469.

NSW Department of Planning and Environment (NSW DPE) (2023). State Vegetation Type Map: C2.0M2.0 and C1.1.M1.1.

NSW Government (2020). *Plains-wanderer Habitat Management Guide*. Department of Planning, Industry and Environment, Sydney.

NSW Scientific Committee (2009). Plains-wanderer Pedionomus torquatus: Review of Current Information in NSW. NSW Scientific Committee, Sydney.

NSW Scientific Committee (2011a). Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South western Slopes bioregions – final determination. NSW Scientific Committee, Sydney.

NSW Scientific Committee (2011b). Sandhill Pine Woodland in the Riverina, Murray-Darling Depression and NSW South Western Slopes bioregions. NSW Scientific Committee, Sydney.

NSW Scientific Committee (2012). *Convolvulus tedmoorei* (a perennial plant) - endangered species listing – final determination. NSW Scientific Committee, Sydney.

NSW Scientific Committee (2016). *NSW Scientific Committee Preliminary Determination: White-bellied Sea-eagle (*Haliaeetus leucogaster*)*. NSW Scientific Committee, Sydney.

Nugent, D.T., Baker-Gabb, D.J., Green, P., Ostendorf, B., Dawlings, F., Clarke, R.H. and Morgan, J.W. (2022a). Multi-scale habitat selection by a cryptic, critically endangered grassland bird - the plains-wanderer (*Pedionomus torquatus*): Implications for habitat management and conservation. *Austral Ecology* 47, 698–712.

Nugent, D., Baker-Gabb, D., Antos, M., Collins, L., Green, P. and Morgan, J. (2022b). Livestock production land and conservation areas play a complementary role in the conservation of a critically endangered grassland bird. *Ecological Solutions and Evidence*.

O'Donnell, W. and Debus, S. (2012). Nest-sites and foraging of the White-bellied Sea-*eagle'Haliaeetus leucogaster*'on the subtropical eastern coast of Australia. *Australian Field Ornithology* 29, 149–159.

Pennay, M., Law, B., Reinhold, L. (2004). Bat calls of New South Wales: Region based guide to the echolocation calls of Microchiropteran bats. NSW Department of Environment and Conservation, Hurstville.

Porteners MJ (1993). The Natural Vegetation of the Hay Plain: Booligal-Hay and DeniliquinBendigo 1:250,000 Maps. Cunninghamia Vol. 3(1): 1-122.OEH (2018a), Biodiversity Assessment Method Operational Manual – Stage 1 | NSW and Office of Environment and Heritage.

OEH (2018b). 'Species credit' threatened bats and their habitats: NSW survey guide for the Biodiversity Assessment Method.

Rodrigues, L., Bach, L., Dubourg-Savage, M., Karapandza, B., Kovac, D., Kervyn, T., Dekker, J., Kepel, A., Bach, P., Collins, J., Harbusch, C., Park, K., Micevski, B. and Minderman, J. (2015). Guidelines for consideration of bats in wind farm projects - revision 2014, EUROBATS publication series no. 6 (English version). Bonn.

Rowland, J. (2012). *Targeted Species Survey Guidelines Grey Snake* Hemiaspis damelii. Queensland Government, Brisbane.

Serov, P., Kuginis, L. and Williams, J.P., (2012). Risk assessment guidelines for groundwater dependent ecosystems, NSW Department of Primary Industries, Office of Water, Sydney.

Stone, Y., Ahern, C.R. and Blunden B (1998). Acid Sulfate Soils Manual 1988. Acid Sulfate Soil Management Advisory Committee, Wollongbar, NSW, Australia.

The Royal Botanic Gardens and Domain Trust (2023). PlantNet NSW Flora Online. Available from: (https://plantnet.rbgsyd.nsw.gov.au/floraonline.htm).

TSSC (2009). *Commonwealth Listing Advice on Weeping Myall Woodlands*. Threatened Species Scientific Committee, Canberra.

TSSC (2012). *Commonwealth Listing Advice on Natural Grasslands of the Murray Valley Plains*. Threatened Species Scientific Committee, Canberra. Available from: (https://www.environment.gov.au/cgi-bin/sprat/public/publicshowcommunity.pl?id=117&status=Critically+Endangered).

Umwelt (2022). Bullawah Wind Farm Bird and Bat Utilisation Survey And Assessment Method. Umwelt Environmental and Social Consultants, North Sydney.

Umwelt (2025). Bullawah Wind Farm Project Amendment Report. Umwelt Environmental and Social Consultants, North Sydney.

WRM (2024). Bullawah Wind Farm Project – Water Resources Impact Assessment, Bullawah Wind Farm Environmental Impact Statement – Appendix 13, Umwelt (Australia) Pty. Ltd.

umwelt

umwelt
Environmental & Social
Consultants

Umwelt (Australia) Pty Limited

T| 1300 793 267 E| info@umwelt.com.au www.umwelt.com.au