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BIRRIWA SOLAR AND BATTERY PROJECT

Environmental Impact Statement

ACEN | Australia

Birriwa Solar
Renewable Energy from ACEN

Prepared for ACEN Australia Pty Ltd
September 2022

Certification

For submission of an environmental impact statement (EIS) under Part 4, Division 4.1 of the NSW Environmental Planning and Assessment Act 1979.

Details of persons by whom this EIS was prepared

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12 September 2022

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12 September 2022

EMM Consulting Pty Limited
Level 3, 175 Scott Street
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Project details

Project name: Birriwa Solar and Battery Project
Application number: SSD-29508870
Address of the land in respect of which the development application is made: The legal property description of the land to be developed is (refer also to Table 3.1 of the EIS): Lot 82 of DP750755, Lot 70 of DP750755, Lot 54 of DP750755, Lot 48 of DP750755, Lot 47 of DP750755, Lot 45 of DP750755, Lot 43 of DP750755, Lot 39 of DP750755, Lot 37 of DP750755, Lot 36 of DP750755, Lot 35 of DP750755, Lot 34 of DP750755, Lot 32 of DP750755, Lot 31 of DP750755, Lot 30 of DP750755, Lot 16 of DP750755, Lot 12 of DP750755 and Lot 1 of DP1004819.

Application details

Applicant name: ACEN Australia Pty Ltd
Applicant address: Suite 2, Level 2, 15 Castray Esplanade, Battery Point, Tasmania 7004

Declaration by registered environmental assessment practitioner

The undersigned declares that this EIS:

- has been prepared in accordance with Part 4 of the *Environmental Planning and Assessment Act 1979*;
- has been prepared in accordance with Schedule 3 of the *Environmental Planning and Assessment Regulation 2001*;
- contains all available information relevant to the environmental assessment of the development, activity or infrastructure to which the EIS relates;
- does not contain information that is false or misleading;
- addresses the Planning Secretary's environmental assessment requirements (SEARs) for the project;
- identifies and addresses the relevant statutory requirements for the project, including any relevant matters for consideration in environmental planning instruments;
- has been prepared having regard to the Department's State Significant Development Guidelines - Preparing an Environmental Impact Statement;
- contains a simple and easy to understand summary of the project as a whole, having regard to the economic, environmental and social impacts of the project and the principles of ecologically sustainable development;
- contains a consolidated description of the project in a single chapter of the EIS;
- contains an accurate summary of the findings of any community engagement; and
- contains an accurate summary of the detailed technical assessment of the impacts of the project as a whole.

Name: Nicole Armit

Registration number: R80025

Organisation registered with: EIANZ

Executive Summary

ES1 Introduction

ACEN Australia Pty Ltd (ACEN), formerly known as UPC\AC Renewables Australia (UPC\AC) proposes to develop the Birriwa Solar and Battery Project, a large scale solar photovoltaic (PV) electricity generation facility along with battery storage and associated infrastructure (the project). The solar component of the project will have an indicative capacity of around 600 megawatts (MW) and will include a centralised battery energy storage system (BESS) of up to 600 MW for a 2 hour duration (1,200 MWh). The BESS will enable energy from solar to be stored and then released during times of demand as well as providing grid stability services and back-up capacity to ensure security of supply.

The project is in the locality of Birriwa and Merotherie, approximately 15 kilometres (km) south-west of the township of Dunedoo, New South Wales (NSW). The project is within the Central-West Orana (CWO) Renewable Energy Zone (REZ) and is within the Mid-Western Regional Council and Warrumbungle Shire Council local government areas (LGA) (refer to Figure ES1).

This environmental impact statement (EIS) accompanies a State significant development (SSD) application for the project.

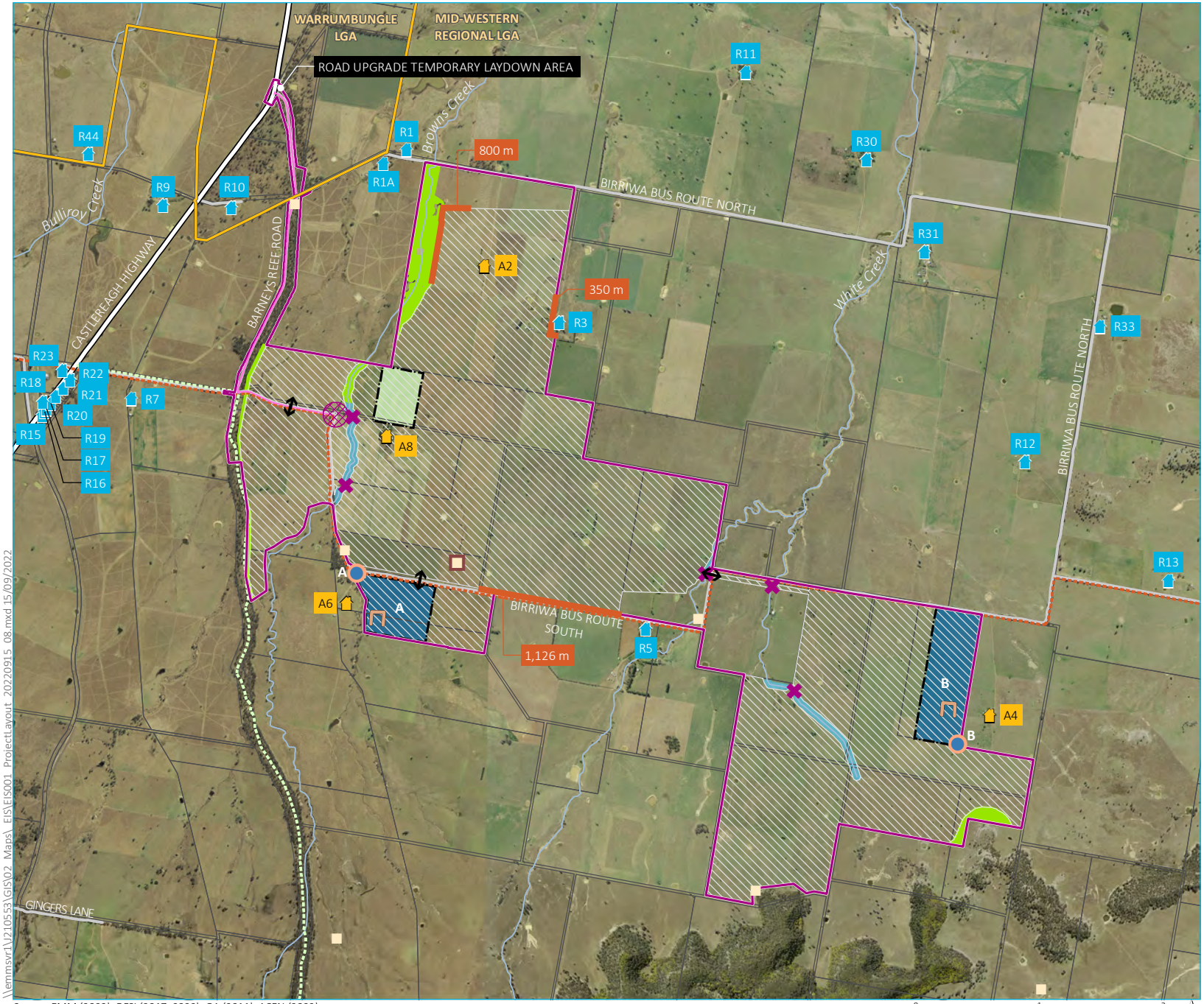
ES2 Strategic context

The National Electricity Market is undergoing rapid and significant transformation from a centralised system of large fossil fuel (coal and gas) generation towards an array of smaller scale and widely dispersed wind and solar and other renewable energy generators. This change is being driven by an evolving power supply mix, weather, consumer preferences, ageing infrastructure and changing technologies. It is expected that all existing NSW coal fired generation infrastructure (capacity of approximately 8,000 MW) will be retired by 2040.

The project will contribute to the security of renewable energy supply in NSW, while reducing greenhouse gas emissions by approximately 6 million tonnes (Mt) (CO_{2e}) over its operation life.

The project is consistent with the NSW electricity infrastructure objectives set out in the *Electricity Infrastructure Investment Act 2020*, being the construction of specified amounts of renewable energy generation and storage infrastructure and the construction of additional infrastructure necessary to minimise costs to electricity customers.

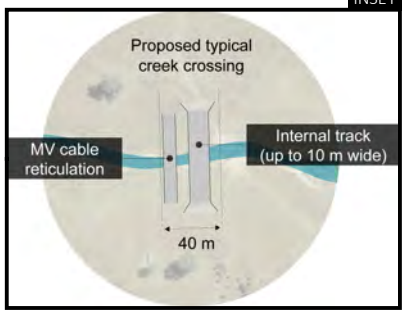
Importantly, the project will also contribute to the continued growth of renewable energy generation and storage capacity in the CWO REZ.



KEY

- Study area
- Impact footprint
  - Development footprint
  - Road upgrade corridor
  - Restricted development area
  - Potential public road crossing location
- Project layout
  - Potential creek crossing point (refer to inset below for indicative design)
  - Proposed access point to the project
  - Connection point (option A or B)
  - Proposed operational infrastructure area including substation, operational facility and BESS (option A or B)
  - Temporary construction compound
  - Landscape screen planting
  - Indicative noise wall location
- Existing environment
  - Dwelling not associated with the project
  - Dwelling associated with the project
  - Aboriginal heritage site (to be salvaged)
  - Aboriginal heritage site (to be avoided)
  - Vegetation to be retained
  - Major road
  - Minor road
  - Watercourse
  - Cadastral boundary
  - Local government area boundary
- Central West Cycle (CWC) Trail
  - CWC main route - Gulgong to Dunedoo
  - CWC alternate route - Slap Dash Creek side trail

INSET



Project layout

Source: EMM (2022); DFSI (2017, 2022); GA (2011); ACEN (2022)

0 1 2 km

GDA 1994 MGA Zone 55

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Birriwa Solar and Battery Project
Environmental Impact Statement
Figure ES1

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ES3 The project

The project will comprise the following components:

- a network of approximately 1 million solar PV panels and associated mounting infrastructure;
- a BESS with a capacity of up to 600 MW and a storage duration of up to 2 hours (1,200 MWh);
- an onsite substation with a connection voltage of up to 500/330 kV;
- electrical collection and conversion systems, including inverter and transformer units, switchyard and control room;
- underground and aboveground cables;
- an operational infrastructure area, including demountable offices, amenities and equipment sheds;
- parking and internal access roads;
- a temporary construction compound (during construction and decommissioning only); and
- upgrade of the access route from the Castlereagh Highway into the development footprint (Barneys Reef Road and part of Birriwa Bus Route South).

The project will be developed within a study area of approximately 1,330 hectares (ha) as shown in Figure ES1. The exact land area to be covered by the project components (the development footprint) has been refined through an iterative design process throughout the preparation of this EIS and has been informed by the outcomes of community and stakeholder engagement and the findings of specialist technical environmental, social and economic assessments.

The project will connect to the proposed CWO REZ Merotherie Energy Hub being developed by the Energy Corporation of NSW (EnergyCo). Details of the connection to the proposed Energy Hub are still being discussed between ACEN and EnergyCo.

ES4 Engagement

ACEN has been actively engaging with the community and stakeholders since planning for the project commenced and has been building a local presence in the area since 2018. This has included direct consultation with stakeholders via face to face meetings, interviews and community information sessions, as well as a dedicated project website, email and community information phone line, project office open to the community, social media pages, letterbox drops, and community newsletters and surveys.

Engagement has been completed with local, State and Commonwealth government agencies, Registered Aboriginal Parties, land and business owners, interest groups and the broader community. Community information and drop-in sessions were held in November and December 2021, and in June 2022 for all stakeholders.

Matters raised in engagement activities have been considered in the preparation of the EIS. Key concerns raised include noise, potential impacts to the Central West Cycle Trail (CWCT), location of the substation and workforce accommodation. Mitigation measures have been incorporated into the project design, such as tree screen planting and identified buffer zones for construction activities, to appropriately manage and mitigate these impacts for the local community. A social impact assessment has also considered in detail the accommodation needs for the anticipated construction workforce and identified measures to address these requirements.

ACEN will continue stakeholder engagement activities to ensure matters raised by the community and other stakeholders are understood and addressed. Future engagement and consultation activities for the project will include public exhibition of this EIS, responding to the submissions received during the public exhibition, ongoing engagement with landholders and further community information sessions.

ES5 Assessment of impacts

ES5.1 Biodiversity

A biodiversity development assessment report (BDAR) (provided in Appendix F) has been prepared for the project by EMM in accordance with the Biodiversity Assessment Method (BAM) and the biodiversity related Secretary's Environmental Assessment Requirements (SEARs).

Measures to avoid and minimise impacts to vegetation were a key input to the project refinement process, resulting in the avoidance of approximately 4.9 ha of Plant Community Type (PCT) 80 – derived native grassland (associated with Grey Box Woodland Endangered Ecological Community), and avoidance of 20.7 ha of PCT 281 – tussock (associated with Box Gum Woodland) from the development footprint. Residual biodiversity impacts include:

- 76.80 ha of PCT 80 – Western Grey Box – White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion, of which only 1.18 ha is of high enough condition for it and its associated habitat for flora and fauna species to require offsetting under the NSW Biodiversity Offset Scheme (BOS); and
- 291.91 ha of PCT 281 – Rough-Barked Apple – red gum – Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion, of which only 7.45 ha is of high enough condition for it and its associated habitat for flora and fauna species to require offsetting under the NSW BOS.

ACEN will compensate for these residual impacts through the implementation of a biodiversity offset strategy.

One Threatened Ecological Community (TEC) listed under the NSW *Biodiversity Conservation Act 2016* (BC Act) at risk of serious and irreversible impacts (SAII) occurs within the study area and two BC Act listed fauna species at risk of SAII have the potential to occur within the study area:

- White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highlands, NSW South Western Slopes, South East Corner and Riverina Bioregions;
- Large-eared Pied Bat; and
- Regent Honeyeater.

The TEC and species have been assessed in accordance with Section 9.1 of the BAM (DPIE 2020) (refer to Appendix F).

ES5.2 Visual

A visual impact assessment (VIA) (provided in Appendix G) was undertaken by EMM to determine the potential impact of the project on the existing visual amenity and landscape character. Visual assessments were undertaken from a number of representative viewpoints selected based on their proximity to the development footprint, location to receptors, positioning on roads, topography and presence of vegetation.

The assessment found there will be a low visual impact from the majority of viewpoints assessed: 1, 4, 5, 6, 7, 8 and Birriwa village, and a moderate visual impact from viewpoints 2, 3 and the CWCT. No viewpoint locations were found to have a high impact rating.

In addition to the viewpoint assessments, each resident within 2 km of the development footprint was assessed for potential visual impacts. The assessment for residences predicts:

- a low visual impact at R1, R1a, R9, R10, R13 – R23;
- a moderate visual impact at R3, R5, R7, R11, R12; and
- no residences with a high impact rating.

Landscape screening will be undertaken to mitigate residual visual impacts at the following locations, as shown in Figure ES1:

- screen planting approximately 800 m long along the development footprint boundary in the north-west corner of the study area, adjacent to Birriwa Bus Route North and non-associated residences R1 and R1a;
- tree planting along the northern side of Birriwa Bus Route South from viewpoint 3 (along the CWCT) extending for approximately 1 km; and
- screen planting along the development footprint boundary at R3, comprising approximately 350 m of screening along the boundary.

Additional mitigation measures such as screen planting within the property may be considered in a separate agreement with landholders.

ES5.3 Traffic and transport

A traffic impact assessment (TIA) (attached in Appendix H) has been prepared by EMM in accordance with the NSW Government's (RTA) *Guide to Traffic Generating Developments* and the SEARs.

The project will be serviced by a network of roads including the Castlereagh Highway, Barneys Reef Road and Birriwa Bus Route South.

The existing level of service (LOS) for the intersections relevant to the project is LOS A (ie good operation) and is predicted to remain at LOS A when project related traffic is accounted for, as well under a cumulative traffic scenario (that is, including combined existing, project and nearby development traffic). The mid-block capacity of the Castlereagh Highway is expected to operate at LOS C during the cumulative traffic scenario.

The project will be accessed via the Castlereagh Highway/Barneys Reef Road intersection (refer to Figure ES1). The available sight distance at this intersection towards the left and right meets the minimum requirements. However, a channelised right turn treatment (CHR) will be required for the northbound right turning traffic from the Castlereagh Highway to Barneys Reef Road. Due to a narrow carriageway width of less than 6.5 m, both Barneys Reef Road and Birriwa Bus Route South will be widened to a 9.2 m wide carriageway for their extent along the project access route.

A number of school bus services operate in the vicinity of the project. Impacts to these services will be mitigated through the implementation of a construction traffic management plan, incorporating a driver code of conduct, which will require project related drivers to maintain 100 m separation distance from any school bus and to avoid overtaking any school buses. The CWCT extends through the study area, including along the section of Birriwa Bus Route South that forms part of the project access route. Impacts to cyclists utilising this cycle trail will be mitigated through the provision of a dedicated approximately 2 m wide dust lane in accordance with relevant cycling guidelines and standards and in consultation with the community.

ES5.4 Aboriginal heritage

An Aboriginal cultural heritage assessment (ACHA) has been prepared for the project by OzArk (provided in Appendix I). The ACHA was prepared in general accordance with the *Code of Practice for Archaeological Investigation in NSW* (DECCW 2010), guided by the *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in New South Wales* (OEH 2011) and the relevant SEARs.

A search of the Aboriginal Heritage Information Management System (AHIMS) database found there are no Aboriginal heritage sites located within the survey area. A survey was completed with representatives from four Registered Aboriginal Parties (RAPs). The results of the survey identified eight previously unrecorded sites, including five within the study area. Avoidance of Aboriginal cultural heritage values was a key aspect of the project refinement process, and the results of the survey were used to refine the development footprint. Subsequently, only one Aboriginal site (Mangarlowe IF-2 – isolated find) will be impacted by the project and will be salvaged prior to commencement of construction.

An Aboriginal cultural heritage management plan will be developed for the project in consultation with the Department of Planning and Environment (DPE), Registered Aboriginal Parties for the project and Heritage NSW, and will include details regarding the management and mitigation of known Aboriginal sites, along with unanticipated finds procedures and training and reporting protocols.

ES5.5 Hazard and risks

A preliminary hazard analysis (PHA) was prepared by Sherpa Consulting (included in Appendix J). The PHA summarises potential hazards and risks associated with the project and details management measures to reduce these hazards and risks to acceptable levels. The PHA considered all hazards and risks associated with the project including battery enclosures and electrical conversion systems (eg inverters and transformers), the on-site substation, electrical collection and conversion systems and ancillary infrastructure.

The PHA determined that the project is not classed as potentially offensive or potentially hazardous development. For all identified events associated with the project, the resulting consequences are not expected to have significant offsite impacts. The assessment identified numerous scenarios/events with potential for off-site impacts, which were subject to qualitative risk analysis in accordance with the *Multi-level Risk Assessment Guideline* (DoP 2011b). Of the 18 events identified, all were rated as “Very Low” risk except for one “Medium” risk event. This event is related to an unauthorised person accessing the proposed BESS/development footprint, resulting in vandalism/asset damage to the infrastructure with the potential for self-injury during the act. To adequately manage this risk, security fencing, cameras, and warning signs will be installed, and onsite security protocols implemented to deter trespassers and minimise unauthorised person access.

Based on the study risk acceptance criteria, the risk profile for the project is considered to be tolerable. The analysis found that the project is compliant with the *Hazardous Industry Planning Advisory Paper* (HIPAP) 4 (DoP 2011c) qualitative risk criteria.

ES5.6 Noise and vibration

A noise and vibration impact assessment (NVIA) (provided in Appendix K) was prepared by EMM in response to the SEARs and in general accordance with the relevant government guidelines.

Construction works are proposed to occur during standard hours Monday to Friday (7.00 am–6.00 pm) and on Saturdays from 8.00 am–6.00 pm. Maximum construction noise and vibration impacts are expected to occur during the site establishment phase, with predictions indicating that construction works will comply with noise management levels under the *Interim Construction Noise Guideline* (ICNG) at all times during Monday to Friday, and on Saturday by incorporating an exclusion zone for site establishment works within 650 m of residences during Saturday afternoons (1.00 pm to 6.00 pm). Based on setback distances from proposed works, construction vibration impacts are considered negligible.

During peak construction, increases in road traffic noise will occur along the Castlereagh Highway, Birriwa Bus Route South and Barneys Reef Road. Assessed road traffic noise levels indicate increases of between 2 dB and 4 dB at several residences; however, the predicted levels are below the thresholds provided in the *Road Noise Policy* (RNP) (DECCW 2011).

The assessment of operational noise considered two locations (A and B, refer to Figure ES1) and three scenarios based on three alternate BESS designs ie a containerised solution for battery racks, outdoor racks or battery racks located within a dedicated building. Consideration of tonal characteristics was included within the assessment based on anticipated tonal characteristics being present from several sources.

Assessment of operational noise concluded that the criteria specified in the *Noise Policy for Industry* (NPfI) (EPA 2017) could be achieved for all scenarios, with the implementation of mitigation and management measures including:

- no electrical infrastructure (ie transformers or inverters) to be installed within 250 m of the property boundary of R3; and
- the 1,200 MVA grid transformer, which will form part of the BESS, will be installed with a 6.5 m high barrier, positioned to reduce noise impacts on nearby sensitive receivers (ie non-associated residences).

ES5.7 Land resources

A land use, soils and erosion assessment (LUSEA) has been prepared to identify and assess potential land capability, soil erosion, sedimentation and rehabilitation impacts associated with project construction and operation (attached in Appendix L). In response to the SEARs, it also provides an assessment of the project on agricultural land.

There is no biophysical strategic agricultural land mapped within the Study Area. Soils in the study area are of low land and soil capability class due to the extensive amount of land utilised for agriculture and low to moderately low inherent soil fertility. The land and soil capability of agricultural lands in the study area are unlikely to change as a result of the project from their current capability and will be managed through the implementation measures outlined in a Soil and Water Management Plan.

The soil erosion hazard has been assessed as high due to the presence of dispersive subsoil. This hazard can be minimised to an acceptable level via adoption of appropriate drainage, erosion and sediment control practices, management measures for which will be incorporated in the construction environmental management plan (CEMP) for the project.

ES5.8 Water resources

A water quality impact assessment and hydrology and flood risk assessment have been prepared by Alluvium and are attached as Appendix M and Appendix N, respectively.

Water quality was assessed via modelling of the project's requirements at the closest point of truth for calibration – the Talbragar River at Dunedoo. Pollutants modelled include total nitrogen (TN), total phosphorus (TP), and total suspended solids (TSS). Results indicate that there will be negligible to no impacts to the receiving environment downstream of the project. It is also anticipated that the project will have negligible impacts on groundwater dependent ecosystems (GDEs) in the study area given the location of GDEs are primarily upstream.

Flood modelling was undertaken for the project to provide planning guidance for placement of internal infrastructure and to assess the potential for external impacts. Areas of higher and low flood hazard have been identified across the study area, using the flood depths and velocities from the 1% AEP event, to guide the detailed design of the project. In relation to potential offsite impacts, the proposed substation and BESS areas will not cause increases in flood level outside of the site boundary.

ES5.9 Social

A social impact assessment (SIA) (Appendix O) was prepared by EMM in accordance with the relevant SEARs and the *Social Impact Assessment Guideline* (DPIE 2021d). The SIA assessed both negative and positive aspects of the project on different groups of people and local communities, while documenting the benefits to the broader region.

Potential social impacts were assessed using a social risk framework based on a combination of consequence and likelihood. The outcomes of the SIA indicate that the social impacts to the local and regional areas will be confined mainly to the construction phase of the project and relate primarily to labour demand and the potential impacts of workforce accommodation demands on rental accommodation and short-term accommodation. There are also potential cumulative impact issues associated with other development occurring or planned in the vicinity of the project.

ACEN will appoint a locally based resource to coordinate community and workforce engagement across all ACEN projects in the local area (including the communities anticipated to experience the most direct social impacts of the project, ie impacts related to local social infrastructure and services; workforce; business and industry; housing and accommodation; and community health and wellbeing). The project office in Gulgong will continue to provide a centralised point of contact for the project and other ACEN projects. A complaints and grievances procedure will ensure that issues and concerns can be easily raised by the community and recorded and responded to by ACEN across all phases of the project.

In relation to realising the social benefits of the project, across the CWO REZ and throughout the EIS community engagement process ACEN has demonstrated its intention to establish a positive, long-term connection with local communities. In the region, ACEN currently has two projects in the approvals phase (this project and the Valley of the Winds project) and one approved project (Stubbo Solar and Battery Project). ACEN is seeking to develop a community benefit sharing program with the local residents and the broader community proximate to ACEN projects, aimed at building and supporting local projects and initiatives.

ACEN's intention is to design and implement benefit sharing programs in line with community needs, the level of social impacts and tailored to the stage of the development, construction or operation of the project. ACEN also aims to have a consistent approach across all the solar projects in the CWO REZ.

At the time of lodgement of this EIS, ACEN's contribution to the community involves the following programs:

- Stubbo Solar and Battery Project Social Investment Program, that aims to eventually transition into a Community Benefit Sharing Program (CBSP);
- CWO solar projects CBSP; and
- ACEN's Neighbour Benefit Sharing Program (NBSP).

Details on these programs are provided in Section 5.5.1 of this EIS.

ES5.10 Bushfire

A bushfire assessment (provided in Appendix P) was undertaken by Cool Burn Fire & Ecology in accordance with the SEARs and *Planning for Bushfire Protection* (PBP) (RFS 2019).

In accordance with the Mid-Western Regional Council and Warrumbungle Shire Council bushfire prone land mapping, the project area is not on designated bushfire prone land. The bushfire assessment determined the risk of bushfire on the project to be low through the implementation of recommended mitigation measures, which includes clear separation of buildings and bushfire hazards, adequate water supply and pressure, and appropriate access for residents, fire fighters, and emergency service workers.

ES5.11 Historic heritage

A historic heritage assessment was undertaken by OzArk to investigate any archaeological potential, including built heritage items of historical heritage significance related to European occupation (refer to Appendix Q).

There are no heritage items listed on the National Heritage List, Commonwealth Heritage List, State Heritage Register or Mid-Western Regional LEP within 5 km of the study area. Surveys completed of the study area confirmed there are no historic heritage items present.

A historic heritage management plan including an unanticipated finds protocol will be implemented for the project in the instance that any previously unrecorded or unanticipated historic objects are encountered during construction.

ES5.12 Other impacts

The EIS has considered other potential impacts related to air quality and waste. Potential impacts are considered to be unlikely/low and a range of mitigation measures have been proposed that will effectively manage these aspects during construction and operation of the project.

ES6 Project justification and conclusion

The project involves the development and operation of a large-scale solar PV generation facility along with battery storage and associated infrastructure. The project will be within the NSW Government declared CWO REZ and will play an important part in achieving the objectives of the CWO REZ by contributing to the continued growth of renewable energy generation and storage capacity. It will support the Commonwealth and State governments in achieving their respective renewable energy and greenhouse gas emission reduction targets.

The project is justified economically due to the significant economic benefits and stimulus it will provide to the local region. The project will generate up to 800 jobs during construction and 20 full time equivalent jobs throughout operations and will provide ongoing economic benefits for both the local economy and broader region. ACEN will work in partnership with Mid-Western Regional Council and the local community to ensure that, as far as possible, the benefits of the projected economic growth in the region are maximised and impacts minimised. During consultation undertaken for the project, stakeholders acknowledged the project as a source of local employment, particularly during construction and were interested in understanding how the benefits of the project could be shared within the community. In this regard, ACEN has been developing and implementing a voluntary NBSP for its solar projects within the CWO REZ.

The site is suitable for the project due to several factors, notably its location within the CWO REZ. In addition, the study area is favourable for the construction and operation of a solar and battery project due to the available solar resource, physical conditions (flat to gently undulating topography and predominantly cleared, agricultural land), absence of biophysical strategic agricultural land and relatively few neighbours living within close proximity. Further, the project's proximity to the proposed CWO REZ transmission link and Merotherie Energy Hub means that there will be infrastructure within the immediate area with the capacity to export the electricity generated by the project to the grid.

The residual environmental and social impacts identified in this EIS will be effectively managed through the mitigation and management measures described throughout, such that the project will not result in significant impacts on the environment or the local community, while achieving the following key benefits:

- contributing to energy security and reliability in NSW by diversifying the State's energy mix and helping to prepare for the retirement of large-scale coal-fired power generation;
- alignment with Commonwealth and NSW Government electricity policies and strategies and regional plans;
- providing ongoing economic benefits for both the local economy within the Mid-Western Regional LGA and the Warrumbungle Shire LGA and more broadly, the regional economy within the Central West; and
- providing significant employment opportunities during the 28 month construction period.

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Appendices

Tables

Figures

Plates

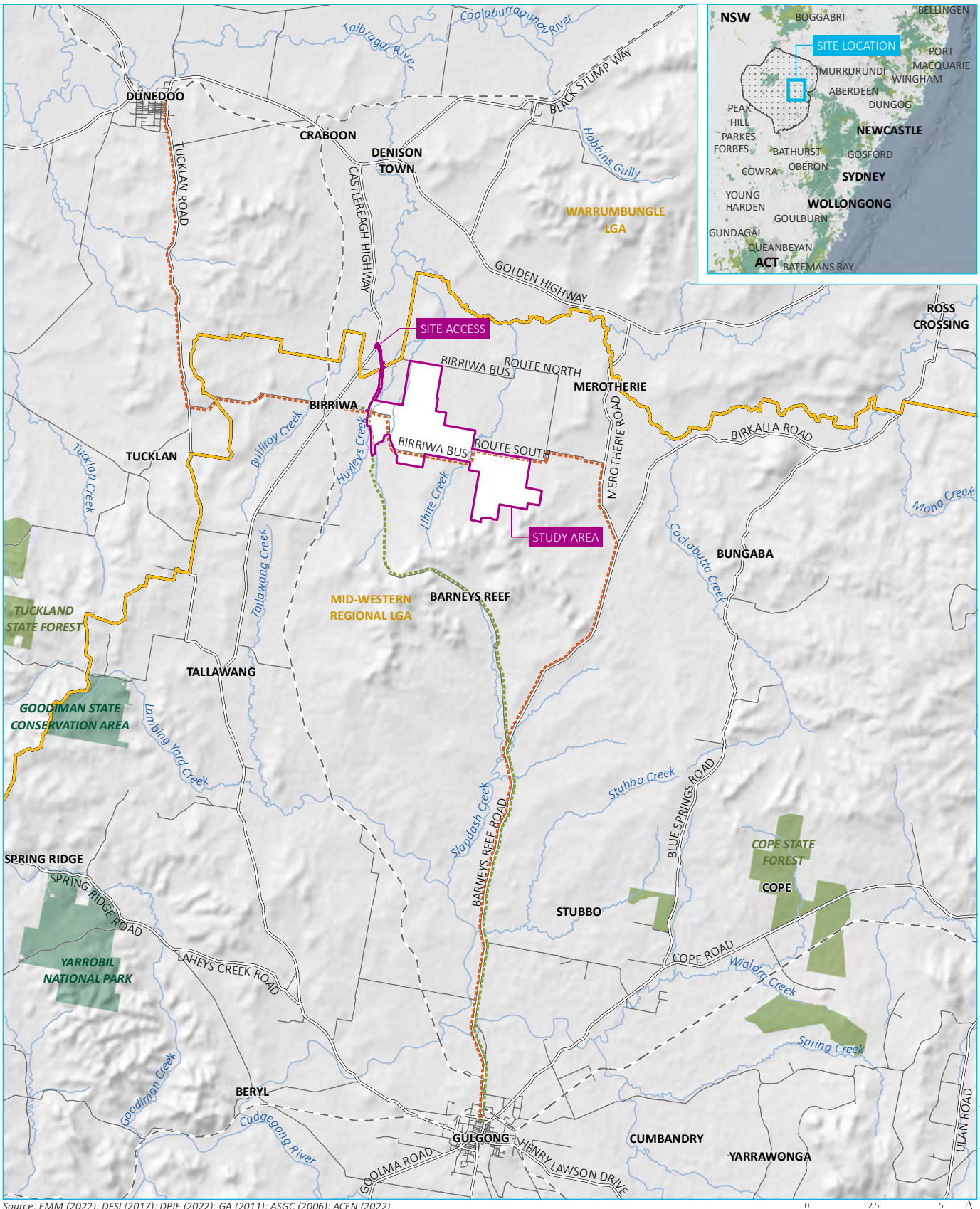
1 Introduction

1.1 Background

ACEN Australia Pty Ltd (ACEN), formerly known as UPC\AC Renewables Australia (UPC\AC) proposes to develop the Birriwa Solar and Battery Project, a large scale solar photovoltaic (PV) electricity generation facility along with battery storage and associated infrastructure (the project). The solar component of the project will have an indicative capacity of around 600 megawatts (MW) and will include a centralised battery energy storage system (BESS) of up to 600 MW for a 2 hour duration (1,200 MWh). The BESS will enable energy from solar to be stored and then released during times of demand as well as providing grid stability services and back-up capacity to ensure security of supply. The project will power the equivalent of approximately 260,000 Australian households.

The project is on Wiradjuri Country, in the localities of Birriwa and Merotherie, approximately 15 kilometres (km) south-west of the township of Dunedoo, in the Central West of New South Wales (NSW) (refer to Figure 1.1). The project is within the Central-West Orana (CWO) Renewable Energy Zone (REZ), and is within the Mid-Western Regional Council local government area (LGA), with part of the access route from the Castlereagh Highway within the Warrumbungle Shire Council LGA. The Central West region of NSW has been selected by the NSW Government for the development of the CWO REZ due to the region's significant potential for renewable energy infrastructure and regional development (NSW Government 2020), with an initial target of 3,000 MW of new transmission capacity to be developed in the region by 2026. To support the development of the CWO REZ, the Energy Corporation of NSW (EnergyCo) is planning several new 500 and/or 330 kilovolt (kV) transmission lines and related connection infrastructure ('Energy Hubs') as well as augmentation of the existing 330 kV network.

The key objective of the project is to deliver up to 600 MW of much needed renewable energy into NSW. In doing so, the project will play an important part in achieving the objectives of the CWO REZ. It will also provide significant economic stimulus to the region through construction jobs and associated flow-on benefits.



Source: EMM (2022); DFSI (2017); DPIE (2022); GA (2011); ASGC (2006); ACEN (2022)

0 2.5 5 km

GDA 1994 MGA Zone 55

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KEY

- Study area

Existing environment

- Rail line
- Major road
- Minor road
- Named watercourse
- Local government area
- Central West Orana Renewable Energy Zone (see inset)
- NPWS reserve
- State forest

Central West Cycle (CWC) Trail

- CWC main route - Gulgong to Dunedoo
- CWC alternate route - Slap Dash Creek side trail

Regional context

Birriwa Solar and Battery Project
Environmental Impact Statement
Figure 1.1

EMM creating opportunities

1.2 Project overview

The project will comprise the following key components:

- a network of approximately 1 million solar PV panels and associated mounting infrastructure;
- a BESS with a capacity of up to 600 MW and a storage duration of up to 2 hours (1,200 MWh);
- an onsite substation with a connection voltage of up to 500/330 kV;
- electrical collection and conversion systems, including inverter and transformer units, switchyard and control room;
- underground and aboveground cables;
- an operational infrastructure area, including demountable offices, amenities and equipment sheds;
- parking and internal access roads;
- a temporary construction compound (during construction and decommissioning only); and
- upgrade of the access route from the Castlereagh Highway into the development footprint (Barneys Reef Road and part of Birriwa Bus Route South).

The project will be developed within a study area of approximately 1,330 hectares (ha) (described further in Section 3.2). The exact land area to be covered by the project components (the development footprint) has been refined through an iterative design process throughout the preparation of this Environmental Impact Statement (EIS) and has been informed by the outcomes of community and stakeholder engagement and the findings of the environmental, social and economic assessments. This is described further in Section 2.5.4.

The project will connect to the proposed CWO REZ Merotherie Energy Hub being developed by EnergyCo. Details of the connection to the proposed Energy Hub are still being discussed between ACEN and EnergyCo and are described further in Section 1.4.

1.3 The applicant

The applicant details are outlined in Table 1.1.

Table 1.1 Applicant details

Name	ACEN Australia Pty Ltd (ACEN) formerly operating as UPC\AC Renewables Australia (UPC\AC)
Postal address	Suite 2, Level 2, 15 Castray Esplanade, Battery Point, Tasmania 7004
Contact	Cédric Bergé
ABN	27 616 856 672
Details	*A partner of UPC Renewables since 2018, ACEN (formerly AC Energy) increased its ownership in UPC\AC Renewables in 2021 to be 100 % by early 2023. This acquisition marks a strategic pivot for ACEN, as the company embarks on its first wholly owned development and operations platform outside of the Philippines.* *While the UPC\AC Renewables name and brand is changing, its highly capable Australian team remains the same. ACEN's strong Environmental, Social, and Governance (ESG) performance underpins its interactions with its employees and partners, the communities it is part of and the environment. The Australian team will continue its work in contributing to Australia's transition to a clean energy future.* ***ACEN Australia*** *ACEN Australia is the platform representing ACEN's renewable energy assets in Australia. It includes several solar, wind, battery and pumped hydro projects across New South Wales, Tasmania, Victoria and South Australia in development and construction. The first of these projects, New England Solar, is expected to be in operation by the end of 2023.* *With 40+ employees and growing, ACEN employees are located in Tasmania, New South Wales and Victoria.* ***ACEN*** *ACEN is the listed energy platform of the Ayala Group. The company has approximately 3,800 MW of capacity in the Philippines, Vietnam, Indonesia, India, and Australia. The company's renewable share of capacity is at 87%, among the highest in the region. 2021 saw the integration of international assets into ACEN and its transformation from a Philippine focused energy provider into a significant regional renewable energy provider in the Asia Pacific, with international assets now comprising 60 per cent of its portfolio. More information on ACEN can be found at: www.acenrenewables.com.* ***Ayala*** *ACEN is the Philippine listed energy platform of the Ayala Group. Founded in 1834, Ayala Corporation is one of the largest companies in the Philippines with core interests in real estate, banking, water, telecommunications, and power. It also has emerging enterprises in infrastructure, healthcare and education. In addition, Ayala's corporate social responsibility programs are managed under the Ayala Foundation. More information can be found at www.ayala.com.* ***Creating value*** *The transition to ACEN Australia brings with it opportunity to create greater shared value. ACEN's aspiration to be a leading renewable energy provider is driven by its goal to create value that benefits society, its employees and shareholders. Sustainability is at the core of its business, and it is integrated into the way they do things.* *Its Sustainability Framework is built on three focus areas embedded across its business operations, governance, and culture, and guided by its Environmental & Social (E&S) Policy.* ***A low carbon portfolio by 2030*** *As ACEN ramps up its renewable energy investments, it aims to fully divest its coal assets by 2030.* ***Protecting the environment*** *The protection and management of ecosystems are a critical component of ACEN's sustainable development strategy.*

Table 1.1 Applicant details

Details	***Community investments*** *ACEN's sustainability initiatives support the development and prosperity of its host communities.* *In December 2021, ACEN Australia started the process of developing its first national Reflect Reconciliation Action Plan (RAP). This marks the start of our journey to take meaningful actions to provide opportunities for Aboriginal people to actively participate in our renewable energy projects, and to share in the benefits that Australia's growing renewable energy industry offers.* *Our vision is to contribute to a more sustainable, inclusive and resilient world where we all have access to affordable renewable energy. Our RAP journey is central to this and will set a framework to build relationships, respect and opportunities for Aboriginal people.* *We have formed an internal Working Group made up of representatives from across Tasmania, NSW and Victoria with varied backgrounds, experiences and interests in Aboriginal participation who each bring a unique perspective. We know that our RAP is a long journey, and it takes leadership to wholeheartedly embrace it and commit to long-term implementation. As our business continues to grow across NSW, VIC and TAS, we're excited by the opportunities it will bring for our business, but importantly, Aboriginal people and communities in the regions where we seek to operate.*

1.4 Related development

The NSW Government has identified a number of REZs across the state, which are areas where solar and wind power generation projects will be grouped together to efficiently store and transmit electricity from these projects across NSW. Five zones have been identified so far, with the CWO REZ the first to enter into the development phase.

The CWO REZ was announced as the "pilot REZ" by the NSW Government in late 2019 and was formally declared by the Minister for Energy and Environment under Section 19(1) of the NSW *Electricity Infrastructure Investment Act 2020* (EII Act) on 5 November 2021.The project aligns with the NSW and Commonwealth Government's objective for energy security and reliability and emissions reductions and will contribute to the continued growth of renewable energy generation and storage capacity in the CWO REZ.

EnergyCo has been appointed as the Infrastructure Planner for the CWO REZ as part of a declaration for the REZ under the EII Act. EnergyCo will lead development of the CWO REZ, including community and stakeholder consultation, property negotiations and environmental planning approvals (NSW Government 2022a).

EnergyCo has considered community feedback received to date on the initial plans for the CWO REZ and the availability of renewable energy resources, and has developed a revised study corridor for the CWO REZ Transmission Link (T-Link), which is shown in Figure 2.4. Three 'Energy Hubs' have also been proposed for the first stage of the CWO REZ, which will collect electricity from renewable energy generators in the surrounding areas. The Merotherie Energy Hub is expected to be located in the vicinity of the study area for the project. Its final location was yet to be defined at the time of lodgement of this EIS. During 2022, EnergyCo will appoint a Network Operator to design, build, finance, operate and maintain the new T-Link and associated infrastructure. In parallel, access rights will be allocated to generation and storage projects that will connect to the new REZ infrastructure (NSW Government 2022a).

The revised study corridor for the CWO REZ T-Link overlaps with the study area for the project, as shown in Figure 2.4. Once EnergyCo finalises the location of the Merotherie Energy Hub, ACEN will discuss optimal connection options between the project and the Merotherie Energy Hub with EnergyCo. This is anticipated to be a relatively short transmission line, which is not included in the project. EnergyCo has indicated its intention to de-risk the generation projects connections in the CWO REZ from a land acquisition and approvals process, to best manage community and social licence, to avoid duplication of transmission infrastructure and to deliver value for money solutions to energy consumers vis-à-vis projects seeking to establish generator connections to the Energy Hubs independently. ACEN and EnergyCo are in ongoing discussions to refine the connection options for the project into the Merotherie Energy Hub.

1.5 Purpose of this document

The project is State significant development (SSD) pursuant to Schedule 1 of the *State Environmental Planning Policy (Planning Systems) 2021* (Planning Systems SEPP), as discussed further in Section 4.3. Accordingly, approval for the project is required under Part 4 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act).

This EIS accompanies a new SSD application for the project. ACEN (operating as UPC\AC at the time) submitted a request for the Secretary's environmental assessment requirements (SEARs) to the Department of Planning and Environment (DPE) in October 2021. DPE issued the SEARs (SSD-29508870) on 5 November 2021.

This EIS has been prepared in general accordance with the *State significant development guidelines – preparing an environmental impact statement* (DPIE 2021a) and describes the project, the existing environment, planning considerations and the statutory context for the project, potential impacts, mitigation measures, residual impacts and a description of the community engagement undertaken and outcomes. It is informed by the technical assessments contained in the appendices and provides an overview of these assessments. It addresses the requirements of the SEARs issued by DPE and the appended agency requirements. A summary of how the SEARs have been addressed is provided in Appendix A.

1.6 EIS terminology

The following terms are used throughout this EIS:

- **Study area**: The area of assessment (approximately 1,330 ha) for baseline surveys and studies conducted for the EIS. The study area comprises the maximum area considered for the project based on the extent of land where ACEN holds landholder agreements and the area of potential impact for road upgrades (refer to Figure 2.3).

- **Impact footprint:** The maximum extent of ground disturbing work, comprising approximately 1,159 ha of land, associated with construction and operation of the project (refer to Figure 2.3), including:

    - **Development footprint**: The area to be developed within land where ACEN holds landholder agreements. All operational components of the project will be within the development footprint. It also includes the area of direct impact for construction of the public road crossings (see definition below). The development footprint is the outcome of the iterative process outlined in this EIS which led to excluding certain areas of environmental or social constraint, as discussed further in Section 2.5.4.

    - **Road upgrade corridor**: The area of direct impact for public road upgrade works along the access route, which comprises part of Barneys Reef Road and its intersection with the Castlereagh Highway and Birriwa Bus Route South, connecting the access point to the project with the Castlereagh Highway.

- **Restricted development area:** Land within the development footprint where disturbance will be avoided wherever possible, with the exception of that required for the provision of fencing, access and electrical reticulation (eg private internal access roads and creek crossings).

- **Proposed access point to the project**: The proposed location where all construction and operation traffic will access the development footprint after using the access route. Access across the development footprint will be possible via internal tracks. Access between different project components (eg solar arrays, BESS) will occur via public road crossings.

- **Public road crossings**: Proposed intersection between internal tracks and public roads to allow construction and operational traffic and cable crossings between different components of the project.

- **Substation, BESS and operational infrastructure area**: The proposed location of key operational infrastructure, including the BESS, substation, control room, site offices, car park, amenities and storage. Two options are considered for the substation, BESS and infrastructure area in this EIS (Option A or Option B, refer to Chapter 3), but only one of the two location options will be constructed.
- **Proposed connection point**: The indicative location of the point at which the facility will connect to the transmission network being developed by EnergyCo via the Merotherie Energy Hub, which is yet to be defined in consultation with EnergyCo.
- **Associated residence:** A dwelling whose owners have parts of their property included in a land agreement with ACEN for the project. Residences identified with an 'A' are associated residences.
- **Non-associated residence**: A dwelling whose owners do not have parts of their property included in a land agreement with ACEN for the project. Residences identified with an 'R' are non-associated.

2 Strategic context and alternatives

2.1 Project need and objectives

2.1.1 Security of Supply

The project will deliver 600 MW of much needed renewable energy supply into NSW. According to its base case (step change) scenario in the *2022 Integrated System Plan* (2022 ISP) (AEMO 2022), the Australian Energy Market Operator (AEMO) expects all of NSW's coal fired generation capacity (approximately 8,000 MW) to retire by 2040. As shown in Figure 2.1, AEMO notes coal is retiring two to three times faster than anticipated in its *Infrastructure Investment Objectives Report* (AEMO 2021).

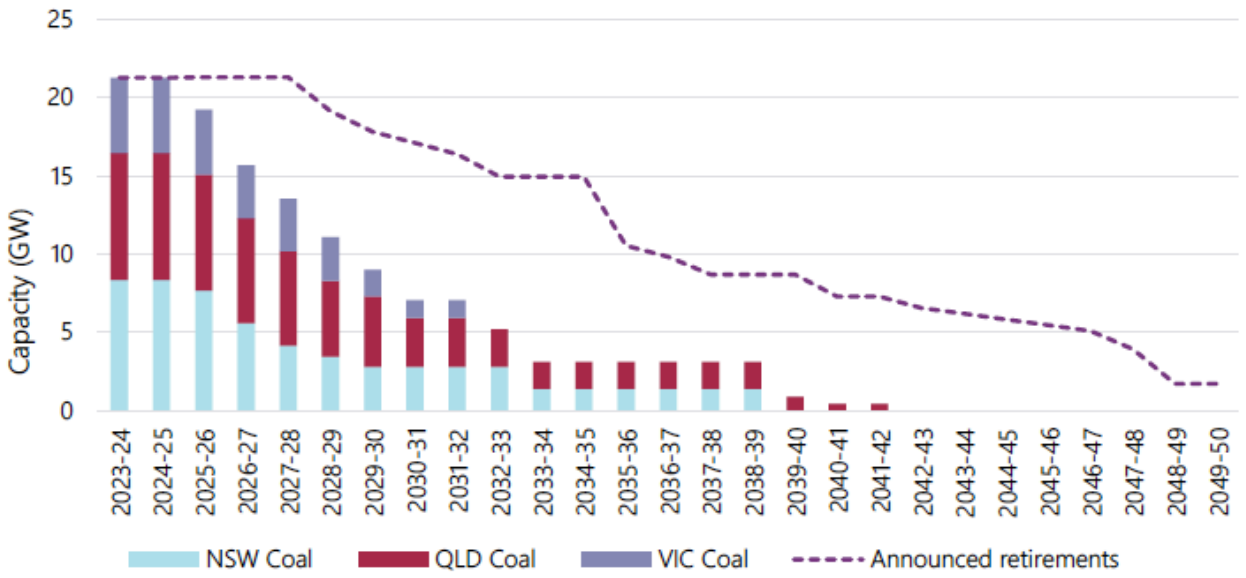


Figure 2.1 Forecast coal retirements under step change scenario

Announced retirements include Liddell power station in 2022–2023 and Eraring power station in 2026, which will close seven years ahead of that originally forecast (NSW Government 2022b). Vales Point power station will close in 2028 and Bayswater and Mt Piper power stations in the early to mid-2030s.

In light of this, if the NSW Government is to maintain a reliable energy supply to its residential customers and industry, as well as meet its ambitious climate change objectives (ie its target of reducing greenhouse gas emissions from 2005 levels by 50% by 2030) it is critical that large renewable projects, such as the project, can proceed in a timely fashion.

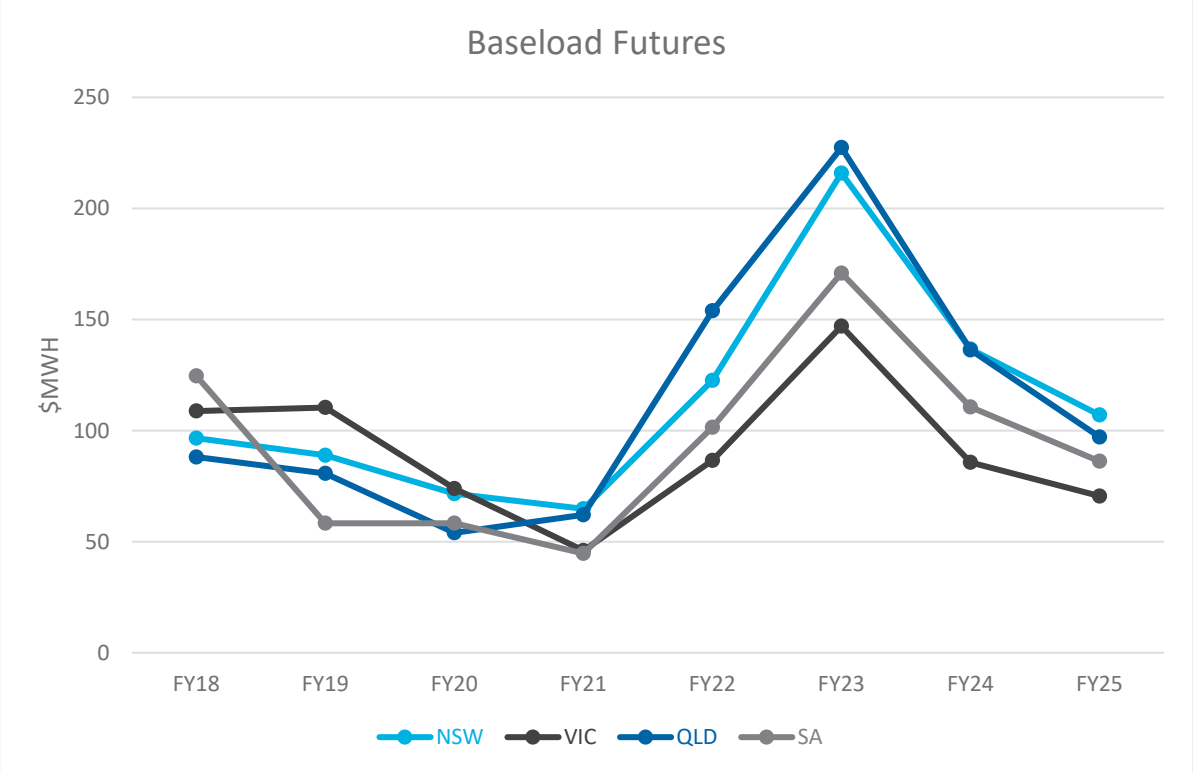
The project is consistent with the NSW Government's electricity infrastructure objectives set out in the EII Act, which are:

- construction of specified amounts of renewable energy infrastructure; and
- construct additional infrastructure necessary to minimise costs to NSW electricity customers and meet the NSW energy security target and reliability standard.

The *Infrastructure Investment Objectives Report* (AEMO 2021) proposes a 20 year development plan for renewable energy and storage infrastructure to deliver on these objectives.

AEMO expects that given the scale of the coal plant retirements, and the relatively lower capacity factors of wind and solar compared with existing coal, approximately nine times (122 GW) more grid scale renewables and triple the amount of current firm capacity (some 45 GW) are needed across the National Electricity Market (NEM) to replace retiring coal fired capacity (refer to Figure 2.2) (AEMO 2022).

Given that the renewable energy generation needs to be developed in advance of when the coal plants are retiring, there is an urgent need for this development in the coming two to five years. The recent combination of the unavailability of coal generators due to outages and lack of coal supply, the war in Ukraine pushing up gas prices, and seasonal cold weather has caused a major uplift in the forward electricity prices in NSW (along with other NEM states, such as Queensland in particular). Forward prices have more than doubled in response and raised the potential for a supply squeeze and even load shedding. This highlights the need for investment in large scale renewables capacity and storage in the NEM in the short term, such as this project, to help bring these prices down.



(Source: Reneweconomy, 1 June 2022)

Figure 2.2 National Electricity Market states wholesale futures prices

2.1.2 Climate change policy

The project will support the Commonwealth and NSW governments in achieving their respective renewable energy and greenhouse gas emission reduction targets, as well as contributing to Australia's commitments globally. In particular, the project will help achieve the objectives of the Commonwealth Government's Large Scale Renewable Energy Target (LRET), Paris Agreement targets and the NSW Government's Net Zero Plan and Energy Roadmap legislation.

Once operational, the project will reduce greenhouse gas emissions by approximately 6 Mt tonnes (CO_{2e}) over its operational life.

2.1.3 Other project objectives

In addition to the energy security and climate change objectives of the project, it will also:

- provide ongoing economic benefits for both the local economy within the Mid-Western Regional LGA and the Warrumbungle Shire LGA and more broadly, the regional economy within the Central West; and
- provide significant employment opportunities during the 28 month construction period.

The project has also been designed to avoid wherever possible and minimise environmental, community and landholder impacts, as discussed further in Section 2.5.4.

An outline of how the project will contribute to achieving the objectives of international, national, state, regional and local government policies, plans and strategies is summarised in Table 2.1.

Table 2.1 Alignment with key strategic planning frameworks

Plan, policy or strategy	Description	Alignment with strategic framework
International context		
The Paris Agreement	*The Paris Agreement* is a legally binding international treaty on climate change adopted by 196 parties in 2015. As a signatory to the agreement, the Australian Government has committed to reduce greenhouse gas emissions by 26%–28% on 2005 levels by 2030.	The project will contribute to meeting Australia's commitments under *the Paris Agreement* by providing an alternative energy source to energy sourced from fossil fuels, thereby reducing the NEM's annual greenhouse gas emissions.
National context		
Large-scale Renewable Energy Target	The Australian Government Clean Energy Regulator administers the *Large-scale Renewable Energy Target* which incentivises investment in renewable energy power such as wind and solar farms. The *Large-scale Renewable Energy Target* of 33,000 gigawatt hours of additional renewable electricity generation was met at the end of January 2021 (Clean Energy Regulator 2021). The annual target will remain at 33,000 gigawatt hours until the scheme ends in 2030. Notwithstanding, the Clean Energy Regulator expects that large-scale renewable generation could reach up to 40,000 gigawatt hours in 2021.	The solar farm component of the project will have an indicative capacity of around 600 MW and include a BESS of up to 600 MW for a 2 hour duration (1,200 MWh), which will make significant contributions towards meeting the Large-scale Renewable Energy Target in future years. In addition, the BESS will be able to store renewable energy to increase market efficiency and enable greater penetration of renewables in the electricity grid.
Integrated System Plan 2020	The *Integrated Systems Plan 2020* (ISP 2020) prepared by the AEMO is an: "actionable roadmap for eastern Australia's power system to optimise consumer benefits through a transition period of great complexity and uncertainty." REZ's are identified in the ISP 2020 as areas where "clusters of large-scale renewable energy can be developed to promote economies of scale in high quality areas and capture geographical and technological diversity in renewable resources" (AEMO 2020).	The CWO REZ is identified within the ISP 2020. The CWO REZ transmission link, to which the project will connect, is identified as an "actionable ISP project", critical to address cost, security and reliability issues.

Table 2.1 Alignment with key strategic planning frameworks

Plan, policy or strategy	Description	Alignment with strategic framework
Net Zero 2050	In October 2021, The Australian government released its *Long Term Emissions Reduction Plan* to achieve net zero emissions by 2050. The Plan aims at reaching a net zero economy through a technology-based approach, whilst protecting relevant industries, regions and jobs. It is part of an overarching strategy for emission reduction, based on a technology-led approach which includes a Technology Investment Roadmap and its Low Emissions Technology Statements.	The project will reduce greenhouse gas emissions by approximately 6 Mt tonnes (CO_{2e}) over its operational life.
State context		
NSW Electricity Infrastructure Investment Roadmap (DPIE 2020)	The *NSW Electricity Infrastructure Roadmap* and its implementing legislation the EII Act, coordinates investment in transmission, generation, storage and firming infrastructure as ageing coal-fired generation plants retire. The roadmap includes actions that will deliver "whole-of system" benefits. The roadmap sets out a plan to deliver the state's first five REZs in the Central-West Orana, New England, South-West, Hunter-Central Coast, and Illawarra regions.	The project is within the CWO REZ and is ideally placed to contribute to the success of the roadmap.
Large-Scale Solar Energy Guideline (DPE 2022)	The *Large-Scale Solar Energy Guideline* (DPE 2022) provides the community, industry, applicants, and regulators with guidance on the planning framework for the assessment of large-scale solar projects and identifies the key planning considerations relevant to solar energy development in NSW. It is noted that this guideline was released in August 2022, and therefore the earlier version of these guidelines (DPIE 2018) is referred to in the SEARs for this project.	Site selection and impact assessment considerations detailed in the guideline have been and will continue to be used to inform the project (Section 2.2).
Net Zero Plan Stage 1: 2020-2030 (DPIE 2020)	The *Net Zero Plan Stage 1 2020–2030* (DPIE 2020) outlines the NSW Government's plan to grow the economy and create jobs while helping the state to deliver a 35% cut in emissions compared to 2005 levels.	The project contributes to Priority 1 of the Plan: "drive uptake of proven emissions reduction technologies that grow the economy, create new jobs or reduce the cost of living." The CWO REZ is also identified in the Plan as critical in replacing retiring coal fired generators in NSW.
Local and regional context		
Central West and Orana Regional Plan 2036 (DPIE 2017)	The *Central West and Orana Regional Plan 2036* (the Regional Plan) was released by DPIE in 2017 to guide land use planning priorities and decision making in the CWO region for the next two decades.	The project directly contributes to Direction 9 (ie "increase renewable energy generation") of Goal 1 of the Regional Plan (ie "to become the most diverse regional economy of NSW").
Our Place 2040 Mid-Western Regional Local Strategic Planning Statement (Mid-Western Regional Council 2020)	The Mid-Western Regional Local Strategic Planning Statement sets out the 20-year vision for land use planning in the Mid-Western Council LGA. Planning Priority 7 of the Local Strategic Planning Statement is to "support the attraction of a diverse range of business and industries". To support this planning priority the *Local Strategic Planning Statement* contains a land use action to "consider renewable energy development in appropriate areas that avoids impacts on the scenic rural landscape and preserves valuable agricultural land."	The project will contribute to Planning Priority 7 of the *Local Strategic Planning Statement* and has been sited to minimise impacts on productive agricultural land and visual amenity, where practicable. An extensive site selection process was undertaken to identify a suitable location for the project that is consistent with Priority 7, as discussed in Section 2.2.

2.2 Site selection and justification

Prior to the announcement of the CWO REZ development by the NSW government, the project location was identified by ACEN as potentially suitable for a solar farm due to its relative proximity to the existing TransGrid 500 kV network approximately 70 km to the east and the existing 330 kV network around 15 km to the south-east. The suitability of the study area has significantly heightened since the CWO REZ was declared by the NSW Government and the announcement of the proposed study corridor for the CWO REZ T-Link, which traverses the study area, as well as the indicative location of the Merotherie Energy Hub being developed by EnergyCo in the vicinity of the study area.

The project location was primarily selected due to the very good solar resource of the area and physical conditions for large-scale solar energy generation. The study area's flat to gently undulating topography and its predominantly cleared, agricultural land use make it highly suitable for the project (refer to Photograph 2.1). The study area is also separated from residential townships, with surrounding topography, vegetation and distance assisting in screening most views from the Golden Highway and Castlereagh Highway. The study area was also selected due to the absence of biophysical strategic agricultural land and farming land with land and soil capability Class 1 to Class 4 (Class 1 represents land capable of sustaining most land uses including those that have a high impact on the soil), the anticipated relatively low level of other environmental constraints, and the relatively few residences within close proximity.

The required land area for the project is driven primarily by the need for a project of sufficient electricity generating capacity to achieve economies of scale in output, justifying the substantial grid connection costs and thus being able to achieve a competitive price for the electricity supplied to the National Electricity Market and ultimately households.

In summary, the study area is considered suitable due to:

- the location of the project being within the CWO REZ, with very good solar resource and physical conditions for large-scale solar energy generation;
- the project's proximity to the proposed CWO REZ T-Link and the Merotherie Energy Hub with capacity to export the electricity generated by the plant to the grid;
- the existing agricultural land use within and surrounding the study area, which is compatible with large-scale solar energy generation and storage; and
- development of the site location for the purposes of a solar farm and BESS is not anticipated to result in significant adverse biophysical, cultural, social or economic impacts.

ACEN is committed to the long-term environmental management of the land within the development footprint in coordination with landholders associated with the project. At the end of the project's investment and operational life, the development footprint will be returned to its pre-existing agricultural land use, in consultation with landholders at that time.

Photograph 2.1 Cleared agricultural land within study area

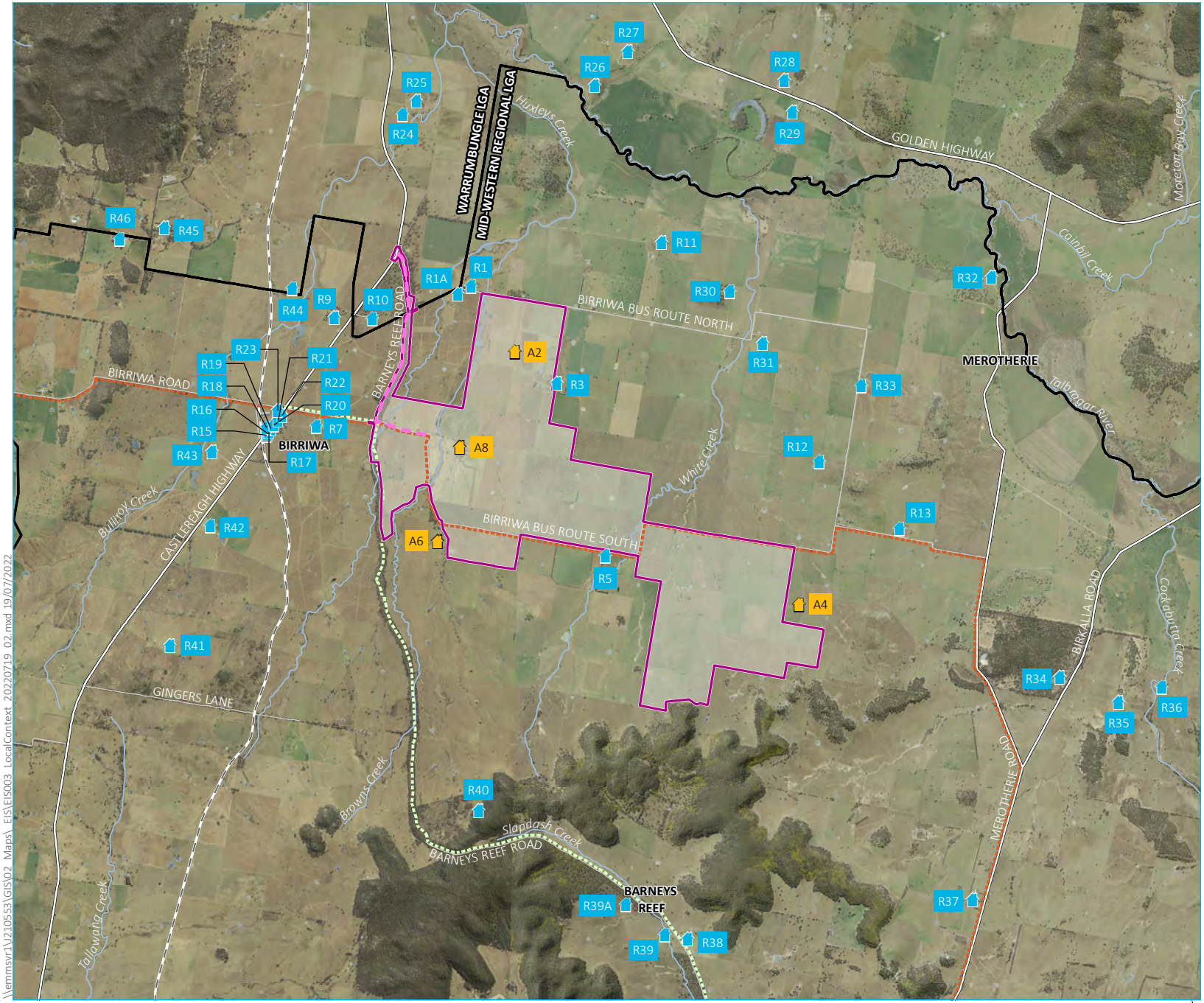
2.3 Key features of the site and surrounds

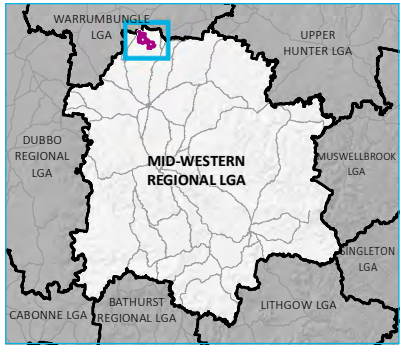
Key features of the study area and surrounding environment are described in Table 2.2 and shown in Figure 2.3.

A number of non-associated and associated residences have been identified within and surrounding the study area, as also shown in Figure 2.3, and described in Table 2.3. There are four associated residences within or in close proximity to the study area (A2, A4, A6 and A8). There are 21 non-associated residences within 2 km of the study area, many of them in the township of Birriwa, and another 22 between 2 km and 5 km away.

Table 2.2 Key features of the site and surrounds

Aspect	Description
LGA	The study area is within the Mid-Western Regional LGA. A section of the project access route along Barneys Reef Road is within the Warrumbungle Shire LGA.
Land zoning	The development footprint in its entirety is zoned RU1 Primary production under the *Mid-Western Regional Local Environmental Plan 2012* (Mid-Western Regional LEP). The access route is also zoned RU1 under the Mid-Western Regional LEP and the *Warrumbungle Local Environmental Plan 2013* (Warrumbungle LEP).
Nearby townships	The study area is within the locality of Birriwa, which has a population of 49 (ABS 2016) and includes a small cluster of residences and rural infrastructure on the Castlereagh Highway approximately 1.4 km west of the study area. Birriwa is situated between Dunedoo (15 km north-west), Gulgong (20 km south), Coolah (40 km north), Mudgee (60 km south) and Dubbo (80 km west).
Landscape	The study area is situated on rural land with a number of scattered rural residential properties within and surrounding the development footprint. Land surrounding the study area is characterised by flat to gently undulating cleared land with scattered rural residences and agricultural buildings and infrastructure (eg silos and livestock yards). Areas of native vegetation occur within and surrounding the study area in the form of scattered paddock trees, vegetation along local roads, creek lines and windbreaks.
Land use	The properties within the development footprint are currently primarily used for sheep and cattle grazing as well as low intensity dry land cropping. Key land uses in the local and broader region include agriculture, consisting primarily of sheep and cattle grazing and dry land cropping, with areas of mining, viticulture and production forestry within the broader region (in the vicinity of Gulgong and Mudgee).
Site history	The study area and surrounds have been modified by historical land use practices and past disturbances associated with land clearing, cropping and intensive livestock grazing.
Land ownership	The land within the study area is comprised of 18 freehold land parcels owned between five landowners, 1 Crown land parcel and 28 road parcels (15 Crown, 13 Local Government).
Residences	There are four associated residences within or in close proximity to the study area (A2, A4, A6 and A8). There are 21 non-associated residences within 2 km of the study area, many of them in the township of Birriwa, and another 22 non-associated residences between 2 km and 5 km from the study area (refer to Figure 2.3).
Nearby natural features	Several ephemeral drainage lines (stream order 1, 2 and 3) of the Talbragar River flow through the study area in a generally northerly direction, including the named Huxley Creek, Browns Creek and White Creek. There are also multiple farm dams within the study area. The nearest national parks to the study area are the Goulburn River National Park, approximately 30 km to the south-east, and the Yarrobil National Park, approximately 20 km to the south-west. Other areas of environmental conservation associated with state conservation areas are west of the Castlereagh Highway. More locally, Barneys Reef Ridge just south of the study area comprises a rocky ridgeline with native vegetation and is zoned C3 Environmental Management under the Mid-Western Regional LEP.
Nearby infrastructure	The study area can currently be accessed by both the Castlereagh Highway (via Birriwa Bus Route South or Barneys Reef Road) and the Golden Highway (via Merotherie Road and Birriwa Bus Route South). The Gwabegar railway line crosses the Castlereagh Highway at Birriwa and travels in a south-south-easterly direction towards Gulgong. This railway no longer provides a passenger service; however, it is understood the Australian Rail Track Corporation uses the railway for freight services.
Planning context	The study area is not within any land identified as: • biophysical strategic agricultural land (BSAL); • flood planning area; • bushfire prone land; or • mine subsidence district. Part of the study area is identified as 'groundwater vulnerable' on the Mid-Western Region LEP Groundwater vulnerability map. A small area of Barneys Reef Road, which forms part of the access route, is identified as 'high biodiversity sensitivity' on the Mid-Western Regional LEP.





KEY

- Study area
- Road upgrade corridor
- Dwelling associated with the project
- Dwelling not associated with the project

Existing environment

- Rail line
- Major road
- Minor road
- Named watercourse
- Waterbody
- Local government area

Central West Cycle (CWC) Trail

- CWC main route - Gulgong to Dunedoo
- CWC alternate route - Slap Dash Creek side trail

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Source: EMM (2022); DFSI (2017, 2022); GA (2011); ACEN (2022)

0 1 2 km

GDA 1994 MGA Zone 55

N

Local context

Birriwa Solar and Battery Project
Environmental Impact Statement
Figure 2.3

EMM
creating opportunities

Table 2.3 Summary of residences within the vicinity of the project

Resident ID	Approximate elevation (m)	Approximate distance to study area (m)
A2	420	0
A4	466	200
A6	447	150
A8	432	0
R1	415	182
R1a	416	332
R3	420	63
R5	460	81
R7	456	745
R9	435	1005
R10	425	452
R11	419	1669
R12	466	1283
R13	448	1533
R15	445	1474
R16	444	1453
R17	444	1433
R18	444	1462
R19	443	1399
R20	442	1354
R21	441	1293
R22	441	1242
R23	442	1310
R24	409	1901
R25	408	2111
R26	430	3213
R27	427	3776
R28	415	4528
R29	409	4300
R30	421	2371
R31	426	2470

Table 2.3 Summary of residences within the vicinity of the project

Resident ID	Approximate elevation (m)	Approximate distance to study area (m)
R32	420	4804
R33	436	2517
R34	431	3462
R35	446	4350
R36	425	4924
R37	474	4011
R38	495	3300
R39	490	3221
R39a	505	2845
R40	550	2758
R41	525	3418
R42	479	2445
R43	453	2260
R44	427	1481
R45	440	3281
R46	445	3907

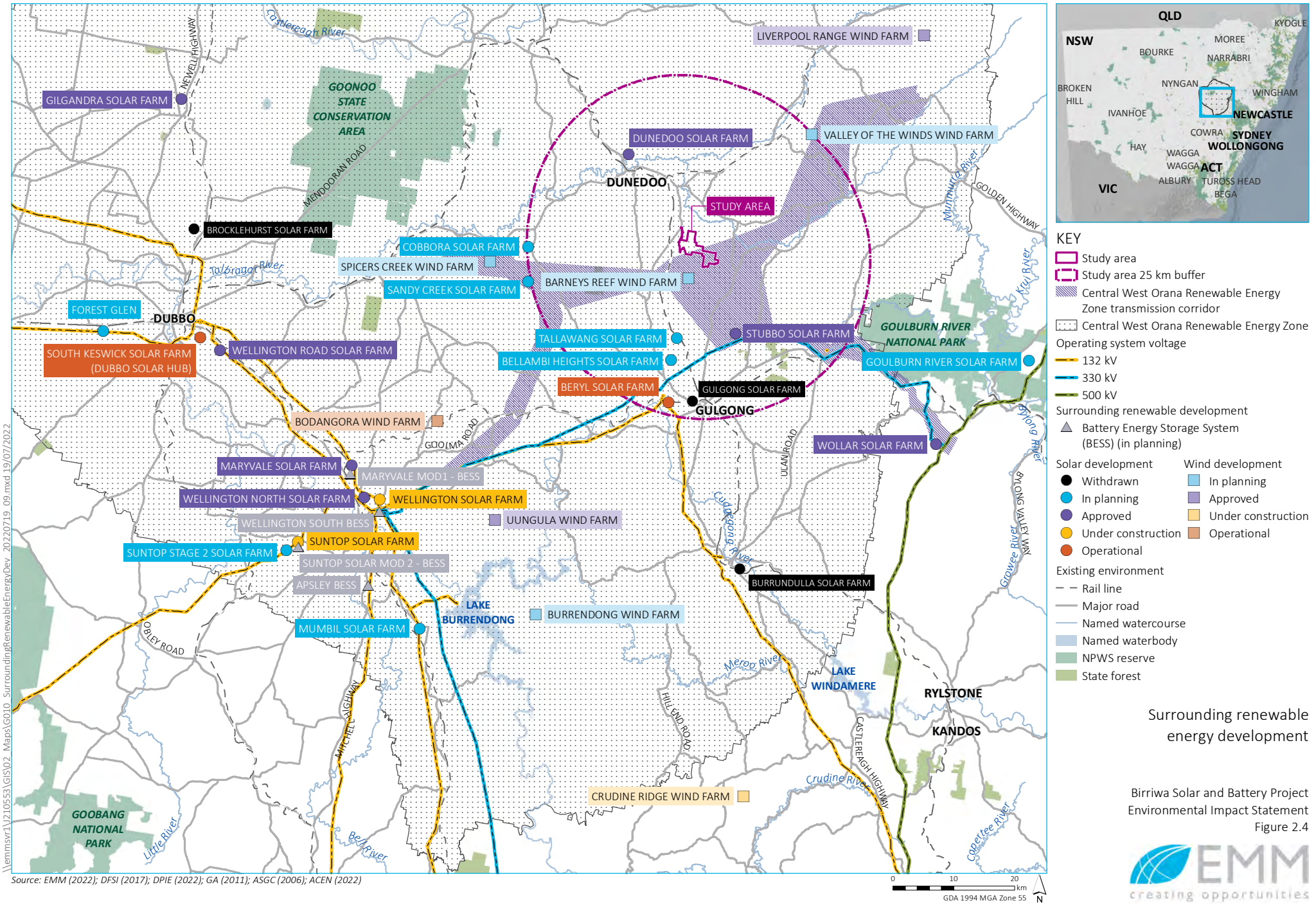
2.4 Surrounding development

Renewable energy development is a growing land use in the area, with the declaration of the CWO REZ in 2021 encouraging significant local and regional investment in energy generation, storage and transmission infrastructure. Proposed, approved, under construction and operational renewable energy developments known at the time of EIS preparation within, and in the vicinity of, the CWO REZ are shown in Figure 2.4, with the following developments known within approximately 25 km of the study area:

- CWO REZ Network Infrastructure (consultation underway);
- Dunedoo Solar Farm (approved in September 2021);
- Stubbo Solar and Battery Project (approved in June 2021);
- Beryl Solar Farm (approved in May 2017 and now in operation);
- Sandy Creek Solar Farm (in planning);
- Valley of the Winds project (in planning);
- Barneys Reef Wind Farm (in planning);

- Bellambi Heights Renewable Project (in planning); and
- Tallawang Solar Farm (in planning).

Other proposed and ongoing development in the region includes the Inland Rail, which would pass through Narromine approximately 120 km to the west of the study area, and various mining projects, including Ulan West, which is within 25 km of the study area. Further information on surrounding developments is provided in Section 6.14.



Source: EMM (2022); DFSI (2017); DPIE (2022); GA (2011); ASGC (2006); ACEN (2022)

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Surrounding renewable energy development

Birriwa Solar and Battery Project
Environmental Impact Statement
Figure 2.4

EMM creating opportunities

2.5 Project options and alternatives considered

2.5.1 'Do nothing'

The option of not developing a solar and battery storage facility or other renewable project would avoid the residual environmental and social impacts outlined in this EIS; however, it would also prohibit the potential project benefits, including:

- utilisation of some of the best renewable energy resources in the world (NSW Government 2022a);
- significant contribution to the production of renewable energy, providing a transition away from retiring coal fired power stations, which currently provide around three quarters of NSW's electricity supply (NSW Government 2022a);
- creation of employment opportunities (up to 800 construction phase jobs and 20 full time equivalent jobs throughout operation);
- direct and indirect benefits to the local and regional economy, including opportunities for local businesses and suppliers, improvements to public infrastructure, general growth and community development;
- diversification of local revenue streams;
- faster achievement of State and Commonwealth renewable energy targets and greenhouse gas reductions; and
- increased energy security.

2.5.2 Alternative project type

While Australia has an abundance of renewable energy sources, alternative power generation options are economically limited from a private investment standpoint, with solar power generation, along with wind, becoming the cheapest forms of new build electricity generating capacity globally, including in Australia. There are significant constraints for the private sector to invest in other technologies (such as pumped hydro) due to their relatively higher costs and higher risks. Replacing retiring coal-fired power plants with a combination of wind farms, solar farms, battery storage systems and pumped hydro is the most economically viable option for the foreseeable future.

It is also noted that in terms of comparing these alternative technologies, large scale wind farms typically take relatively longer to develop than solar farms (up to ten years, compared with up to five years as a rough guide), and that pumped hydro provides back up capacity, which still requires abundant low-cost energy to pump water, which is largely provided by solar during the day. Hence, pumped hydro is not a primary energy source, it is a form of storage. Thus, there is no avoiding the need for large scale solar generation from projects such as this one to secure the State's energy supply in the foreseeable future.

2.5.3 Alternative location

The study area is identified as highly suitable for a solar and battery project development as discussed in Section 2.2. Alternative locations for a project of this magnitude are limited due to the requirements of surface area, topography, proximity to existing and/or proposed energy infrastructure and available network capacity, as well as the need to avoid major townships and areas of high biodiversity value.

Alternatives to the project location were considered by ACEN as part of the site identification process, including other potential sites in NSW and further west in the Central West region. The primary constraint in considering locations further to the west is the increasing distance from the transmission network – both existing and planned. Alternatives which are further away from the planned T-Link would need long transmission lines and easements to connect into the network, which would come with additional environmental and social impacts and costs.

Landholder interest and willingness to enter into legal agreements with ACEN is another key factor that dictates a project's location. Alternative sites, while suitable from a technical point of view, may not be owned by interested landholders.

As such, the selected study area is considered optimal for development of the project.

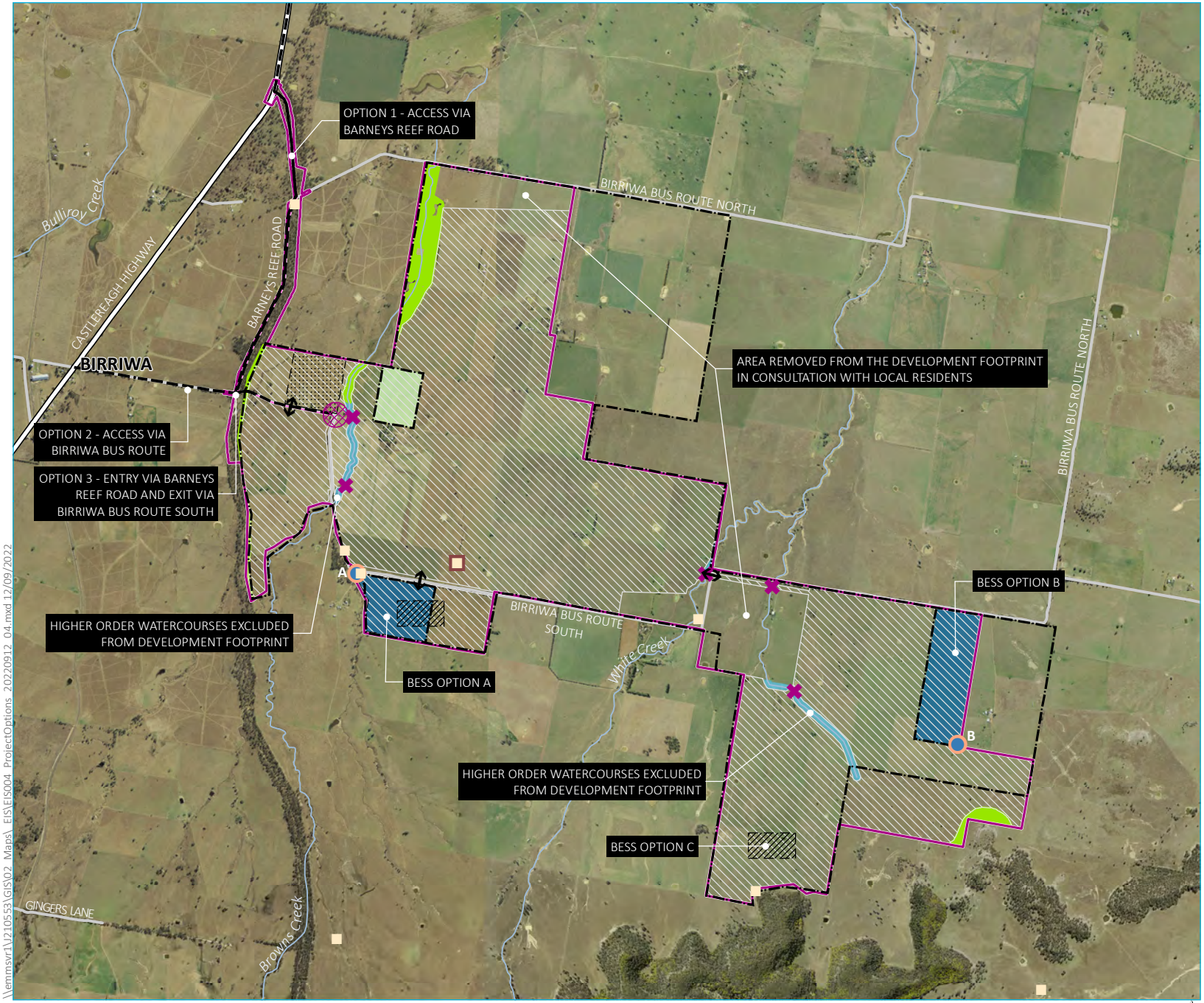
2.5.4 Project refinement

Key elements of the project design have been progressed in parallel with the preparation of the EIS to allow the outcome of environmental surveys and studies to inform the design process. Environmental and social aspects were a key consideration during the refinement of the project, which was conducted in consultation with key stakeholders, including residences. Key project elements which have been influenced and refined by technical studies and consultation outcomes include:

- the project site access route;
- BESS capacity, duration, design and location within the development footprint; and
- the development footprint including revisions to include setbacks from public roads and neighbouring dwellings.

A figure showing the key options considered is provided in Figure 2.5, while a description of the selected options and refinements is provided in the sub-sections below.

The detailed project components, including the preliminary project layout within the development footprint, its indicative power generating capacity and the sizing and configuration of the BESS, have been progressed during the preparation of the EIS, but all detailed designs and specific equipment selection decisions will ultimately be determined in the detailed design stage, which will take place post determination of the project and prior to construction.



KEY

- Study area
- Impact footprint
  - Development footprint
  - Road upgrade corridor
  - Restricted development area
  - Potential public road crossing location
- Project layout
  - Potential creek crossing point
  - Proposed access point to the project
  - Connection point (option A or B)
  - Proposed operational infrastructure area including substation, operational facility and BESS (option A or B)
  - Temporary construction compound
- Key options assessed
  - Site access options
  - Previous temporary laydown area
  - Previous BESS options
  - Initial study area
- Existing environment
  - Aboriginal heritage site (to be salvaged)
  - Aboriginal heritage site (to be avoided)
  - Major road
  - Minor road
  - Watercourse
  - Cadastral boundary
  - Vegetation to be retained

Key options assessed

Source: EMM (2022); DFSI (2017, 2022); GA (2011); ACEN (2022)

0 1 2 km

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Birriwa Solar and Battery Project
Environmental Impact Statement
Figure 2.5

EMM creating opportunities

i Project site access route options assessment

Three options were considered for the access route into the development footprint. The three options, key inputs into the assessment process, the selected option and reasons for the selection are outlined in Table 2.4.

Table 2.4 Project site access route selection

Aspect	Option analysis
Options considered: (refer to Figure 2.5)	• Option 1: via Barneys Reef Road (two-way). • Option 2: via Birriwa Bus Route South (two-way). • Option 3: entry via Barneys Reef Road and exit via Birriwa Bus Route South (one-way clockwise circulation).
Key inputs:	• Review of land use and land ownership. • Traffic survey and inspection of existing road infrastructure. • Biodiversity field survey. • Consultation with Mid-Western Regional Council and Warrumbungle Shire Council. • Consultation with the Central West Cycle Trail committee. • Consultation with the community, especially residents of the Birriwa and Merotherie localities.
Selected option:	**Option 1: via Barneys Reef Road (two-way)**
Key reasons for selection:	Option 1 was selected for a range of reasons, notably: • it was the preferred route for Mid-Western Regional Council and there was no objection from Warrumbungle Shire Council – the owner/operators of the roads; • the alignment of Barneys Reef Road (Option 1) provides good sight distance and the grade is relatively flat; • there are vertical alignment issues on Birriwa Bus Route South (Option 2 and Option 3), which would be a concern for sight distances and heavy vehicle use; • the road widening and upgrades required are significantly lower for Barneys Reef Road (Option 1) compared with Birriwa Bus Route South (Option 2); • a major intersection upgrade would be required for Option 2 at the Castlereagh Highway, with associated short-term disruption of a major road during construction; • there are social impact concerns associated with Option 3, including potential increased travel time and safety concerns associated with a one-way system; and • there are greater impacts on the Central West Cycle Trail associated with Option 2 and Option 3.
Considerations	Option 1 will require some clearing of high-condition roadside vegetation; however, this has been reduced as much as possible through the concept design process, and applicable offsets for the loss of biodiversity have been accounted for in the Biodiversity Development Assessment Report (Appendix F).

ii BESS design options assessment

Various design options have been considered for the BESS during the project development process and are identified in Table 2.5, along with selected options (where relevant) and considerations.

Table 2.5 BESS design considerations

	BESS type	BESS capacity and duration	BESS location (co-located with solar farm infrastructure)
Options considered:	Battery rack enclosures (3 variants): • Outdoor stand-alone racks. • 40 foot container housing battery racks. • Dedicated use building(s) with internal zones housing battery racks.	Different BESS capacity and durations were assessed, eg 600 MW, 1,000 MW, 2,000 MW and 3,000 MW, for 1 hour and 2 hours.	• 'Option A' located in the south-west of the development footprint. • 'Option B' located in the east of the development footprint. • 'Option C' located in the south-east of the development footprint. Refer to Figure 2.5.
Key inputs:	• Hazard and risk • Technical design • Social • Visual • Noise	• Hazard and risk • Technical design • Social • Noise	• Hazard and risk • Technical design • Social • Visual • Noise • Access, including for emergency services
Selected option:	Approval is sought for all three options. One option will be selected at detailed design stage. All three options are considered in this EIS.	Capacity: 600 MW Duration: up to 2 hours The 600 MW capacity, up to 2 hours (1,200 MWh) was selected due to predicted exceedances of the relevant noise criteria at some non-associated residents at a higher storage capacity. However, it is noted that a higher capacity of 1,000 MW, up to 1 hour was assumed for the purposes of estimating the required construction workforce for the project, which then defines the traffic assumptions and workforce assessed as part of the traffic and social impact assessment respectively.	Approval is sought for Option A and Option B, noting that only one will be constructed, with the final option to be selected at detailed design stage. Both are considered and assessed in this EIS.
Considerations	The BESS enclosure type will be determined during the detailed design stage. The EIS has assessed the worst-case scenario for the enclosure type for each respective technical study.	The 600 MW capacity and the 2 hour (1,200 MWh) duration were selected as a result of economic and technical feasibility considerations.	Option C was eliminated due to potential social and visual impacts, as it is on elevated topography, increasing views from multiple sensitive receptors. Two options are considered for the BESS location in the EIS. The final location will depend on the T-Link connection point location.

iii Development footprint and environmental constraints

Throughout the project refinement process, ACEN has made considerable effort to avoid potential environmental and social impacts, where possible, which has been achieved through the designation of:

- a 'development footprint' – which excludes areas of environmental and social constraint from being directly impacted by the project; and
- 'restricted development areas' – in these areas, disturbance will be avoided wherever possible, with only specific nominated works or uses permitted.

In instances where potential impacts cannot be avoided, ACEN's design principles have sought to minimise environmental impacts and/or implement mitigation measures to manage the extent and severity of any residual environmental impacts.

Detailed technical environmental investigations have identified environmental and land use constraints that have informed the development footprint, restricted development areas and preliminary infrastructure layout and include:

- Aboriginal cultural heritage sites identified during archaeological surveys;
- native vegetation and threatened species habitat mapped during biodiversity surveys;
- location of residences and direct feedback from residents;
- location of higher order watercourses;
- Crown land (including Crown roads);
- local roads; and
- areas of higher flood hazard, with potential flooding depths of greater than 300 mm during a 1% Annual Exceedance Probability (AEP) event (ie 1 in 100 year flood) based on the results of modelled flood extents.

The environmental constraints which have informed the development footprint are shown in Figure 3.1.

A summary of the key environmental constraints considered as part of the project refinement process and selection of the development footprint is provided in Table 2.6.

Table 2.6 Matters considered during project refinement

Aspect	Matters considered during project refinement
Biodiversity	Measures to avoid and minimise impacts to vegetation were considered during the project refinement process, resulting in avoidance of significant biodiversity values. As a result, 4.9 ha of PCT 80 – derived native grassland (DNG) within the study area will be avoided by the project. The study area for the project encompassed approximately 1,330 ha. The final area of the development footprint has been reduced to 1,159 ha, which is a reduction in the original design by 171 ha and will reduce impacts on the threatened ecological communities within the study area. Accordingly, the reduction in impact on Box Gum Woodland and DNG and Grey Box woodland and grassland also reduces the impact on native flora and fauna habitat. Public road crossings have been located within the development footprint within areas of minimal vegetation, thereby avoiding the need to remove vegetation for these crossings. Refinements to the project layout have also excluded as many higher order streams from the development footprint as possible. Three third order streams are restricted development areas, where impact will be avoided, thereby avoiding impacts to any associate riparian vegetation, with the exception of that required for the provision of fencing, access and electrical reticulation (ie private internal access roads and electrical cables). In addition, a key design principle within the project refinement process has been to maximise the placement of project infrastructure in cleared areas and, wherever possible, limit impacts to native vegetation of low quality only. In relation to the road upgrade corridor, the conceptual road upgrade design has sought to minimise the clearance of native vegetation as much as possible. The concept design was developed in consultation with EMM ecologists and with Mid-Western Regional Council to develop a design that avoids as much of the native vegetation along the existing road verge as possible.
Aboriginal cultural heritage	A field survey of the study area and surrounds identified eight Aboriginal sites. Of the eight identified, four (Mangarlowe OS-2, Roxanna OS-1, Winora OS-1, Barneys Reef Road ST-1) are outside of the development footprint and will not be impacted as part of the project. ACEN refined the development footprint to avoid impacts to a further three Aboriginal sites (White Creek OS-1, Mangarlowe OS-1 and Mangarlowe IF-1). Therefore, impacts to seven of the eight identified Aboriginal sites in the study area will be avoided by the project. One Aboriginal site, Mangarlowe IF-2, will be impacted by the project and will be salvaged prior to the commencement of construction. The methodology for the salvage of this site will be finalised as part of an Aboriginal cultural heritage management plan (ACHMP) to be prepared for the project.
Visual	A key consideration of the project design refinement process has been the potential visibility of project infrastructure from the identified rural dwellings. In response to feedback received from neighbouring landholders and the local community during targeted engagement, revisions have been made to reduce the extent of the development footprint in the northern, central and eastern part of the study area. This has significantly reduced the distance of proposed infrastructure from these residences, therefore reducing the level of visual impact on a number of receptors including: R5, R1 and R1a.
Traffic and transport	Alternative site access options were considered as discussed in Section 2.5.4i. Option 1 via Barneys Reef Road was the selected option for the project. The reasons for this option being selected are discussed in Section 2.5.4i. A concept road upgrade design was prepared in consultation with Mid-Western Regional Council and Warrumbungle Shire Council for the purpose of environmental assessments. This concept design is currently assessed as a worst case scenario. ACEN is continuing consultation with Mid-Western Regional Council and Warrumbungle Shire Council to refine the design within the development footprint of the concept plan. At a meeting in June 2022, Council's traffic committee agreed that the speed limit for the construction period along Barneys Reef Road can be reduced to 80 km/hr along the Mid-Western Regional Council section for regular traffic. This will allow to further refine and minimise the required upgrade works (including the footprint) along the road corridor.

Table 2.6 Matters considered during project refinement

Aspect	Matters considered during project refinement
Water	The development footprint has been designed to minimise impacts on watercourses, where possible. The three third order streams within the development footprint are restricted development areas as a result of avoidance of impact to higher order watercourses. The development footprint provides appropriate setbacks from all third order streams. Project refinements have also reduced the number of creek crossings required for as part of the project's internal access tracks. Flood modelling outputs resulted in refinements being applied to the location of the temporary laydown area. The proposed location was identified to avoid a 20% AEP event (ie 1 in 5 year flood) and avoiding impact to the second order stream west of the study area, near Huxley's Creek. The majority of first and second order watercourses within the development footprint have no discernible channel. Nonetheless, the placement of project infrastructure within the development footprint will avoid first and second order streams, where possible. ACEN proposed to avoid locating critical infrastructure in major flow paths in order not to create significant flood impacts. The proposed substation and BESS areas (option A or option B) or any other related infrastructure do not cause increases in flood level within or outside of the study area.
Hazards and risks	The following controls were identified to limit exposure to electric and magnetic fields (EMF): • the design, selection and procurement of electrical equipment for the project will comply with relevant international and Australian standards; • location selection for the project infrastructure (ie accounts for separation distance to surrounding land uses including neighbouring properties and agricultural operations) and fencing within the project boundary will assist in limiting the exposure to EMF for the general public; • exposure to EMF (specifically magnetic fields) from electrical equipment will be localised and the strength of the field attenuates rapidly with distance; and • duration of exposure to EMF for personnel onsite will be transient. The BESS is designed so that the separation distance/clearance between the BESS sub-units meets the requirements of *Standard for the Installation of Stationary Energy Storage Systems* (National Fire Protection Agency 855 2020).
Land use	ACEN has designed the project to minimise impacts on agricultural land, wherever possible. In addition, as part of the land use conflict risk assessment (LUCRA) (refer to Appendix L), impacts to neighbouring agricultural operations have also been considered. There is no mapped BSAL within the study area.
Noise	As part of the detailed design process, potential noise-generating infrastructure (including substations and BESSs) will be positioned within the development footprint with a view to maximising distance between this infrastructure and nearby residences where practicable.
Socio-economic	Proximity to local regional towns and subsequent availability of local businesses, services and a local labour force have been considered.

3 Project description

3.1 Overview

The project involves the development, construction and operation of a solar PV electricity generation facility and BESS, which consists of PV modules, trackers, batteries, inverters, transformers and associated infrastructure.

The impact footprint provided in Figure 3.1 incorporates the land required for the:

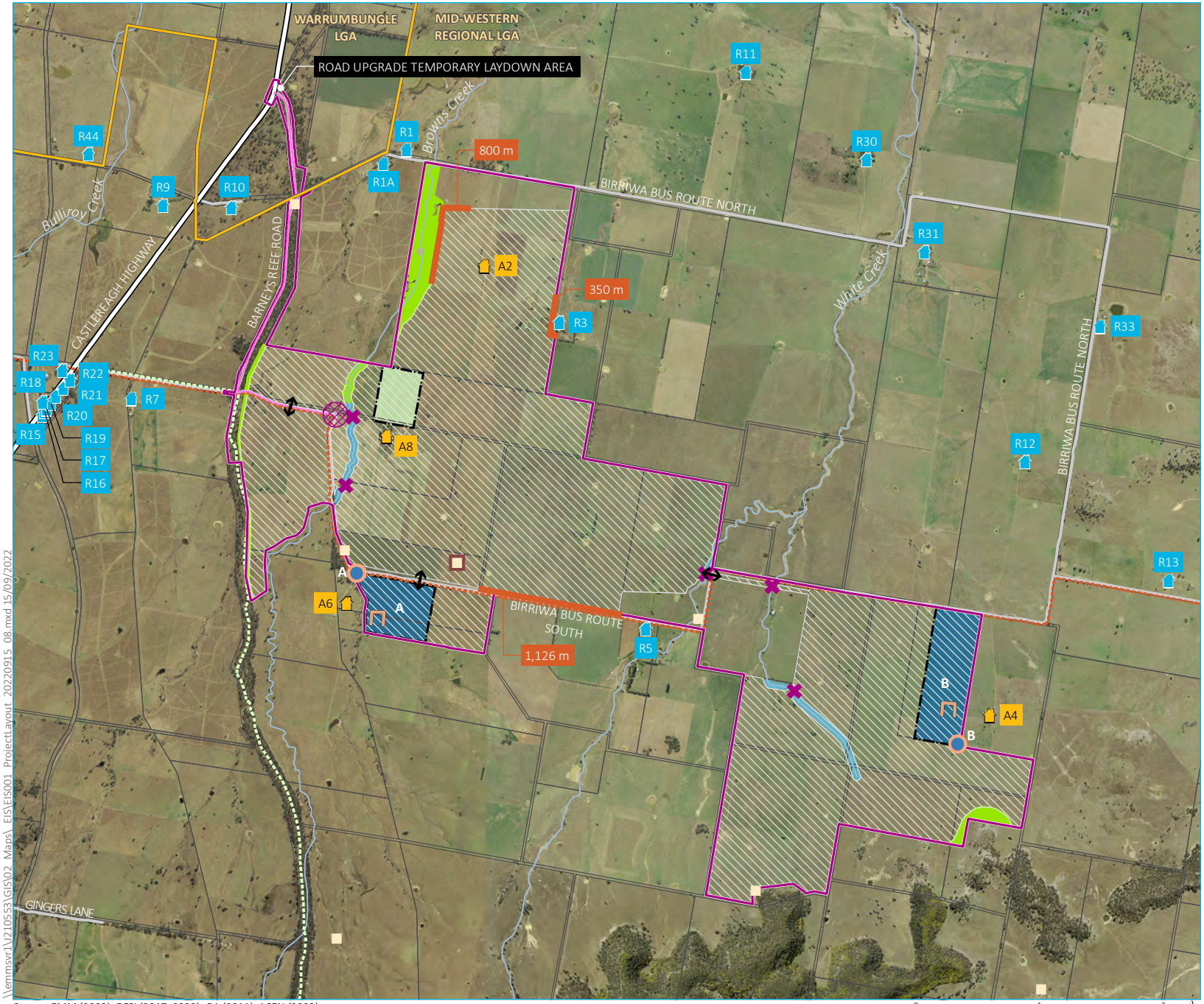
- development footprint, including:
    - PV modules and associated mounting infrastructure including tracking systems;
    - operational infrastructure area (including substation, BESS and ancillary infrastructure including an operations and control building);
    - electrical collection and conversion systems;
    - underground and aboveground cables;
    - parking and internal access roads;
    - security fencing; and
    - a temporary construction compound including laydown area;
- road upgrade corridor (ie area of direct impact for public road upgrade works); and
- construction footprint of public road crossings (ie area of direct impact for public road crossings).

During the preparation of the EIS, the development footprint within the study area was refined on the basis of environmental constraints identification, stakeholder engagement, community consultation and design of project infrastructure, with the objective of developing an efficient project that avoids and minimises environmental and social impacts.

The project will have a targeted 'sent out' electricity generating capacity of approximately 600 MW (AC) and up to 600 MW energy storage for up to 2 hours (1,200 MWh). The final number of PV modules within the development footprint will be dependent on detailed design, availability and commercial considerations at the time of construction.

The project will connect to the proposed Merotherie Energy Hub via one of two indicative connection points (refer to Figure 3.1). The exact location of the interface point between the project and the Merotherie Energy Hub is currently being defined in consultation with EnergyCo.

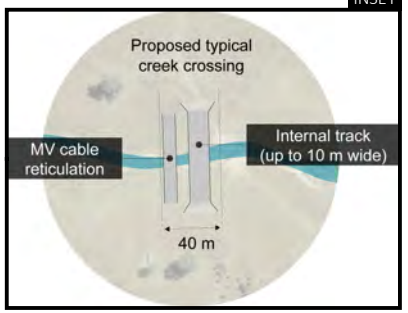
The development footprint will be accessed via the Castlereagh Highway, Barneys Reef Road and Birriwa Bus Route. From the project site access point, private internal roads will be used to traverse the development footprint. A section of Barneys Reef Road and Birriwa Bus Route South will require upgrades to provide safe access to the development footprint during construction of the project.



KEY

- Study area
- Impact footprint
  - Development footprint
  - Road upgrade corridor
  - Restricted development area
  - Potential public road crossing location
- Project layout
  - Potential creek crossing point (refer to inset below for indicative design)
  - Proposed access point to the project
  - Connection point (option A or B)
  - Proposed operational infrastructure area including substation, operational facility and BESS (option A or B)
  - Temporary construction compound
  - Landscape screen planting
  - Indicative noise wall location
- Existing environment
  - Dwelling not associated with the project
  - Dwelling associated with the project
  - Aboriginal heritage site (to be salvaged)
  - Aboriginal heritage site (to be avoided)
  - Vegetation to be retained
  - Major road
  - Minor road
  - Watercourse
  - Cadastral boundary
  - Local government area boundary
- Central West Cycle (CWC) Trail
  - CWC main route - Gulgong to Dunedoo
  - CWC alternate route - Slap Dash Creek side trail

INSET



Project layout

Source: EMM (2022); DFSI (2017, 2022); GA (2011); ACEN (2022)

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Figure 3.1

EMM creating opportunities

3.2 Study area

As outlined in Section 1.2, the study area is around 1,330 ha and extends (wholly or partly) over 18 freehold land parcels and one parcel of Crown land. A schedule of lands for the study area is provided in Table 3.1 and shown in Figure 3.2.

Table 3.1 Involved lots within the study area

Project infrastructure component	Lot	Deposited plan (DP)
	82	DP750755
	70	DP750755
	54	DP750755
	48	DP750755
	47	DP750755
	45	DP750755
	43	DP750755
	39	DP750755
	37	DP750755
	36	DP750755
	35	DP750755
	34	DP750755
	32	DP750755
	31	DP750755
	30	DP750755
	16	DP750755
	12	DP750755
	1	DP1004819

Note: The schedule of lands is also taken to include any crown land and road reserves contained within the study area.

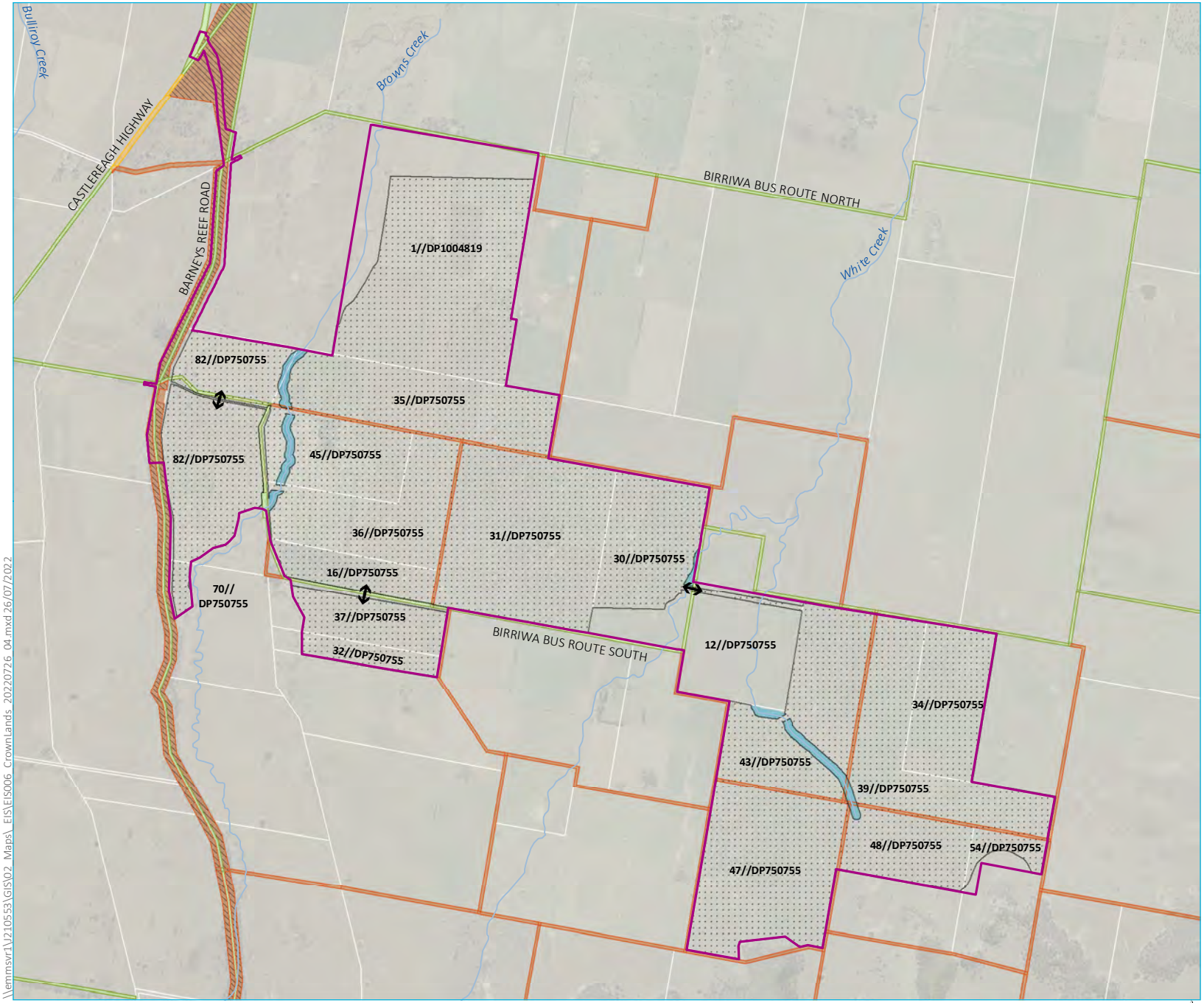
The impact footprint sits within the study area and is the maximum extent of ground disturbing works associated with the construction and operation of the project. The impact footprint has been reduced in size from that originally considered in response to engagement with local residents, and the outcomes of environmental assessments and constraints identification, and comprises:

- the development footprint (area to be developed within land where ACEN hold landholder agreements);
- road upgrade corridor (area of direct impact for public road upgrade works along the access route); and
- construction footprint of public road crossings (area of direct impact for construction of public road crossings to allow construction and operational traffic and cable crossings between different land parcels).

In addition, restricted development areas have been identified which include land within the development footprint where disturbance will be avoided, wherever possible, with the exception of that required for the provision of fencing, access and electrical reticulation (ie private internal access roads and electrical cables).

As described in Section 2.5, a number of alternative arrangements have also been considered throughout the project refinement process for the placement of internal access roads, as well as the proposed footprints for substation and BESS infrastructure. ACEN has adopted a flexible approach to design for this infrastructure to ensure that the final location can respond to identified social and environmental impacts and constraints.

As described in Chapter 4, the land on which the onsite substation is constructed is likely to require subdivision. At the end of the operational life of the grid substation, the infrastructure on the subdivided lot will be decommissioned and the lot will be reconsolidated back into the residual lot. Once the final location of the onsite substation is determined, the proposed subdivision will be the subject of ongoing discussion with Mid-Western Regional Council, DPE and the project landholders. The proposed subdivision is shown in Figure 3.3 including indicative areas of existing and proposed subdivided lots.



KEY

- Study area

Impact footprint

- Development footprint
- Restricted development area
- Potential public road crossing location

Existing environment

- Watercourse
- Travelling stock reserve

Controlling authority

- Freehold
- Crown
- Local Government Authority
- Shared Crown/Council

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Source: EMM (2022); DFSI (2017, 2022); GA (2011); ACEN (2022); DECCW (2010)

0 1 2 km

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Schedule of lands within the study area

Birriwa Solar and Battery Project
Environmental Impact Statement
Figure 3.2

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Source: EMM (2022); DFSI (2017, 2022); GA (2011); ACEN (2022)

BESS subdivision

Birriwa Solar and Battery Project
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Figure 3.3

EMM
creating opportunities

3.3 Physical layout and design

The project is subject to detailed design. Aspects of the project (including the siting of project elements and construction methodology) are subject to change during the detailed design process but will otherwise not lie beyond the development footprint identified on Figure 3.1. This EIS is based on consideration of reasonable worse case environmental impacts to allow flexibility in design and construction methodology. The road corridor upgrade and public road crossings have been based on a concept design plan (refer to Appendix C).

3.3.1 Project components

i PV modules

The project will involve the installation of rows of PV modules (solar panels) mounted on trackers, with multiple rows making up 'power blocks' or 'arrays' that are connected into a power conversion unit (PCU). The exact number of PV modules and the final configuration will not be determined until the detailed design stage after development approval is granted; however, based on a 600 MW (AC) facility, it is anticipated that there will be approximately 1.2–1.4 million PV modules.

The final electricity generation capacity will also be determined separately through formal consultation with EnergyCo, the to-be-appointed Network Operator of the CWO REZ and the Australian Energy Market Operator and possibly TransGrid, in a distinct connection study process, which will be subject to the capacity limits of the CWO REZ T-Link. As the CWO REZ infrastructure is being developed by EnergyCo on a greenfield basis and the project has been shortlisted by EnergyCo as a Candidate Foundation Generator (CFG) project as part of its recent process, ACEN has every reason to believe that the targeted 600 MW will be achievable. However, in light of the early stage of the EnergyCo CFG process and the bespoke connection process that is envisaged as part of this, the MW capacity of the project should not be fixed with regards to the project approval. Regardless, all PV modules will be contained within the development footprint.

The project involves the use of a single axis tracking system. An example of the type of PV modules mounted on a single axis tracking system that may be used is provided in Plate 3.1. The PV modules will be installed on racking frames fixed onto a horizontal tracker tube, with this mounted on top of vertical piles driven or screwed into the ground. The PV modules will be installed in rows generally spaced between 8 m and 12 m apart depending on the tracking system selected, the configuration of the panels on the trackers and the final design. The rows of PV modules will be aligned in a north-south direction, allowing the panels to rotate from east to west during the day, tracking the sun's movement.

The PV modules will be up to 1.2 m from the ground when in the horizontal position, while the lower edge of each PV module will be no less than 0.3 m from the ground or above the flood depth level at the maximum tilt angle. The maximum height of the modules to the higher edge from ground level at the maximum tilt angle is expected to be 4.7 m, which is assuming a '2 in portrait' (2P) configuration (ie worst case assumption for visual impact assessment). Examples of '1 in portrait' (1P) and 2P configurations are shown in Plate 3.1 and Plate 3.2.

DC cables will be strung underneath the PV modules, housed in cable trays, or passed through the tracker tubes before being connected to the PCUs.

Source: NexTracker (2018)

Plate 3.1 Example of a PV module layout (2 in portrait or 2P configuration)

Source: NexTracker (2018)

Plate 3.2 Example of a PV module layout (1 in portrait or 1P configuration)

ii Power conversion units

The PCUs comprise three main components (inverters, transformers and a ring main unit) and are designed to convert the DC electricity generated by the PV modules into AC form, which is compatible with the national electricity grid. The PCUs will also increase the voltage of the electricity from 11 kV, which is the typical voltage of the DC system prior to conversion to AC; that is, the electricity generated by the PV modules and the multiple strings collected in Combiner Boxes, converted to AC power and stepped up to 33 kV by the PCUs for transmission to the substation via medium voltage cables buried underground.

The exact dimensions and configuration of the PCUs will be determined during detailed design and the original equipment manufacturers (OEMs) active in the market are constantly developing new products with slightly different MW capacities, designs and dimensions. The PCUs are typically either containerised (20 ft or 40 ft shipping containers) or a skid-mounted or "outdoor" design, which is with the cabinets and transformers mounted on either a steel platform or a thin concrete pad.

An example of what the PCUs may look like within the development footprint is provided in Plate 3.3. This particular example, which might be deployed but has not been chosen and is provided for illustrative purposes only, is an outdoor design mounted on a steel skid with dimensions of approximately 8 m in length by 2.6 m wide by 2.7 m high. The exact manufacturer and model to be used will be determined as part of the grid connection studies and the detailed design and procurement phase.

The quantity of PCUs required will be determined during detailed design; however, based on a 600 MW facility and the current range of products in the market that are relevant for this project, it is anticipated that approximately 80–160 PCUs will be required, depending on the final design and procurement decisions made at the time of construction.

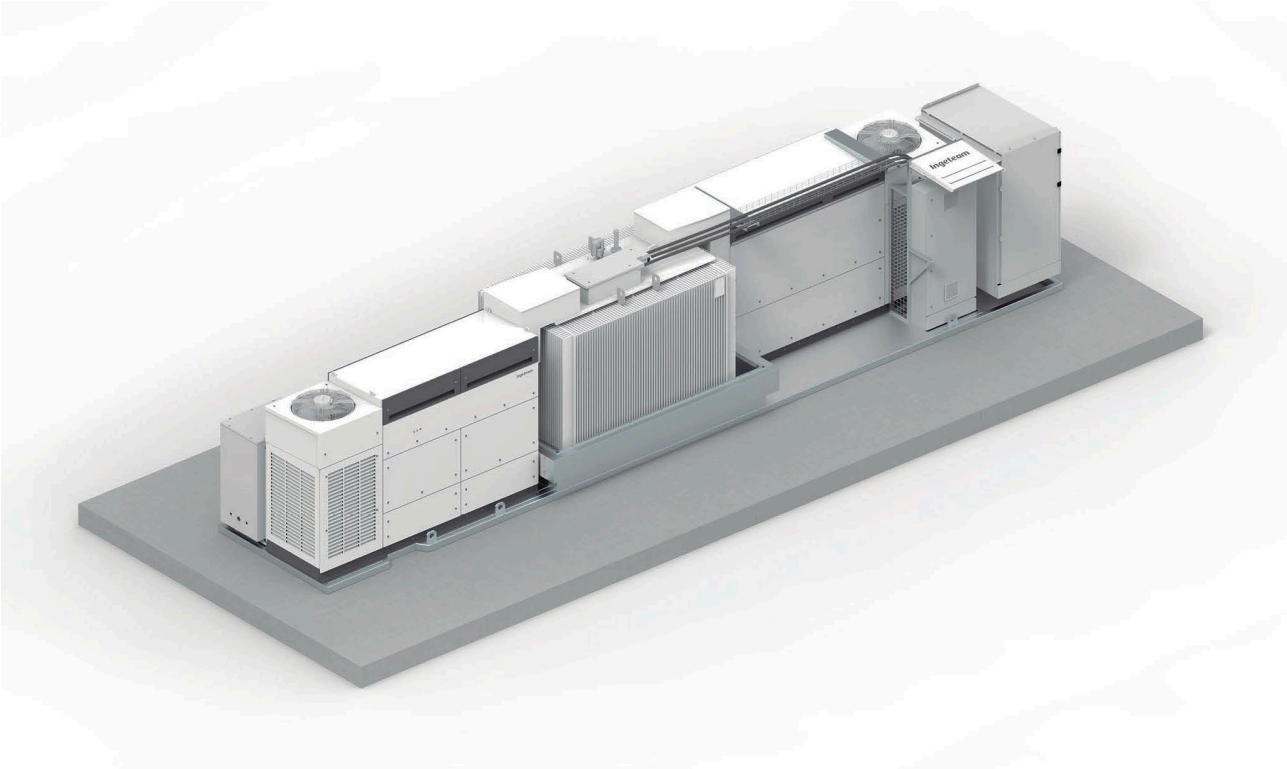


Plate 3.3 Example of a PCU mounted on a galvanized steel skid

Source: Ingeteam (2022)

iii Electrical reticulation cable network

A medium voltage (MV) cable reticulation network will be required to transport the electricity around the PV module arrays. If underground, cables of either 11 kV, 22 kV or 33 kV will be installed at a depth of at least 600 millimetres (mm) and will be designed and fitted in accordance with relevant Australian industry standards. Electricity from the MV cable network will be stepped up to high voltage (HV) at the substation.

Overhead transmission lines may also be required to transport electricity within the development footprint and restricted areas. The alignment of the overhead transmission lines and design, height and style of the structures required to support them will be determined during the detailed design stage of the project. The easement and distance between each structure required for the overhead transmission lines will be dependent on the type of structure selected.

Small corridors for MV cabling may be required between land parcels in the study area. Disturbance associated with these cabling corridors will be within the development footprint or the construction footprint of public road crossings (Figure 3.1). The exact alignments will be determined during detailed design.

As part of the MV cable reticulation network development, waterway crossings will also be required. Waterway crossings will be constructed within the restricted development area (Figure 3.1); however, their exact location will be determined during detailed design. It is assumed that each crossing will require a disturbance corridor of up to 40 m wide (including road and cable corridors), which has been allowed for in the biodiversity assessment for the project (refer to Section 6.2). All waterway crossings will comply with the *Policy and Guidelines for Fish Friendly Waterway Crossings* (DPI 2003) and *Guidelines for Watercourse Crossings on Waterfront Land* (DPI 2012).

iv Operational infrastructure area

An operational infrastructure area will be constructed at one of two location options within the development footprint (Figure 3.1) and will include the BESS, substation and supporting infrastructure.

a Battery energy storage system

The purpose of the BESS will be to support the transmission network via the Frequency Control and Ancillary Services (FCAS) markets, introduce a dispatchable capability to the project's energy generation profile and allow for revenue diversification. Depending on the choice of inverters for the BESS it may also provide system strength related services to support the solar farm's operation in the network, if required in the future.

In relation to the capacity of the BESS, it is noted that while approval is sought for a 600 MW capacity system, the project design initially included a BESS with a 1,000 MW capacity/1,000 MWh system. For the purposes of the impact assessment within this EIS a 1,000 MW/1,000 MWh system was initially assessed. However, following the results of predicted exceedances of the relevant noise criteria at some non-associated residents at a higher storage capacity, the capacity of the BESS has been revised and reduced to 600 MW for a 2 hour duration (1,200 MWh). A higher capacity of 1,000 MW was assumed for the purposes of estimating the required construction workforce for the project, which then defines the traffic assumptions and workforce assessed as part of the traffic and social impact assessment respectively.

The project therefore includes a centralised BESS of up to 600 MW capacity, with a storage duration of up to 2 hours (1,200 MWh). The specific technology, MW rated capacity and energy storage of the proposed BESS will be determined during the detailed design stage of the project and will be dependent on a number of commercial and financial considerations. Primarily, market need is what will dictate the final MW and MWh energy storage configuration, as a battery designed to primarily provide FCAS services for example requires only a short duration, whereas a battery designed for "generation-shifting" of the solar component of the project would logically have a longer duration with the MW capacity possibly aligned with an offtake (Power Purchasing Agreement). The sizing of the BESS may also be driven by government policy given the current focus on mechanisms to ensure reliability and dispatchability of renewable energy power generation, including the Energy Security Board's consultation on the design of a capacity mechanism.

The BESS will be adjacent to the substation within one of two proposed operational infrastructure areas (Figure 3.1) and will be housed within either outdoor standalone racks, shipping containers or dedicated use buildings. The specific design details for the BESS and their respective enclosure types have not been confirmed.

Each of the operational infrastructure areas presented in Figure 3.1 provide adequate flexibility for design and siting of the applicable BESS at each location. Indicative footprint sizes and infrastructure heights for the potential BESS structures are summarised in Table 3.2. These dimensions should be considered indicative only. Exact dimensions will be refined during the detailed design stage of the project.

Table 3.2 Comparison of BESS design options

BESS design	Indicative footprint	Height of dominant infrastructure	Maximum height of infrastructure
Outdoor standalone rack	8.6 ha	3.8 m	25 m (lightning protection)
Containerised	9.5 ha	3.8 m	
Dedicated use building	9.4 ha	7.5 m	

The major components for each BESS design include:

- Batteries – the specific battery module manufacturer and model has not been selected; however, it will likely be a type of lithium-ion battery.
- Inverters – convert the DC electricity generated by the PV modules into AC. Potential use of grid forming inverters is to be considered once the grid connection studies are commenced as part of the EnergyCo process.
- Transformers – typically integrated with the PCUs along with the inverters; the exact configuration (size, design etc) of the transformers will be subject to the type and size of battery racks used and the BESS configuration.
- Heating ventilation air conditioning (HVACs) – used as part of the BESS to maintain the batteries at a temperature that will optimise their lifetime and performance.
- Fire protection – fire protection systems will be installed and could include automatic gas fire extinguishing systems, thermal sensors and/or smoke and temperature detectors connected to a fire control panel.

The components described above will be similar for each of the BESS structures likely to be constructed as part of the project. As noted above, the specific design details for the BESS have not been confirmed and will not be known until the completion of the detailed design stage of the project.

b Substation

Electricity from the medium voltage electrical reticulation cable network will be increased to high voltage electricity at the substation, to match the voltage of the network at the connection point. The substation will sit within one of the two nominated operational infrastructure areas (Figure 3.1).

The substation will consist of an indoor switch room to house the medium voltage switchboard and circuit breakers, and an outdoor switch yard to house the transformer(s), gantries and associated infrastructure. A security fence will be installed around the substation to maintain project site security and public safety.

The 600 MW transformer yard is proposed to be up to approximately 200 m by 100 m; and the switch yard is proposed to be up to approximately 150 m by 100 m. No component will be higher than the transmission tower, which is expected to be approximately 30 m high.

From the substation, electricity generated by the project will be injected into the grid at the development footprint boundary via one of two indicative connection points (Figure 3.1). The exact location of the interface point between the project and the Merotherie Energy Hub are being defined in consultation with EnergyCo, as explained in Section 1.4.

c Ancillary infrastructure

In addition to the BESS and substation, the operational infrastructure area will house:

- a workshop and associated infrastructure;
- a temperature-controlled spare parts storage facility; and
- staff office, operations and control room, meeting facilities, amenities and carparking.

v Supporting infrastructure

In addition to the infrastructure described above, the project will also require:

- a number of new internal roads to facilitate access within the development footprint to allow for construction and ongoing maintenance; and
- fencing and landscaping.

Chain-link (or mesh) security fencing will be installed within the study area to a height of up to 2.4 m. The specific location of the security fencing will be determined in consultation with the contractors selected for the construction of the project and project landholders. Fencing will restrict public access to the development footprint. Where possible, fencing will be positioned to minimise disruption to ongoing agricultural operations on land adjacent to the development footprint.

A temporary laydown area will be required during the construction stage of the project and will include laydown and storage areas and a compound, located within the development footprint. A temporary laydown area for the road upgrade is also proposed on an area previously disturbed at the entrance of Barneys Reef Road, off the Castlereagh Highway. The final location for the temporary laydown area, indicatively shown on Figure 3.1, will be defined in consultation with Warrumbungle Shire Council and Mid-Western Regional Council. The area used for the temporary laydown area within the development footprint will be revegetated or have PV modules and associated infrastructure installed once it is no longer required.

3.3.2 Project access

i Access

The primary vehicle access route will be via the Castlereagh Highway, Barneys Reef Road and Birriwa Bus Route South. The primary project access point on Birriwa Bus Route South will provide access to the development footprint (refer to Figure 3.1).

Internal access roads will be constructed to facilitate access to the remainder of the development footprint; however, up to three public road crossings will be constructed to allow project-related vehicles to move across public road corridors and between parcels of land that form part of the development footprint (Figure 3.1). These crossings will reduce the impact of project-related vehicles on the local road network and maximise the use of the project's internal road network during construction and operations. Design considerations of the public road crossings have been determined in consultation with Mid-Western Regional Council and have been located in areas to avoid vegetation impact or clearance. A typical public road crossing concept design is included in Appendix C.

In addition, waterway crossings will be required to facilitate vehicle movements and cable crossings within the development footprint. Waterway crossings are proposed within the restricted development area (Figure 3.1); however, their exact location will be determined during detailed design. It is assumed that each crossing will require a disturbance corridor of up to 40 m wide (including road and cable corridors). The design and construction of waterway crossings and cable crossings will generally comply with the *Guidelines for controlled activities on waterfront land – riparian corridors* (Natural Resources Access Regulator, 2018); *Guidelines for laying pipes and cables in watercourses on waterfront land* (NSW Office of Water 2012); *Policy and Guidelines for Fish Friendly Waterway Crossings* (DPI 2003) and *Guidelines for Watercourse Crossings on Waterfront Land* (DPI 2012).

Proposed transport routes from both Sydney and Newcastle ports are included in Figure 3.5.

ii Road upgrades

Proposed upgrades to the primary vehicle access route are summarised in Table 3.3.

Table 3.3 Road upgrades and project access

Road	Location	Upgrade requirements	Timing
Castlereagh Highway/Barneys Reef Road	Intersection	Basic left turn (BAL) and basic right turn (BAR) treatment to cater for the largest vehicle accessing the project (excluding over-dimensional vehicles).	Prior to construction
Barneys Reef Road	Whole road	7.2 m road carriageway (including 3.1 m travel lanes and 0.5 m shoulders).	
Barneys Reef Road/Birriwa Bus Route South	Intersection	Basic left turn (BAL) and basic right turn (BAR) treatment to cater for the largest vehicle accessing the project (excluding over-dimensional vehicles).	
Birriwa Bus Route South	From intersection with Barneys Reef Road to project access point	7.2 m road carriageway (including 3.1 m travel lanes and 0.5 m shoulders).	
	Project access point	Rural property access type.	

Table 3.3 Road upgrades and project access

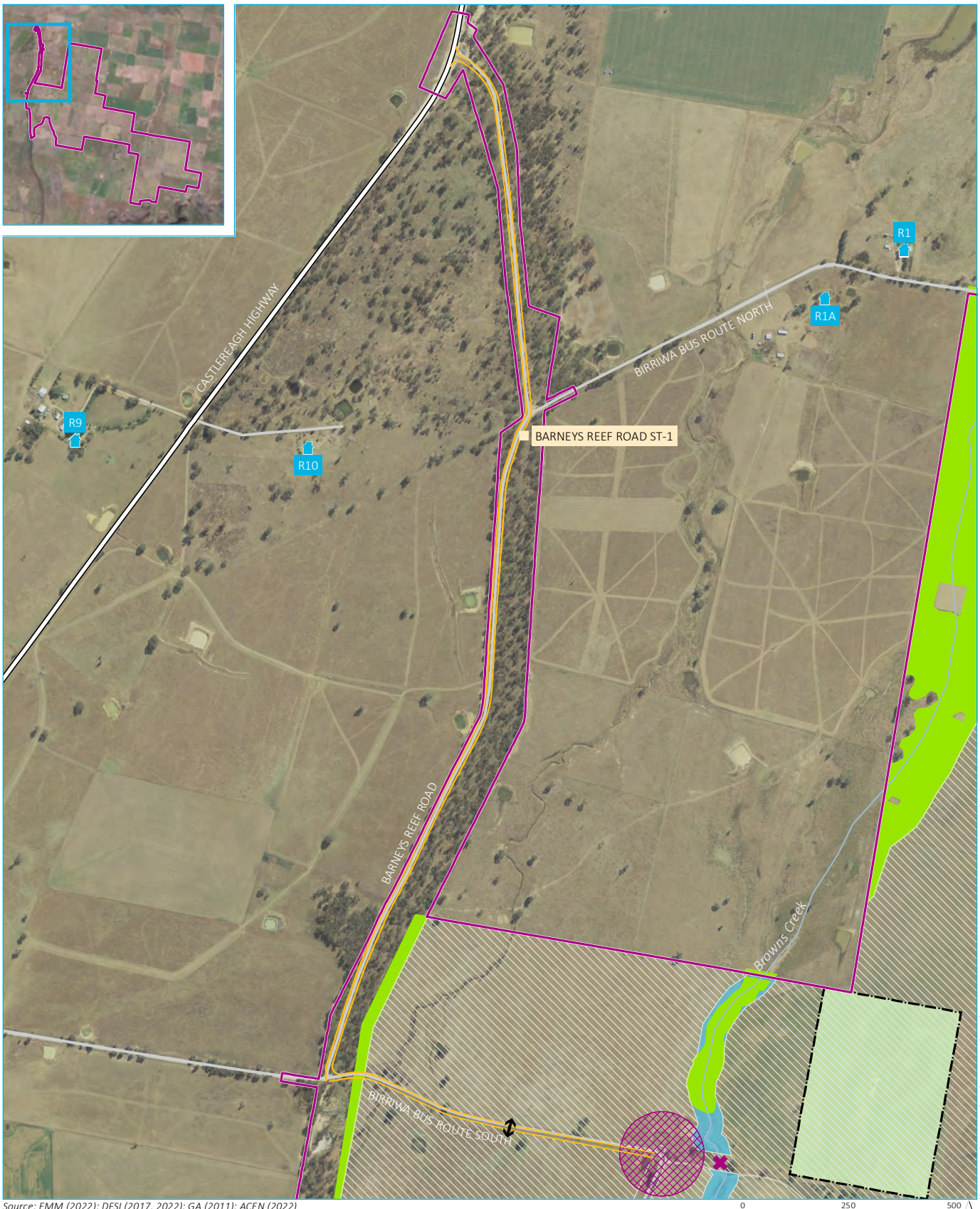
Road	Location	Upgrade requirements	Timing
	Public road crossings	The design considerations of the public road crossings have been determined in consultation with Mid-Western Regional Council and have been indicatively located in areas to avoid vegetation impact or clearance. A typical public road crossing concept design has been included in Appendix C.	

A concept engineering design (Appendix C) has been developed in consultation with Warrumbungle Shire Council and has been used to inform the extent of the road upgrade corridor in Figure 3.4. To facilitate construction, the indicative design works indicate that there will be a requirement for a maximum disturbance of approximately 4 ha. This includes areas of native vegetation, non-vegetated land (ie hard surfaces or gravelled tracks and driveways), vegetation within the maintained easement and exotic vegetation. The road upgrade corridor utilises existing roads, tracks and maintained road shoulders to the extent practicable to minimise the amount of vegetation clearing and surface disturbance required. In particular, the conceptual road upgrade design has sought to minimise the clearance of native vegetation as much as possible, with approximately 1.29 ha of native vegetation proposed to be cleared to facilitate the access road upgrade.

The road upgrade corridor that has been assessed as part of the EIS and supporting technical assessments is conservative and provides flexibility for the final road alignment during detailed design. The extent of the road upgrade corridor may be refined (ie reduced) prior to determination, subject to the outcomes of consultation with Warrumbungle Shire Council and Mid-Western Regional Council. Wherever possible, the final road alignment will avoid clearance of native vegetation.

Where the road upgrade corridor extends beyond the road reserve into private property, landowner's consent has been sought to support the lodgement of the development application for the project.

A final design will be prepared in consultation with Warrumbungle Shire Council and Mid-Western Regional Council; however, the final design will not increase the extent of the road upgrade corridor.



Source: EMM (2022); DFSI (2017, 2022); GA (2011); ACEN (2022)

0 250 500 m

GDA 1994 MGA Zone 55

N

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KEY

- Study area

Impact footprint
- Development footprint
- Restricted development area
- Potential public road crossing location

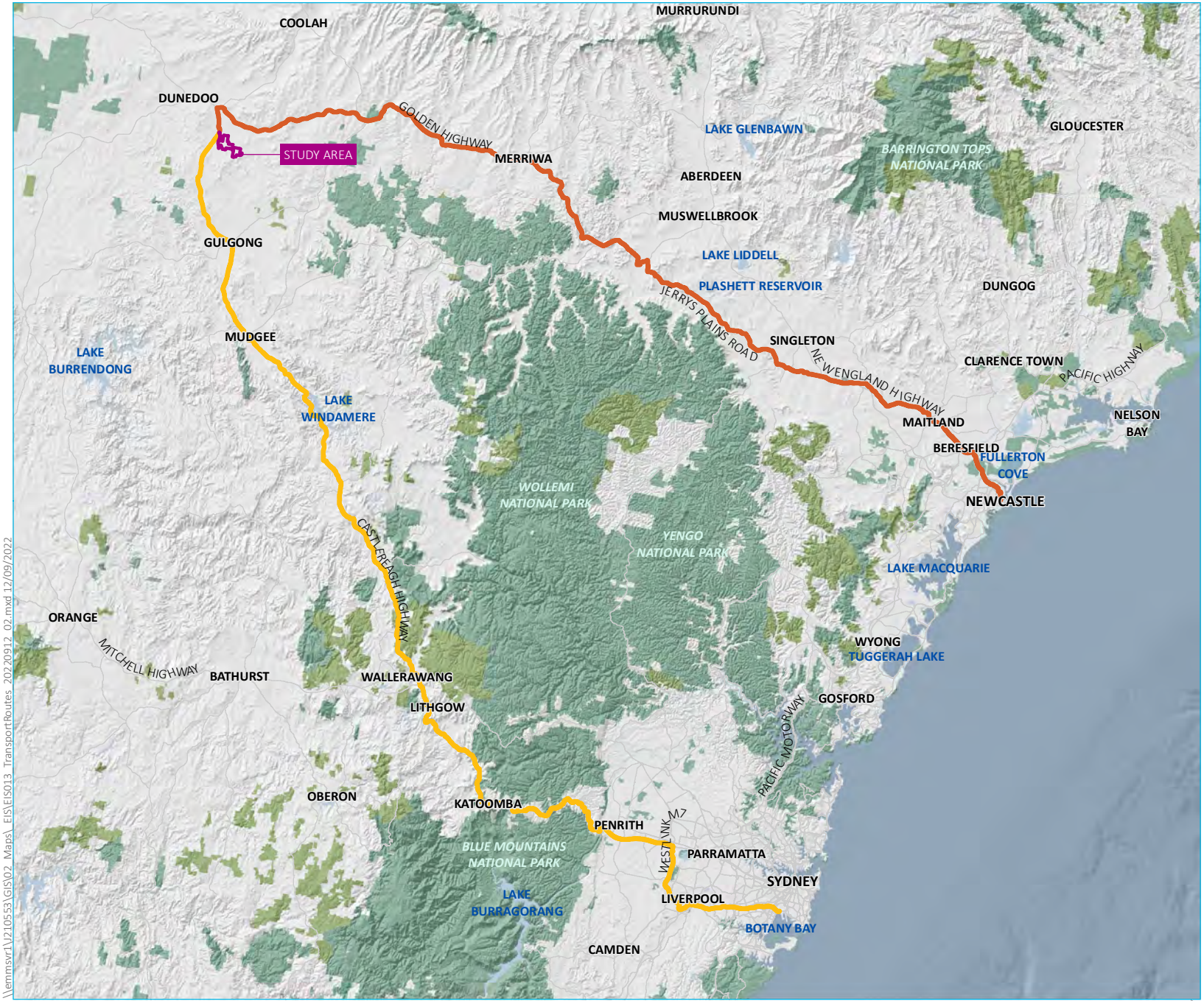
Project layout
- Potential creek crossing point
- Proposed road design
- Proposed access point to the project
- Temporary construction compound

Existing environment
- Dwelling not associated with the project
- Aboriginal heritage site (to be avoided)
- Major road
- Minor road
- Watercourse
- Vegetation to be retained

Proposed road upgrades

Birriwa Solar and Battery Project
Environmental Impact Statement
Figure 3.4

EMM creating opportunities



KEY

- Study area
- Proposed transport route
  - Sydney
  - Newcastle
- Existing environment
  - Major road
  - Named waterbody
  - NPWS reserve
  - State forest

Source: EMM (2022); DFSI (2020, 2021); GA (2011); ACEN (2022)

0 25 50 km

GDA 1994 NSW Lambert

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Proposed transport routes

Birriwa Solar and Battery Project
Environmental Impact Statement
Figure 3.5

EMM creating opportunities

3.3.3 Services

i Water

Water demands for the project during both construction and operation will be sourced preferentially from:

- commercial suppliers of treated wastewater (water trucks); or
- farm dams within the study area (for non-potable construction purposes to minimise use of imported water and in accordance with the harvestable rights provisions).

Water sources will be determined in consultation with suppliers and landholders and be subject to availability. The project will not impact adjacent licensed water users or basic landholder rights during construction.

It is estimated that approximately 300 kilolitres (kL) of water per day will be required (the volume of approximately 15 water trucks, which is the number included in the traffic assessment in this EIS, with a capacity of 20,000 l), equating to approximately 218 megalitres (ML) over the 28 month construction period. Most of this water will be required for dust suppression, with other minor uses including site amenities, fire protection and washing of equipment and plant.

During operations, approximately 7.5 ML of non-potable water will be required annually for ongoing maintenance activities such as cleaning PV modules (indicatively once a year) and vegetation management and for amenities and potable purposes by operational staff.

Additional water will also be required for fire protection. Volumes will be determined during detailed design; however, it is anticipated that up to 80 kL will be required as an emergency water supply for firefighting within the development footprint and up to 650 kL will be required for the fire protection systems associated with the BESS.

In summary, project water requirements are anticipated to be:

- construction (assuming 28 month construction period) = 218 ML; and
- operations (assuming a 30 year operational life and an allowance of 1 ML for fire protection) = 225 ML.

ii Telecommunications

Telecommunication utilities are not available at the site. As such, the cellular network will be used during construction. During operations, connection to telecommunications will be via optical fibre expected to be installed along transmission lines, with cellular backup.

iii Sewer

There is no sewer access at the site. Therefore, amenity facilities will be pumped out via tanker and delivered to the closest available sewage treatment facility or as agreed with Mid-Western Regional Council during construction. ACEN or its contractors will consult with Mid-Western Regional Council prior to commencement of construction to reach an agreement.

iv Electricity

Access to electricity during construction activities will be via the local distribution network where available and via diesel generation where access to the grid is unavailable.

Electricity requirements during operation will include lighting, staff computers, domestic appliances and on-site security systems during operations. Electricity generated by the project will be used for most activities during operations, except for maintaining the inverters and transformers during the night which will involve a small amount of auxiliary load being supplied from the grid.

3.4 Uses and activities

3.4.1 Construction

i Staging

The anticipated period of construction for the project is 28 months, which is expected to commence in early 2024.

The construction of the project will generally include the following overlapping stages:

- public road upgrades including public road crossings;
- site establishment including security fencing and internal access tracks;
- construction (including temporary construction ancillary facilities);
- BESS and substation installation; and
- commissioning and testing.

ii Site preparation

Site establishment works and preparation for construction may include:

- the establishment of a temporary construction compound in a fenced-off area within the development footprint including:
    - a project office;
    - containers for storage;
    - workshops;
    - parking areas;
    - workforce amenities; and
    - temporary laydown areas, including those associated with public road upgrades;
- construction of access tracks and installation of boundary fencing;
- site survey to confirm infrastructure positioning and placement;
- ongoing geotechnical investigations to confirm the ground conditions;
- preliminary earthworks and installation of environmental controls including erosion and sediment management structures; and
- identification and demarcation of no-go zones around trees and vegetation to be retained.

As part of site establishment works, management measures will be implemented to mitigate potential impacts on the environment and receptors within close proximity of the development footprint. Where required, additional or improved drainage channels, sediment control ponds and dust control measures will be implemented. Further, laydown areas and waste handling, fuel and chemical storage areas will be strategically placed to minimise potential environmental impacts during the construction stage of the project.

Earthworks will be limited to the locations requiring resurfacing activities for temporary construction facilities (including laydown areas, construction compounds and carparking areas) and permanent operational infrastructure such as the substation, BESS and ancillary infrastructure. A small level pad area may need to be prepared for the PCUs depending on which specific solution is chosen in detailed design.

Minor earthworks will also be required to prepare the development footprint for the installation of the rows of PV modules including some grading or levelling including “cutting and filling” where required. The need for heavy earthworks and compaction is expected to be low due to the flat topography of the development footprint and will be minimised as much as practicable. Farm dams may be filled in if this does not have adverse hydrology impacts as assessed in this EIS.

The extent of excavations and volume of fill required for the project will depend on geotechnical conditions and the final locations for infrastructure and will be determined during detailed design of the project.

iii Activities

Upon completion of the site establishment and pre-construction activities described above, construction activities will typically be rolled out as follows:

- installation of steel piles and mounting system for the tracking system and PV modules;
- secure PV modules to mounting system;
- trenching and installation of DC cabling and medium voltage cables;
- installation of PCUs either on steel skids, concrete pads or in modified shipping containers;
- construction of workshop and associated infrastructure, temperature-controlled spare parts storage facility, permanent staff office, operations and control room, meeting facilities, amenities and carparking;
- construction of the substation (including grid connection-related infrastructure);
- establishment of the BESS compound;
- installation of battery racks either in cabinets, modified shipping containers or sheds;
- installation of inverters associated with the BESS;
- test and commission project infrastructure; and
- removal of temporary construction facilities.

iv Plant and equipment

The plant and equipment required for the construction of the project will include:

- earthmoving machinery and equipment for site preparation (eg rollers, dump truck, concrete truck, excavators, grader and compactor);
- cable trenching and laying equipment;
- pile-driving equipment;
- assisted material handling equipment (forklifts and cranes);
- machinery and equipment for installation of the substation and BESS;
- generators; and
- water trucks for dust suppression.

v Delivery of construction material and infrastructure

Construction materials and infrastructure will be transported to the development footprint via road. Heavy vehicles up to 26 m in length and over-dimensional vehicles will require access to the development footprint. Construction materials and infrastructure delivered to the development footprint will include:

- PV modules;
- piles;
- tracking tubes and associated tracker equipment (eg motors, bearings, drivetrains, etc);
- electrical infrastructure including cabling and PCUs;
- construction and permanent operations and maintenance buildings and associated infrastructure; and
- earthworks and lifting machinery and equipment.

vi Transport routes and vehicle movements

Construction materials and infrastructure are anticipated to be transported to the study area via road from either:

- Port of Newcastle (via the Golden Highway and the Castlereagh Highway); or
- Port of Sydney (via the Golden Highway and the Castlereagh Highway).

Deliveries may also come from elsewhere in Australia, subject to supplier selection, port capabilities and fees.

The origins of project-related light vehicle movements and preferred transport routes will be dependent on the geographic area from which people travel to the study area; however, it is anticipated to include people travelling from Gulgong, Mudgee, Dunedoo, Dubbo and surrounds.

All project-related vehicles will use the primary vehicle access route described in Section 3.3.2i.

Approximately 40 oversize and/or overmass (OSOM) vehicles will be required during the construction phase for deliveries (eg transformers and prefabricated buildings). It is anticipated that there will be no more than one OSOM vehicle travelling to the study area per day. The maximum estimated length of the OSOM vehicles is estimated to be up to 120 m. It is anticipated that decommissioning will require the same number of OSOM vehicles (ie to remove the infrastructure). The OSOM vehicles considered in the EIS relate to high-risk over-dimensional vehicles. Special purpose vehicles, restricted access vehicles and exempt OSOM vehicles are included in the number of heavy vehicles assessed in the EIS.

No OSOM vehicle movements are anticipated during operations.

Estimated maximum vehicle movements per day during construction are provided in Table 3.4.

Table 3.4 Estimated peak daily vehicle movements during construction

Vehicle type	Peak movements per day
Light vehicles	530[1]
Heavy vehicles	120
OSOM	1
Total	**651**

Notes: 1. Assumes peak construction workforce of 800 people and carpooling (ie 1.5 people per light vehicle).

The potential impacts of project-related vehicle movements on the local and regional road network have been assessed as part of the Traffic impact assessment (TIA, refer to Section 6.4 and Appendix H).

vii Hours

Construction activities will be undertaken during standard daytime construction hours consistent with the *Interim Construction Noise Guideline* (ICNG) (DECC 2009), with the addition of work on Saturday afternoons from 1.00 pm to 6.00 pm, as follows:

- 7.00 am to 6.00 pm Monday to Friday;
- 8.00 am to 6.00 pm on Saturdays; and
- no works on Sundays or public holidays.

ACEN proposes the following construction activities may be undertaken outside these hours without the approval of the Secretary:

- activities that are inaudible at non-associated residences;
- the delivery of materials as requested by the NSW Police Force or other authorities for safety reasons; or
- emergency work to avoid the loss of life, property and/or material harm to the environment.

The allowance for works to be undertaken on Saturday afternoons is being requested by ACEN to help minimise the construction schedule duration without significantly increasing the peak workforce numbers. This is seen as having two primary benefits for the community, which is firstly that workers who move to the area for the construction phase will not be idle on a Saturday afternoon, and secondly that by limiting the need for additional workers to stay within a given construction schedule, this will have less of an impact on local accommodation availability. The noise assessment has considered this out of hours work on Saturday afternoons (refer to Section 6.7), and proposed mitigation measures to ensure compliance with the relevant noise management limits (NMLs).

Other out of hours work and extended construction hours may be required on limited occasions such as for special deliveries to minimise road traffic disruption, or in the case of emergencies. The Secretary, Mid-Western Regional Council, Warrumbungle Shire Council and surrounding landholders will be notified of any foreseeable exceptions.

viii Workforce

The project will require a peak construction workforce of up to 800 people (assuming concurrent construction of the solar and BESS infrastructure). It is anticipated that the average construction workforce throughout the 28 month construction period will be approximately 360 people (solar component only). Construction of the BESS is anticipated to take approximately 16 months with an average construction workforce of approximately 170 people.

Consultation will continue with Mid-Western Regional Council, Warrumbungle Shire Council, business owners and key stakeholders throughout the assessment and development phases of the project regarding managing potential impacts and opportunities associated with the construction workforce and accommodation capacity.

The construction workforce will be sourced from the local area as far as practicable with ACEN considering options to provide training for local hires. Where possible, ACEN will also consider the construction schedules of other renewable and transmission projects in the CWO REZ in the scheduling of the project's construction to minimise the impact on the local community.

Accommodation required for non-local hires is anticipated to be sourced through the use of available rental and motel accommodation in surrounding townships and regional centres (ie Dunedoo, Gulgong, Mudgee and Wellington, or potentially as far away as Dubbo if necessary). If approved, the on-site construction workforce accommodation proposed as part of the Valley of the Winds Wind Farm (SSD-10461) may also be used to house non-local hires. Potential cumulative impacts have been considered as part of the social impact assessment (SIA, refer to Section 6.10 and Appendix O). It is anticipated that EnergyCo will consider a coordinated approach for housing workers that are involved in the construction of CWO REZ projects.

3.4.2 Operations

i Activities

It is anticipated that the facility will require regular maintenance throughout its operational life. This will include the following ongoing tasks:

- site maintenance including:
    - vegetation maintenance;
    - weed and pest management;
    - fence and access road management; and
    - landscaping;

- infrastructure maintenance including:
    - PV module cleaning;
    - PV module, PCU and tracker system repair (if required);
    - inverter and PCU replacement (within every 7–10 years); and
    - equipment, cabling, substation and communications system inspection and maintenance.

ACEN is currently in discussions with a number of the landholders to enable sheep grazing to resume on portions of the development footprint following the completion of construction of the project, if practicable. A detailed protocol will be developed to ensure biosecurity is maintained and that grazing does not impact on the safe and efficient operation of the project or result in injury to farm workers, stock or operations staff.

To ensure the optimal electricity production output for the project is maintained, the PV modules may need to be washed periodically to remove dirt, dust and other matter. Water for panel cleaning will be transported to the project via water trucks. Washing will not require any detergent or cleaning agents.

The operational workforce will also be responsible for ongoing security monitoring of project infrastructure. Perimeter security cameras may be utilised to assist with monitoring.

ii Transport route and vehicle movements

All project-related vehicles will use the primary vehicle access route described in Section 3.3.2i.

Regular light vehicle access will be required throughout operations; however, is not anticipated to exceed approximately 20 light vehicles per day. Heavy vehicles may be required occasionally for replacing larger components of project infrastructure including inverters, transformers or components of the BESS.

iii Hours

The project, which includes both a solar PV component and a BESS, will have the ability to operate 24 hours per day, 7 days per week, 365 days per year.

iv Workforce

Throughout operations, it is anticipated that a workforce of up to 20 people will be required.

Highly technical operations and maintenance activities will typically be undertaken by specialist subcontractors and/or equipment manufacturers whereas routine activities such as fencing maintenance and vegetation management are likely to be offered to local contractors wherever available.

3.4.3 Decommissioning

Once the project reaches the end of its investment and operational life, the project infrastructure will be decommissioned and the development footprint returned to its pre-existing land use, namely suitable for grazing or cropping, or another land use as agreed by the project owner and the landholders at that time.

Project decommissioning will require disturbance of the development footprint during the removal of equipment. A significant number of people, including both staff and contractors, and vehicle movements will be required during the decommissioning stage of the project.

Any underground cabling below 600 mm will remain in-situ following project decommissioning unless otherwise agreed with the landholders.

ACEN will attempt to recycle all dismantled and decommissioned infrastructure and equipment, where possible. Structures and equipment that cannot be recycled will be disposed of at an approved waste management facility (refer to Section 6.13.2).

3.4.4 Environmental management

An environmental management strategy will be implemented to provide the strategic framework for environmental management of the project. The strategy will:

- incorporate a project environmental management plan (EMP), all other required plans, protocols, management and mitigation measures proposed in this EIS;
- identify all relevant statutory approvals;
- establish roles, responsibility, authority and accountability of all key personnel involved in the environmental management of the project;
- establish procedures for consulting with the local community and relevant agencies about the operation and environmental performance of the development; and
- establish procedures for handling of complaints, disputes, non-compliances and emergency response.

A consolidated summary of the management measures that will be implemented during the construction and operation of the project to manage, mitigate and/or monitor potential impacts identified within this EIS is provided in Appendix E.

3.5 Timing

The construction phase of the project is expected to take up to 28 months from the commencement of site establishment works, including completion of the substation and BESS.

The operational lifespan of the project will be in the order of 30 years, unless the solar farm is re-powered at the end of the PV modules' technical life. The decision to re-power the solar farm will depend on the economics of solar PV technology and energy market conditions at that time. Should the PV modules be replaced during operations, the lifespan of the project may extend to up to 50 years.

The BESS's operating life is likely to be 20 years, with the potential for replacing components to extend its life if the market conditions and the cost of the batteries warrant this.

4 Statutory context

4.1 Introduction

This chapter identifies the key relevant statutory requirements for the project having regard to the EP&A Act and EP&A Regulation, and other relevant NSW and Commonwealth legislation and environmental planning instruments.

This section addresses:

- power to grant approval (ie approval pathway);
- permissibility;
- other approvals;
- pre-conditions to exercising the power to grant approval; and
- mandatory matters for consideration.

Relevant statutory requirements are considered in detail in the assessment sections of the EIS (Chapter 6) and supporting technical reports in Appendix F to Appendix Q.

This chapter identifies the statutory requirements relevant to the assessment and evaluation of the project. All relevant statutory requirements, including administrative requirements, relevant to the project are provided in Appendix B.

4.2 Permissibility

Section 2.36(9) of *State Environmental Planning Policy (Transport and Infrastructure) 2021* (Transport and Infrastructure SEPP) states that development for the purpose of a solar energy system may be carried out by any person with consent on any land. Therefore, the project is permissible with consent.

4.3 Approval pathway

Approval for the project is sought under Division 4.7 of the EP&A Act, which relates to the application pathway for SSD. The project is classified as SSD as it meets both the requirements of Section 2.6 of the *State Environmental Planning Policy (Planning Systems) 2021* (Planning Systems SEPP), namely:

- it requires development consent; and
- is specified in Schedule 1, section 20 (development for the purpose of electricity generating works that has a capital investment value of more than $30 million).

The consent authority for SSD is either the NSW Independent Planning Commission or the NSW Minister for Planning.

4.4 Other approvals

This section identifies the other approvals that are required to carry out the project and explains why they are required. These approvals are outlined in Table 4.1 and have been grouped into the following categories:

- Commonwealth approvals, includes consideration of applicability of Commonwealth legislation;
- consistent approvals, which are approvals that cannot be refused and are required to be issued consistently under Section 4.42 of the EP&A Act if the project is approved;
- other approvals, which are approvals that are not expressly integrated into the SSD application process; and
- approvals not required, which are approvals that would be required if the project was not SSD as per Section 4.41 of the EP&A Act.

Table 4.1 Approvals and licences required

Approval	Requirement
Commonwealth approvals	
Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)	Under the EPBC Act, a proponent proposing to undertake an action that may or will have a significant impact on matters of national environmental significance (MNES), or the environment generally for 'Commonwealth agencies', is to be referred to the Department of Climate Change, Energy, the Environment and Water (DCCEEW) for determination as to whether or not it is a controlled action. A search of the Commonwealth Protected Matters Search Tool indicates that there are no World Heritage Properties, National Heritage Places or wetlands of international importance within the vicinity of the study area. A biodiversity development assessment report (BDAR) was prepared for the project and found that the project is not considered likely to significantly impact on threatened species, ecological communities or migratory species listed under the EPBC Act. Due to the matters of national environmental significance involved (Box-Gum Woodland, Grey Box Woodland and Koala habitat) along the access corridor, a referral will be made under the EPBC Act.
Native Title Act 1993	The Commonwealth *Native Title Act 1993* recognises and protects native title rights in Australia. It allows a native title determination application (native title claim) to be made for land or waters where native title has not been validly extinguished, for example, extinguished by the grant of freehold title to land. There are currently no native title determinations over the study area. A native title claim covering an area from Dunedoo to Lithgow, that includes the study area, was registered on 31 August 2018 on behalf of the Warrabinga-Wiradjuri people (NC2018/002). There is another native title claim, registered on 20 December 2011 on behalf of the Gomeroi People (NC2011/006), approximately 2.4 km north of the study area.
Consistent approvals	
An environment protection licence (EPL) under Part 3 of the NSW *Protection of the Environment Operations Act 1997* (POEO Act)	The generation of electricity from solar power is not defined as a scheduled activity in Schedule 1 of the POEO Act and therefore an EPL is not required.
An approval under Section 138 of the NSW *Roads Act 1993*	Approval will be required under section 138 of the NSW *Roads Act 1993*, for any works in, on or over a public road. This will include the access road upgrade and public road crossings. Approval will be required from: • Warrumbungle Shire Council (Barneys Reef Road); and • Mid-Western Regional Council (Barneys Reef Road and Birriwa Bus Route South).

Table 4.1 Approvals and licences required

Approval	Requirement
Other NSW approvals	
NSW *Conveyancing Act 1919*	The development footprint will require a separate lease from the owners of the affected land. Lease of a solar farm site is treated as a lease of premises, regardless of whether the lease will be for more or less than 25 years. The plan defining 'premises' (being the development footprint) will not constitute a 'current plan' within the meaning of Section 7A of the NSW *Conveyancing Act 1919* and therefore will not require subdivision consent under section 23G of the Act. The land on which the onsite substation is constructed is likely to require subdivision. At the end of the operational life of the grid substation, the infrastructure on the subdivided lot will be decommissioned and the lot will be reconsolidated back into the residual lot. Section 23G of the NSW *Conveyancing Act 1919* will likely apply to the subdivision of the land required for the onsite substation. Once the final location of the onsite substation is determined, the proposed subdivision will be the subject of ongoing discussion with Mid-Western Regional Council, DPE and the project landholders.
NSW *Crown Land Management Act 2016*	A number of Crown roads have been identified within the study area, as shown in Figure 3.2. Crown roads within the development footprint and road upgrade corridor will require closing or an application for tenure, which will be undertaken in consultation with NSW Crown Lands in parallel with the assessment process for the project.
Approvals not required	
A permit under the NSW *Fisheries Management Act 1994* to block fish passage or dredge or carry out reclamation work on water land	The project will require works within waterfront land, including upgrades of existing road crossings and/or establishing new crossings over watercourse within the study area. These works will be undertaken generally in accordance with *Policies and Guidelines on Fish-Friendly Waterway Crossings* (DPI undated), *Policy and Guidelines for Fish Habitat Conservation and Management* (DPI 2013) and *Guidelines for Controlled Activities on Waterfront Land* (NRAR 2018).
An Aboriginal heritage impact permit under Section 90 of the *National Parks and Wildlife Act 1974*	Avoidance of Aboriginal cultural heritage values has been a key aspect of the project refinement process. Subsequently, only one Aboriginal site will be impacted by the project, with the impact footprint refined to avoid other identified sites (refer to Section 6.3). An ACHMP will be developed post determination (and pre-construction) in consultation with DPE, registered Aboriginal parties (RAPs) and Heritage NSW and will detail the management and mitigation of known Aboriginal sites along with unanticipated finds procedures, and training and reporting protocols.
A bushfire safety authority under Section 100B of the NSW *Rural Fires Act 1997*	Bushfire risks associated with the project have been assessed in accordance with *Planning for Bushfire Protection* (PBP) (RFS 2019) (refer to Section 6.11).
A water use approval under Section 89, a water management work approval under Section 90 or an activity approval (other than an aquifer interference approval) under Section 91 of the *Water Management Act 2000*	Works near or within watercourses within the study area will be required as part of the project and will be carried out in generally accordance with *Guidelines for Controlled Activities on Waterfront Land* (NRAR 2018).

4.5 Pre-conditions to approvals

Pre-conditions for the consent authority in exercising the power to grant approval for the project are provided in Table 4.2.

Table 4.2 Pre-conditions to being able to grant approval for the project

Statutory reference	Pre-condition	Relevance	Section in EIS
State Environmental Planning Policy (Resilience and Hazards) 2021, Section 4.6(1) (contamination and remediation to be considered in determining development application)	A consent authority must not consent to the carrying out of any development on land unless: (a) it has considered whether the land is contaminated, and (b) if the land is contaminated, it is satisfied that the land is suitable in its contaminated state (or will be suitable, after remediation) for the purpose for which the development is proposed to be carried out, and (c) if the land requires remediation to be made suitable for the purpose for which the development is proposed to be carried out, it is satisfied that the land will be remediated before the land is used for that purpose.	The project involves a change of use from agricultural use (grazing) to electrical generating works. Agricultural activities have occurred on and near the development footprint; however, no potentially contaminative locations have been identified to date. An assessment of land use and soils has been conducted as part of the EIS.	Section 6.6 and Appendix J
State Environmental Planning Policy (Transport and Infrastructure) 2021, Section 2.118 (development with frontage to classified road)	The consent authority must not grant consent to development on land that has a frontage to a classified road unless it is satisfied that: (a) where practicable and safe, vehicular access to the land is provided by a road other than the classified road, and (b) the safety, efficiency and ongoing operation of the classified road will not be adversely affected by the development as a result of – (i) the design of the vehicular access to the land, or – (ii) the emission of smoke or dust from the development, or – (iii) the nature, volume or frequency of vehicles using the classified road to gain access to the land, and (c) the development is of a type that is not sensitive to traffic noise or vehicle emissions, or is appropriately located and designed, or includes measures, to ameliorate potential traffic noise or vehicle emissions within the site of the development arising from the adjacent classified road.	The closest classified road to the study area is the Castlereagh Highway, which is approximately 1.3 km west of the study area at its closest point. Upgrades to Barneys Reef Road, which connects to the Castlereagh Highway, will be required as part of the project; however, these upgrades are not expected to impact the safety, efficiency and ongoing operation of the Castlereagh Highway. Project-related vehicle movements on the Castlereagh Highway during construction and operation have been considered as part of the TIA (Appendix H).	Section 6.4

Table 4.2 Pre-conditions to being able to grant approval for the project

Statutory reference	Pre-condition	Relevance	Section in EIS
Mid-Western Regional LEP, Clause 4.1E (Subdivision on land in Zone RU1 for non-agricultural land uses)	(3) Development consent must not be granted for the subdivision of land in Zone RU1 Primary Production unless the consent authority is satisfied that— (a) the subdivision will not adversely affect the use of the surrounding land for agriculture, and (b) the subdivision is necessary for the ongoing operation of the permissible use, and (c) the subdivision will not increase rural land use conflict in the locality, and (d) the subdivision is appropriate having regard to the natural and physical constraints affecting the land.	The land on which the onsite substation is constructed is likely to require subdivision. At the end of the operational life of the grid substation, the infrastructure on the subdivided lot will be decommissioned and the lot will be reconsolidated back into the residual lot. The subdivision of the lot(s) that is selected for the onsite substation from may result in a lot size that is less than the minimum lot size under the Mid-Western Regional LEP. Notwithstanding, in accordance with the provisions of Section 4.38 of the EP&A Act, the proposed subdivision will be permissible subject to the approval of the Minister for Planning or their delegate.	Section 4.5
Mid-Western Regional LEP, Clause 6.4 (Groundwater vulnerability)	(4) Development consent must not be granted to development on land to which this clause applies unless the consent authority is satisfied that— (a) the development is designed, sited and will be managed to avoid any significant adverse environmental impact, or (b) if that impact cannot be reasonably avoided—the development is designed, sited and will be managed to minimise that impact, or (c) if that impact cannot be minimised—the development will be managed to mitigate that impact.	Part of the study area is identified as 'groundwater vulnerable' on the Mid-Western Region LEP Groundwater vulnerability map. However, groundwater is not anticipated to be impacted by the project.	Section 6.9 and Appendix N
Mid-Western Regional LEP, Clause 6.5 (Terrestrial biodiversity)	(4) Development consent must not be granted to development on land to which this clause applies (ie land identified as Moderate or High Biodiversity Sensitivity) unless the consent authority is satisfied that— (a) the development is designed, sited and will be managed to avoid any significant adverse environmental impact, or (b) if that impact cannot be reasonably avoided by adopting feasible alternatives—the development is designed, sited and will be managed to minimise that impact, or (c) if that impact cannot be minimised—the development will be managed to mitigate that impact.	A small area of Barneys Reef Road, which is proposed to be upgraded for project access, is identified as 'high biodiversity sensitivity' on the Mid-Western Regional LEP. Potential impacts to biodiversity have been assessed as part of the BDAR for the project.	Section 6.2 and Appendix F

Table 4.2 Pre-conditions to being able to grant approval for the project

Statutory reference	Pre-condition	Relevance	Section in EIS
Mid-Western Regional LEP, Clause 6.9 (Essential services)	Development consent must not be granted to development unless the consent authority is satisfied that any of the following services that are essential for the proposed development are available or that adequate arrangements have been made to make them available when required— (a) the supply of water, (b) the supply of electricity, (c) the disposal and management of sewage, (d) stormwater drainage or on-site conservation, (e) suitable road access.	Essential services have been considered for the project and are described in Chapter 3 of this EIS.	Chapter 3
Warrumbungle LEP, Clause 6.3 (Terrestrial biodiversity)	(4) Development consent must not be granted to development on land to which this clause applies (ie land identified as 'biodiversity' on the terrestrial biodiversity map) unless the consent authority is satisfied that— (a) the development is designed, sited and will be managed to avoid any significant adverse environmental impact, or (b) if that impact cannot be reasonably avoided by adopting feasible alternatives—the development is designed, sited and will be managed to minimise that impact, or (c) if that impact cannot be minimised—the development will be managed to mitigate that impact.	A small area of Barneys Reef Road, which is proposed to be upgraded for project access, is identified as 'biodiversity' on terrestrial biodiversity mapping under the Warrumbungle LEP. Potential impacts to biodiversity have been assessed as part of the BDAR for the project.	Section 6.2 and Appendix F

4.6 Mandatory considerations

The mandatory conditions that must be satisfied before the consent authority may grant approval for the project are listed in Table 4.3.

Table 4.3 Mandatory considerations for the project

Statutory document	Section reference	Mandatory consideration	Section in EIS
Considerations under the EP&A Act and EP&A Regulation			
NSW *Environmental Planning and Assessment Act 1979*	Section 1.3	Relevant objects of the Act	Section 7.4
	Section 4.15(1)	Matters for consideration – general In determining a development application, a consent authority is to take into consideration such of the following matters as are of relevance to the development the subject of the development application:	
		(a) the provisions of— (i) any relevant environmental planning instruments, and … (iv) the regulations (to the extent that they prescribe matters for the purposes of this paragraph), That apply to the land to which the development application relates.	See below
		(b) the likely impacts of that development, including environmental impacts on both the natural and built environments, and social and economic impacts in the locality.	Chapter 6
		(c) the suitability of the site for the development.	Section 2.2
		(e) the public interest.	Chapter 7
Environmental Planning and Assessment Regulation 2021	Section 24	(1) A development application must— (a) be in the approved form, and (b) contain all of the information and documents required by: (i) the approved form, and (ii) the Act of this Regulation, and (c) be submitted on the NSW planning portal.	The EIS will be submitted via the NSW planning portal and has been prepared in the approved form.
	Section 190	(1) An environmental impact statement must contain the following information –	
		(a) the name, address and professional qualifications of the person who prepared the statement,	Certification page
		(b) the name and address of the responsible person,	Table 1.1
		(c) the address of the land— (i) to which the development application relates, or (ii) on which the activity or infrastructure to which the statement relates will be carried out,	Table 3.1
		(d) a description of the development, activity or infrastructure,	Chapter 3
		(e) an assessment by the person who prepared the statement of the environmental impact of the development, activity or infrastructure, dealing with the matters referred to in this Division.	This table
		(2) The person preparing the statement must have regard to—	

Table 4.3 Mandatory considerations for the project

Statutory document	Section reference	Mandatory consideration	Section in EIS
		(a) for State significant development—the *State Significant Development Guidelines*	The EIS has been prepared in accordance with the *State significant development guidelines – preparing an environmental impact statement* (DPIE 2021a).
		(3) An environmental impact statement must also contain a declaration by the person who prepared the statement of the following—	
		(a) the statement has been prepared in accordance with this Division, and	Certification page
		(b) the statement contains all available information that is relevant to the environmental assessment of the development, activity or infrastructure, and	
		(c) the information contained in the statement is not false or misleading.	
	Section 192	(1) An environmental impact statement must contain the following –	
		(a) a summary of the environmental impact statement,	Executive summary
		(b) a statement of the objectives of the development, activity or infrastructure,	Section 2.1
		(c) an analysis of feasible alternatives to the carrying out of the development, activity or infrastructure, considering its objectives, including the consequences of not carrying out the development, activity or infrastructure,	Section 2.5
		(d) an analysis of the development, activity or infrastructure, including—	
		(i) a full description of the development, activity or infrastructure, and	Chapter 3
		(ii) a general description of the environment likely to be affected by the development, activity or infrastructure and a detailed description of the aspects of the environment that are likely to be significantly affected, and	Section 2.3 Chapter 6
		(iii) the likely impact on the environment of the development, activity or infrastructure, and	Chapter 6 and Appendix F to Appendix Q
		(iv) a full description of the measures to mitigate adverse effects of the development, activity or infrastructure on the environment, and	Appendix E
		(v) a list of the approvals that must be obtained under another Act or law before the development, activity or infrastructure may lawfully be carried out,	Table 4.1
		(e) a compilation, in a single section of the environmental impact statement, of the measures referred to in paragraph (d)(iv),	Appendix E

Table 4.3 Mandatory considerations for the project

Statutory document	Section reference	Mandatory consideration	Section in EIS
		(f) the reasons justifying the carrying out of the development, activity or infrastructure, considering biophysical, economic and social factors, including the principles of ecologically sustainable development set out in Section 193.	Chapter 7
Mandatory relevant considerations under EPIs			
State Environmental Planning Policy (Transport and Infrastructure) 2021	Part 2.3, Division 17, Section 2.121	(4) Before determining a development application for development to which this section applies, the consent authority must: … (b) take into consideration: (ii) the accessibility of the site concerned, including— (A) the efficiency of movement of people and freight to and from the site and the extent of multi-purpose trips, and (B) the potential to minimise the need for travel by car and to maximise movement of freight in containers or bulk freight by rail, and (iii) any potential traffic safety, road congestion or parking implications of the development.	Section 6.6 and Appendix F
State Environmental Planning Policy (Resilience and Hazards) 2021	Part 3.7	In determining whether a development is— (a) a hazardous storage establishment, hazardous industry or other potentially hazardous industry, or (b) an offensive storage establishment, offensive industry or other potentially offensive industry, consideration must be given to current circulars or guidelines published by the Department of Planning relating to hazardous or offensive development.	Section 6.6 and Appendix J
Mid-Western Regional Local Environmental Plan 2012	Clause 2.3(2)	The consent authority must have regard to the objectives for development in a zone when determining a development application in respect of land within the zone.	Section 2.2
	Clause 6.3 Earthworks	(3) Before granting development consent for earthworks, the consent authority must consider the following matters— (a) the likely disruption of, or any detrimental effect on, existing drainage patterns and soil stability in the locality, (b) the effect of the proposed development on the likely future use or redevelopment of the land, (c) the quality of the fill or of the soil to be excavated, or both, (d) the effect of the proposed development on the existing and likely amenity of adjoining properties, (e) the source of any fill material or the destination of any excavated material, (f) the likelihood of disturbing Aboriginal objects or other relics, (g) proximity to and potential for adverse impacts on any watercourse, drinking water catchment or environmentally sensitive area.	Chapter 6

Table 4.3 Mandatory considerations for the project

Statutory document	Section reference	Mandatory consideration	Section in EIS
Warrumbungle Local Environmental Plan 2013	Clause 2.3(2)	The consent authority must have regard to the objectives for development in a zone when determining a development application in respect of land within the zone.	The only land within the Warrumbungle Shire LGA that will be impacted by the project is adjacent to the existing road corridor of Barneys Reef Road (refer to Figure 3.2).
	Clause 6.1 Earthworks	(3) Before granting development consent for earthworks (or for development involving ancillary earthworks), the consent authority must consider the following matters— (a) the likely disruption of, or any detrimental effect on, drainage patterns and soil stability in the locality of the development, (b) the effect of the development on the likely future use or redevelopment of the land, (c) the quality of the fill or the soil to be excavated, or both, (d) the effect of the development on the existing and likely amenity of adjoining properties, (e) the source of any fill material and the destination of any excavated material, (f) the likelihood of disturbing relics, (g) the proximity to, and potential for adverse impacts on, any waterway, drinking water catchment or environmentally sensitive area, (h) any appropriate measures proposed to avoid, minimise or mitigate the impacts of the development.	Chapter 6
Considerations under other legislation			
NSW *Biodiversity Conservation Act 2016*	Section 7.14	(2) The Minister for Planning, when determining in accordance with the NSW *Environmental Planning and Assessment Act 1979* any such application, is to take into consideration under that Act the likely impact of the proposed development on biodiversity values as assessed in the biodiversity development assessment report. The Minister for Planning may (but is not required to) further consider under that Act the likely impact of the proposed development on biodiversity values.	Section 6.2 and Appendix F

5 Engagement

5.1 Introduction

ACEN has been consulting with stakeholders and building a local presence in the region since 2018, using a range of engagement mechanisms to consult with local landholders, neighbouring property owners, Warrumbungle Shire Council, Mid-Western Regional Council, community groups and local service providers.

This chapter provides an overview of the communication and engagement activities carried out before and during the preparation of this EIS, as well as proposed future engagement activities. It also summarises the community views in relation to the project, as understood by the data and information gathered from the consultation undertaken. In doing so, this chapter demonstrates compliance with the consultation requirements set out in the *Undertaking Engagement Guidelines for State Significant Projects November 2021* (SSD Engagement Guidelines 2021) (DPIE 2021b).

This chapter discusses community engagement, where 'community' is defined in accordance with the SSD Engagement Guidelines (DPIE 2021b) as:

> the people and groups that are interested in, or affected by a State significant project, such as local residents, community groups, Aboriginal and Torres Strait Islander communities, culturally and linguistically diverse communities, peak bodies, and businesses

Further details on the issues raised by the community during engagement for the project, and where these issues have been addressed in the EIS, is provided in Appendix D.

5.2 Regulatory requirements

Engagement has been undertaken by ACEN in accordance with the requirements of the SSD Engagement Guidelines 2021 and the project SEARs. Table 5.1 demonstrates engagement was consistent with the community participation objectives in the SSD Engagement Guidelines.

In addition to the EIS consultation undertaken by ACEN, EMM has undertaken consultation specifically to inform the Socio-economic Impact Assessment (SIA). SIA consultation has been undertaken in accordance with the DPE's *Social Impact Assessment Guideline for State Significant Projects* (SIA Guideline 2021) (DPIE 2021c); and the *Technical Supplement: Social Impact Assessment Guideline for State significant Projects* (SIA Technical Supplement 2021) (DPIE 2021d). A full description of the SIA engagement program is provided in the SIA (refer to Appendix O).

Table 5.1 Compliance with community participation objectives

Community participation objectives	Compliance
Identify the people or groups who are interested in or are likely to be affected by the project.	Interested and affected parties for the project are summarised in Section 5.3.3.
Use appropriate engagement techniques. This is particularly important when engaging with specific groups, such as Aboriginal and Torres Strait Islander groups, where engagement should be a discrete, planned activity undertaken by and with experienced Indigenous engagement specialist.	A number of different and complementary engagement techniques were adopted for the EIS consultation program as discussed in Section 5.3 and Table 5.6 and Table 5.7. Table 5.7 provides a summary of engagement with Aboriginal and Torres Strait Islander individuals and groups for the purpose of the Aboriginal cultural heritage assessment.
Ensure the community are provided with safe, respectful and inclusive opportunities to express their views.	A number of different and complementary engagement techniques were adopted for the EIS consultation program as discussed in Section 5.3.4 and Table 5.6 and Table 5.7.
Involve the community, councils and government agencies early in the development of the proposal, to enable their views to be considered in project planning and design.	ACEN has been building a local presence in the region since 2018 using a range of engagement mechanisms to consult with local landholders, neighbouring property owners, Warrumbungle Shire Council (WSC), Mid-Western Regional Council (MWRC), community groups and local service providers. Section 5.3.4 and Table 5.6 and Table 5.7 describe how the community and other stakeholders have been involved in the EIS engagement process.
Be innovative in their engagement approach and tailor engagement activities to suit the context, scale and nature of the project.	A number of different and complementary engagement techniques were adopted for the EIS consultation program as discussed in Section 5.3 and Table 5.6 and Table 5.7. The SIA field study program (Appendix O – SIA of EIS) engagement process was amended in response to cited consultation fatigue and feedback from near neighbours.
Provide clear and concise information about what is proposed and the likely impacts for the relevant people or group they are engaging with.	The project description is provided in Chapter 3, and a summary of impacts in Chapter 6. A number of community information sessions were held for the project by ACEN, in which information on the project was provided to the community.
Clearly outline how and when the community can be involved in the process.	As described in Section 5.3.4, a website, email address, and telephone hotline was established for the project. In addition to providing regular updates on the project and links to key project documents, the website details opportunities for participation. Section 5.3 describes the various methods ACEN has adopted to keep the community informed of opportunities for participation in the EIS process. Section 5.5 describes how ACEN proposes to engage with the community as the project progresses.
Make it easy for the community to access information and provide feedback.	Section 5.3.6 describes the various tools used to provide the community an opportunity to provide feedback.
Seek to understand issues of concern for all affected people and groups and respond appropriately to those concerns.	Section 5.5.2 outlines the complaints and grievances management plan that will be developed and implemented for the project and provisions of timely information to communities.
Provide feedback about how community and stakeholder views were used to shape the project or considered in making decisions.	Chapter 2 describes how feedback from community engagement was considered in the project design and project refinement.
Be able to demonstrate how the demography of the area affected has been considered in how and what engagement activities have been undertaken.	The SIA social baseline (Appendix O) informed the development of the SIA field study program and targeted engagement with stakeholders (ie social housing providers, short-term accommodation providers, health care providers). The EIS consultation program leveraged off regional events (eg agricultural shows) occurring in the local area to enable access to the broader community and in particular rural landholders.

5.3 Consultation approach

5.3.1 Community engagement plan

To assist ACEN in delivering meaningful engagement that considered the needs of all stakeholders, ACEN and EMM prepared a strategic Community Engagement Plan (engagement plan). The engagement plan was prepared in accordance with the SSD Engagement Guidelines, which incorporates the adoption of best practice objectives for community participation in state significant projects: that it should be open and inclusive; easy to access; relevant; timely; and meaningful.

The engagement plan identified objectives for the engagement process; project stakeholders; and established communication channels, tools and activities for the duration of the project's planning and approvals process.

5.3.2 Communication and engagement objectives

The communication and stakeholder engagement objectives for the project, as described in the engagement plan are to:

- build high levels of key stakeholder awareness, understanding and acceptance of the project purpose, scope, timeframes and outcomes;
- ensure there is consistent and accurate project information in the public domain; and
- collect representative key stakeholder and community inputs about existing and potential future risks, impacts, and benefits associated with the project.

5.3.3 Key stakeholders

ACEN has developed an extensive and comprehensive stakeholder list of organisations and individuals, with stakeholders categorised into sub-groups based on organisation or individual type. Key stakeholders have been identified and grouped based on organisation type, individual interest or interaction with the project. Identified project stakeholders have been assessed and classified according to the anticipated levels of project impacts and their levels of interest and potential influence on project delivery outcomes.

Table 5.2 outlines the assessment criteria and categories. Table 5.3 provides an overview of key stakeholders and their level of engagement, based on the International Association of Public Participation Spectrum.

Table 5.2 Stakeholder assessment and classification criteria and levels

Details	Level 1	Level 2	Level 3	Level 4
Project impacts on the stakeholder	High impact	Low impact	High impact	Low impact
Stakeholder levels of interest/influence on project decision-making/ outcomes	High interest/influence	High interest/influence	Low/medium interest/ influence	Low interest/influence

Table 5.3 Project stakeholder list and engagement level

Classification	Stakeholder group	Stakeholder name	IAP2 Spectrum Level of Engagement
1	Federal regulatory authorities	• Department of Climate Change, Energy, the Environment and Water (DCCEEW) • Australian Renewable Energy Agency (ARENA)	Inform Consult
1	State regulatory authorities	• DPE • DPE – Biodiversity and Conservation Division (BCD) • Transport for NSW (TfNSW) • Heritage NSW	Inform Consult
2	State regulatory authorities	• DPE Water and Natural Resources Access Regulator (NRAR) • Energy Corporation of NSW • Environment Protection Authority (EPA) • Department of Primary Industries • Crown Lands • Central West Local Land Services • Rural Fire Service • Fire and Rescue NSW • Water NSW • Western NSW Local Health District (LHD) • SafeWork NSW	Inform Consult
1	Local	• Warrumbungle Shire Council • Mid-Western Regional Council	Inform Consult
2	Elected representatives	• Federal: – Hon Andrew Gee MP, Member for Calare, NSW – Hon Mark Coulton MP, Member for Parkes, NSW – Hon Catherine King MP, Minister for Infrastructure, Transport, Regional Development and Local Government	Inform
3		• State: – Mr Dugald Saunders, MP Member for Dubbo – Mr Roy Butler, MP Member for Barwon	Inform
3		• Local: – Cr Des Kennedy, Mayor Mid-Western Regional Council • Mayor Ambrose Doolan, Warrumbungle Shire Council	Inform Consult
1	Landholders associated with the project	• Associated landowners	Inform Consult Collaborate
1	Landowners/businesses not associated with the project, but potentially directly impacted	• There are four associated residences within or in close proximity to the study area (A2, A4, A6 and A8). • There are 21 non-associated residences within 2 km of the study area, many of them in the township of Birriwa, and another 22 non-associated residences between 2 km and 5 km from the study area. • Residents of Birriwa.	Inform Consult Collaborate

Table 5.3 Project stakeholder list and engagement level

Classification	Stakeholder group	Stakeholder name	IAP2 Spectrum Level of Engagement
3	Landowners/businesses not associated with the project, but potentially indirectly impacted	• Residents of Dunedoo and Gulgong • Road users of Castlereagh Highway/Birriwa Bus Route South/ Barneys Reef Road • Road users of Golden Highway/Merotherie Road/ Birriwa Bus Route South	Inform
2	Local Aboriginal groups/ people	• Local Aboriginal Land Council • Registered Aboriginal Parties	Inform Consult Collaborate
4	Broader community	• Dunedoo, Gulgong and Mudgee business operators including: – short-term accommodation providers; – real-estate agents; and – employment and training organisations.	Inform
3	Community service providers	• Western NSW Local Health District (LHD) operations: – Dunedoo and Gulgong Multipurpose Health Services (MHSs) – Mudgee hospital and health service • TAFE Dunedoo, Gulgong and Mudgee • Social housing providers • NSW Police service operations in Mudgee, Gulgong and Dunedoo • Cudgegong Rural Fire Service (RFS)	Inform Consult
3	Interest groups	• Central West Cycle Trail Inc (CWC Trail Inc) • Dunedoo District Development Group	Inform Consult
4	Transport user groups	• Odgen Coaches • Eastend Bus Services • Hodgens Bus Service	Inform Consult
1	Utility providers	TransGrid/Energy Corporation of NSW	Inform Consult
3	Local media	• Gulgong Gossip • Mudgee Guardian • Dunedoo District Diary • 3 Rivers Community Radio Station Dunedoo, Coolah Mendooran 96.1 and 95.3 • ABC Central West radio	Inform

5.3.4 Engagement Tools

The engagement process was designed to be inclusive, transparent, structured and meaningful for the local community and broader stakeholders. It included a variety of communication tools and activities to promote awareness of the project, provide information and encourage feedback. Examples of project communication materials can be found in Table 5.4.

Multiple and diverse opportunities to engage and provide feedback were incorporated in the EIS engagement program, including community information sessions, and traditional communication channels like letters, project updates and a project phone line and project office. This approach encouraged the representation of diverse stakeholder groups and age demographics within the consultation process.

Table 5.4 presents a summary of the communication and engagement tools utilised.

Table 5.4 Summary of key engagement tools

	Tool	Description	Timing	Target Stakeholder Groups
	Project website	Provides regular updates on the project, links to key project documents, and details opportunities for participation. The project website can be accessed via the following link: https://birriwasolarfarm.com.au This page also includes a query/feedback form.	Ongoing	All stakeholders
	Project email address	A dedicated project email address – info@birriwasolarfarm.com.au – answers queries from residences and stakeholders. Five emails have been received from the community about the project. The project email address has been promoted on all community notifications and advertising.	Ongoing	All stakeholders
	Community information line	Provides an avenue for the community to enquire about the project or provide feedback. Email: info@birriwasolarfarm.com.au Community information line: 1800 290 995	Ongoing	All stakeholders
	Project office	Provides a centralised location for the community and stakeholders to access project information and meet with the project team. The project office in Gulgong at the following address and is staffed Tuesday–Thursday 9.00 am to 5.00 pm. Address: 79B Herbert Street, Gulgong NSW 2852	Ongoing, open to the community	All stakeholders
	Project social media pages	Provides regular updates on the project, links to key project documents, and details opportunities for participation. The project Facebook can be accessed via the following link: https://www.facebook.com/BirriwaSolarFarm	Ongoing	All stakeholders
	Face-to-face meetings	Provides an opportunity for all stakeholders to meet with the project team to express feedback or concerns and receive updates on the project.	August 2021 and ongoing	Associated and non-associated landowners
	In-depth SIA interviews	Used to gather information on community values, strengths and vulnerabilities and determine the potential impacts on those directly affected by the Project. The in-depth interviews were undertaken over the telephone, teleconferences and video conference.	March to May 2022	Associated and non-associated landowners, business, community service providers, interest groups, transport user groups

Table 5.4 Summary of key engagement tools

	Tool	Description	Timing	Target Stakeholder Groups
	Surveys	Used to gather information regarding short-term accommodation provision and housing market conditions within communities of the local area. The survey was administered in person and over the telephone.	March to April 2022	Broader community: short-term accommodation providers, real estate agents
	Community Information Sessions and drop-in sessions	A drop-in session where community members and stakeholders can ask questions and/or provide verbal or written feedback to members of the project team.	November and December 2021 and June 2022	All stakeholders
	Project fact sheet	Provide key information on the project and upcoming activities. A project update and letters were delivered via letter box drop to the local community and published on the project website.	November 2021 and updated June 2022	All stakeholders with strong focus on residents with 5 km of the study area
	Presentations and briefings	Used to keep identified stakeholders updated on specific events and activities tailored to the stakeholder group being consulted.	Ongoing	Associated and non-associated landowners, community service providers, special interest groups
	Media advertising	ACEN has utilised media including print and online journalism and paid advertisements, television and radio to advertise project related community events.	Ongoing	All stakeholders, local and regional community
	Project email mailing list	An avenue for community members to subscribe to receive regular project updates. Registration link: https://birriwasolarfarm.com.au/contact-us-or-register-for-updates/	Ongoing	All stakeholders, local and regional community
	Procurement and employment register	Allows registration of interest for employment opportunities during all phases of the project. Registration link: https://birriwasolarfarm.com.au/contact-us-or-register-for-updates/	Ongoing	All stakeholders, local and regional community, employment agencies, contractors, local businesses
	Local events	ACEN had a stall at the Dunedoo Show and the Gulgong Show in February 2022. ACEN sponsored local events such as the Henry Lawson Festival in Gulgong in June 2022.	Ongoing	All stakeholders, local and regional community

5.3.5 Early project communication and engagement

i Overview

ACEN recognises the importance of stakeholder engagement to the success of the project. Consultation and engagement with affected parties, stakeholders, and the broader community has been an integral part of the development of the project as well as informing the scoping of investigations for this EIS. ACEN has been building a local presence in the region since early 2018. At the stage of assessing the potential for a solar project in the area, ACEN undertook a large number of one-on-one meetings with local landholders, including landowners associated with the project and neighbouring property owners. ACEN also facilitated a group meeting with broad landholder participation prior to commencing detailed land security negotiations. In 2021, engagement with neighbouring landholders intensified in the lead up to preparation of the Scoping Report.

In addition, ACEN has undertaken targeted engagement with Mid-Western Regional Council, Warrumbungle Shire Council, local State MPs, community groups and local service providers over the past three years. ACEN's engagement principles of adopting a model of consulting early and often, with a view of minimising surprises for the community and stakeholders, aligns with the *Undertaking Engagement Guidelines for State Significant Project* (DPE 2021b).

ii Engagement activities

In September 2021, ACEN published a project website (www.birriwasolarfarm.com.au), Facebook page, dedicated email address (info@birriwasolarfarm.com.au) and project hotline (1800 290 995). ACEN also made targeted phone calls and posted a letter and project fact sheet to the following sensitive receptors:

- all landholders within 2 km of the study area boundary; and
- all dwellings within 5 km of the study area boundary.

The letters identified the likely impacts as assessed by ACEN, including the proximity to the site and whether or not a visual impact was likely to occur. The project fact sheet provided key project facts and directed stakeholders to the project website. Further, the letters were signed by an ACEN representative and contained their mobile number and email address and encouraged people to get in touch.

The responses received from early community engagement are summarised as follows:

- Two neighbouring landowners expressed concern over the change to the landscape, the visual impact and the cumulative effect of multiple projects in the area.
- One neighbouring landowner enquired about decommissioning, the connection to the CWO REZ Network Infrastructure and ACEN's ownership structure and intentions to sell the project. Concerns regarding visual impact and property devaluation were also flagged. ACEN noted the challenges associated with the connection and provided further information to the community member on the ACEN joint venture and a Fact Sheet on the project.
- Two members of the Birriwa community indicated their support for the project.
- Dugald Saunders – Member of Parliament for Dubbo noted that there are many projects in the area and enquired whether ACEN would be considering a Community Benefit Sharing mechanism.

5.3.6 EIS Engagement

i Government and other agencies

The stakeholder engagement process targeting government agencies commenced in August 2021 with briefing meetings held as detailed in Table 5.5.

Table 5.5 Summary of early stakeholder engagement activities with government agencies

Stakeholder group	Engagement type	Key outcomes
Mid-Western Regional Council	Virtual meeting on 5 August 2021	ACEN provided a presentation of the proposed project, including indicative development footprint, timeframes and general strategy. No specific issues were raised at this time. ACEN committed to ongoing consultation with Council.
DPE	Virtual meeting on 9 September 2021 and a follow up virtual meeting on 13 September 2021	ACEN and EMM provided a presentation of the proposed development to DPE and enquired whether there were any specific requirements to be considered prior to lodgement of the Scoping Report. DPE noted specific items to be addressed, including the importance of cumulative impacts in relation to traffic and other elements, visual and landscape impacts. DPE requested that consultation with the Biodiversity Conservation Division of DPE and Warrumbungle Council should occur prior to lodgement of the Scoping Report.
Warrumbungle Shire Council	Virtual meeting on 15 September 2021	ACEN provided a general project presentation, including project schedule, issues to be assessed in the EIS, access via Warrumbungle public roads, community engagement and next steps. Some key aspects raised by Council comprised: • access via Barneys Reef Road (800 m within the Warrumbungle Shire Council LGA); • accommodation capacity/cumulative impacts with other projects; and • community engagement. ACEN provided a commitment to on-going consultation with Council, especially in relation to access route and community engagement.
DPE – Biodiversity Conservation Division	Virtual meeting on 17 September 2021 and follow up email	ACEN and EMM provided an overview of the proposed project. The method of assessment for the biodiversity study was discussed, particularly in relation to Category 1 land, the timing of surveys, potential for an EPBC Act referral and flood assessment approach. The Biodiversity Conservation Division noted that ongoing discussions with them is the preferred approach to confirming methodology for the EIS where there is any uncertainty.

ii Consultation participation summary

ACEN has actively engaged with landholders throughout the preparation of the EIS, which has involved consulting with all neighbouring landholders, both associated and non-associated. A summary of participation in the EIS consultation program and key issues raised is presented in Table 5.6. These issues were incorporated into the project refinements and technical assessment scoping as discussed in Section 2.5.4.

Table 5.6 EIS engagement participation by key activity

Method	Format	Timeframe	Target audience	Participated
Drop-in occasional session	Face-to-face at the project office in Gulgong.	Throughout EIS preparation	All interested and potentially affected stakeholders	Numerous conversations with stakeholders who dropped in to discuss the project.
One-on-one meetings	Face-to-face engagement with the project team, teleconference and phone calls, and follow up letters, emails.	Throughout EIS preparation	Associated and non-associated landowners	Numerous meetings with associated and non-associated landowners.
			Special interest groups	Several meetings with representatives of the CWC Trail Inc.
			Broader community	Numerous meetings with residents of Birriwa township as well as key representatives from Mid-Western regional council and several meetings with key representatives of Warrumbungle Shire Council.
Community drop-in session	Face-to-face at the project office in Gulgong. Drop-in session was advertised via radio (Magic 87.6 Radio), posters distributed in the community, social media, website promotion and word of mouth.	9–11 November 2021	All interested and affected stakeholders	21 attendees
Community drop-in open day session	Face to face drop-in session held at the Dunedoo Bowling Club. Open day advertised via radio coverage, social media and local paper coverage (front page).	8 December 2021	Birriwa and Dunedoo community members	14 attendees
Community information stall at Dunedoo Show	Face-to-face engagement with the project team. The stall was advertised via local radio (3 Rivers Community Radio); social media, website, poster advertised in store fronts in Dunedoo and word of mouth.	12 February 2022	All interested and affected stakeholders	25 attendees
Community information stall at Gulgong Show	Face-to-face engagement with the project team. The stall was advertised via local radio; social media, project website, posters advertised in Gulgong store fronts and word of mouth.	19 February 2022	All interested and affected stakeholders	20 attendees

Table 5.6 EIS engagement participation by key activity

Method	Format	Timeframe	Target audience	Participated
SIA in-depth interviews	Videoconference and teleconference	18 March 2022 – 19 May 2022	Non-associated landowners	7 non-associated landowners
			Associated landowners	2 associated landowners
			Local government	1 local government representative
			Service providers and community organisations contacted	14 participants
Real-estate agent and short-term accommodation providers interviews	Face-to-face and teleconference	March–April 2022	Real estate agents and short-term accommodation providers across the locations of Dunedoo, Gulgong, Mudgee and Wellington	13 real estate agents 23 short-term accommodation providers
Community drop-in session	Face-to-face at the project office in Gulgong. Drop-in session was advertised via radio (Magic 87.6 Radio), posters distributed in the community, social media, website promotion and word of mouth.	15 June 2022	All interested and affected stakeholders	1 attendee
Community drop-in session	Face to face drop-in session held at the Dunedoo Bowling Club. Open day advertised via radio coverage, social media and local paper coverage.	16 June 2022	All interested and affected stakeholders	7 attendees

iii Summary of engagement

A summary of the engagement undertaken during the preparation of the EIS is provided in Table 5.7.

Table 5.7 Engagement conducted to date

Stakeholder	Methods of engagement	Summary of engagement
Associated landowners	Face to face meetings (where possible) Phone calls and follow up emails	ACEN has engaged with associated landowners and a number of the near-neighbours since 2018. Early engagement activities included face to face meetings and a group meeting. ACEN has been in regular contact with associated landowners since August 2021 to date and ongoing. The engagement is undertaken through a combination of face-to-face discussions, telephone discussions and written (email or letter) communities. Engagement has involved discussion on a number of different themes including site access, consultation process and assessment process, traffic and transport, livestock and farming, renewable energy industry, management of potential noise, location of substation and BESS location and visual impacts, impacts to property prices and impacts to community groups such as the CWCT group, social fabric and community cohesion, hazards and safety, community benefit sharing and investment, compensation, updates on project progress and schedule and CWO REZ progress and cumulative impacts. In May 2022, EMM conducted telephone and video meetings with [two] associated landowners as part of the socio-economic impact assessment
Non-associated landowners	Face to face meetings (where possible) Phone calls and follow up emails	ACEN has also engaged with several of the near neighbours who ultimately decided not to become associated with the project in 2018. The engagement with the remaining non-associated landowners/tenants commenced in August 2021 once the project development footprint was more narrowly defined and is ongoing. ACEN conducted a letterbox drop of all landowners within an approximate 5 km radius of the study area in September 2021. Letters also included reference to the project website and hotline, and contact details for the relevant landholder liaison and a fact sheet was annexed to the letter which gave an overview of the project, the company and the development process. The key objectives were to introduce the project, introduce ACEN, seek permission for photographs to be taken from the neighbouring properties as part of the visual impact assessment and discuss any concerns. Follow up emails were sent in September 2021 and face to face meetings were held in compliance with local COVID-19 restrictions at the time with three neighbouring landowner/tenants to further discuss the project. Key themes raised with non-associated landholders include social fabric and community cohesion, hazards and safety, traffic and transport, workforce accommodation, livestock and farming and employment opportunities, procurement/local business participation and Aboriginal heritage. These impacts and opportunities are summarised in Table 5.8 and in Appendix D. In April and May 2022, EMM conducted telephone and video meetings with [seven] non-associated landowners or tenants in the immediate vicinity of the project as part of the socio-economic impact assessment. During consultation, particularly consultation to inform the socioeconomic impact, non-associated landowners identified a range of potential project impacts and opportunities. These impacts and opportunities are summarised in Table 5.8 and in Appendix D as well as discussed further in the SIA (Appendix O).

Table 5.7 Engagement conducted to date

Stakeholder	Methods of engagement	Summary of engagement
Broader community	Email Website Project updates Project Office Face to face Radio advertisements Phone calls and follow up emails	ACEN has engaged with the broader community since November 2021. ACEN had the following face to face meetings with the broader community: • In November 2021 a three-day drop-in session opened to the public to introduce the Project. The event was promoted through all media formats, socials, radio, newspaper, posters, word of mouth. 20 people came into enquire about the Stubbo and Birriwa Solar projects. • In December 2021, a drop-in session for the Project was held at Dunedoo Bowling club. Nine people attended. The event was promoted through radio, socials, newspapers, posters, and word of mouth. Themes discussed included: development site, cultural and historical interest in the Birriwa district. • In February 2022, an information stall held at the Gulgong Society Show and an information stall held at the Dunedoo Society Show. Approximately 45 people approached the stall display for more information. Themes discussed included proximity to properties, visual impacts and possible traffic and noise impacts during construction. • In June 2022, ACEN held two drop-in community information sessions. The sessions were open to the public and provided an opportunity to the meet the team to find out more about the project. Approximately eight people attended. The event was promoted through all media formats socials, radio, newspaper, posters, word of mouth.

Table 5.7 Engagement conducted to date

Stakeholder	Methods of engagement	Summary of engagement
Mid-Western Regional Council	Face to face meeting Phone calls and follow up emails	Council provided written advice to DPE in response to the Scoping Report. ACEN had the following face-to-face meetings with representatives of Council: • August 2021 to introduce the project, timeframes and proposed approvals strategy. • September 2021 to present the project, discussion around access routes, public roads within the Warrumbungle Shire Council LGA, community consultation, and other requirements of the SSD process. • October 2021 to provide a project update including informing MWRC of lodgement of the Scoping Report and meeting with the Development Control Engineer to discuss site access arrangements including route option selection and internal access track potions, council's expectations, and requirements. • November 2021 to hold a site visit to drove/walk along all proposed access route options including Blue Springs Road (located within Warrumbungle Shire Council LGA), Birriwa Bus Route North, Birriwa Bus Route South and their intersection with the Castlereagh Highway. • December 2021 to provide update on proposed access route and internal road access to the Solar Farm, including selection methodology, assessing all options, access road Birriwa Bus Route south, the CWCT and substation. • January 2022 to provide update on EIS preparation and development activities and request feedback on access options. • February 2022 to provide a general update on the project with a focus on access route via Barneys Reef Road within the Council area, as well as outcome of the community consultation, timeframes of development and EIS, in alignment with REZ development, cumulative impacts and access to the site. • In May 2022, to provide a project update to General Manager and Manager Economic Development officer on Neighbour benefit sharing and broader ACENs Central West Community Benefit Sharing scheme, and provided updates on timeframes and on consultation with EnergyCo. • In June 2022 to provide an update, and discuss with Council and the traffic committee the design of upgrades to Barneys Reef Road. Council confirmed agreement on a couple of matters relevant to the project, including: the speed limit for the construction period can be reduced to 80 km/h for regular traffic; construction traffic speed limit is expected to be set at 40 km/h as per the Traffic Management Plan (TMP) to be prepared prior to construction; the design considerations for public road crossings were supported for the project. • In July 2022 to provide a general update prior to lodgement of the EIS.

Table 5.7 Engagement conducted to date

Stakeholder	Methods of engagement	Summary of engagement
		ACEN has also had the following email correspondence with Council: • October 2021 to provide a project update following lodgement of the Scoping Report and follow up with the Development Control Engineer about site access arrangements including route option selection and internal access track portions, council's expectations, and requirements. • November 2021 to discuss to discuss site access arrangements, route option selection and internal access track portions. • February 2022 to follow up on site access and route options. • June 2022 on several occasions to discuss on road design and refinement. • November 2021 to advise of the project drop-in sessions at the Gulgong project office. • In April 2022, EMM conducted a video meeting with Council as part of the SIA.
Warrumbungle Shire Council	Face to face meeting Phone calls and follow up emails	Council provided written advice to DPE in response to the Scoping Report. ACEN had the following face-to-face meetings with representatives of Council: • August 2021 to provide an update on the project. • October 2021 to provide a project update including informing Council of lodgement of the Scoping Report. • February 2022 to provide a general update on the project with a focus on the site access route via Barneys Reef Road within the LGA, as well as outcomes of community consultation, timeframes for submission of the EIS, alignment with REZ development, cumulative impacts and access to the site. • July 2022 to follow up on the upgrades to Barneys Reef Road that will be used to access the project. • July 2022 to provide a general update prior to lodgement of the EIS. ACEN has also had the following email correspondence with Council: • October 2021 to provide a project update including informing Council of lodgement of the Scoping Report. • November 2021 to advise of the project drop-in sessions at the Gulgong project office and provide a project update on access routes and community consultation. • January 2022 to provide an update on EIS preparation and development activities and request feedback on access options. Key issues or concerns raised by Council related to the project workforce accommodation strategy and potential cumulative impacts of other major projects.
DPE	Face to face meeting Phone calls, follow up emails and letters	ACEN has consulted with DPE on numerous occasions, to keep the department informed of the project.

Table 5.7 Engagement conducted to date

Stakeholder	Methods of engagement	Summary of engagement
NSW MP for Dubbo	Phone calls, letters and emails Face to face meeting	October 2021 to provide the local MP with an update about the project and community consultation process. May 2022 - a meeting in Dubbo to discuss key issues including land use, shared benefits with the community, long term sustainable economic participation, skills and training opportunities, neighbour payment models, workforce accommodation, and the CWO REZ.
DCCEEW	Face to face meeting	A meeting occurred with DCCEEW was held on 2 June 2022. Key plans and vegetation mapping of the project were presented in relation to potential impacts to listed endangered ecological communities.
TfNSW	Phone calls, letters and emails Face to face meeting	Engagement with TfNSW was facilitated by Mid-Western Regional Council and included design considerations for the Castlereagh Highway intersection and matters raised at the traffic committee on 17 June 2022 regarding speed limits on Council Roads and public road crossings. Input and agency request within the SEARs (letter dated 28 October 2021).
Aboriginal stakeholders	Face to face meeting Site visit Phone calls, letters and emails Advertisements placed in local newspapers	Engagement associated with the Aboriginal cultural heritage assessment (ACHA) for the project has been conducted in accordance with the *Aboriginal cultural heritage consultation requirements for proponents 2010* (DECCW 2010). This includes engagement with relevant government agencies, local Aboriginal groups and the local community. Further detail on this process is provided in Section 6.5 of this EIS and Appendix I. There are nine registered Aboriginal parties (RAPs) for the project. In August 2021 the nine RAPs received a letter that provided an overview of the project and requested feedback on the proposed ACHA methods and invited further information on cultural values associated with the project. OzArk conducted an Aboriginal heritage survey for the project, with the assistance of representatives from four RAPs. Survey was undertaken from 8–10 November 2021 (3 days); 17–18 January 2022 (2 days); 14–15 March 2022 (2 days) and 22 March 2022 (1 day).
NSW Crown Lands (Land and Asset Management)	Email	Engagement with Crown Lands has been undertaken in relation to obtaining the required landowners consent for the project, due to the presence of Crown land and roads within the study area. DPE will request Crown Lands review the EIS and provide comment on any affected Crown land as part of the normal process.

Table 5.7 Engagement conducted to date

Stakeholder	Methods of engagement	Summary of engagement
Interest groups: • CWC Trail Inc • Dunedoo Historical Society • Dunedoo Show Society	Face to face meetings Phone calls and emails	ACEN had the following face-to-face meetings, email and phone correspondence with representatives of the Dunedoo Show Society, Dunedoo Historical Society and CWC Trail Inc: • December 2021 – Dunedoo show society contacted ACEN regarding sponsorship for the upcoming Dunedoo Show in February 2022. • December 2021 – president of the Dunedoo Historical Society dropped into the community and stakeholder event to discuss the project and the cultural and historical interest in the Birriwa district. Expressed some concern about the project although seemed understanding of the need for it. • December 2021 – phone conversation with the CWC Trail Inc, provided an overview of the project, organised a meeting and invite to drop in session, which CWC Trail Inc attended. • January 2022 – phone conversation with CWC Trail Inc to arrange the project team to attend the next CWC meeting. • February 2022 – follow up phone conversation with CWC Trail Inc to attend the CWC Trail Inc meeting. • February 2022 – face to face meeting with CWC Trail Inc to provide an update on the development application and consultation process. Discussion topics included potential impacts during construction along Birriwa Bus Route South and Barneys Reef Road, potential impacts on close neighbours providing morning teas to cyclists, potential impacts on accommodation in regional towns during construction, alternative route options and potential for contribution to CWC Trail Inc projects in the area. • March 2022 – email correspondence with minutes of the meeting distributed to the CWC Trail Inc. • April 2022 – phone conversation with CWC Trail Inc to discuss feedback from the meeting and discuss the Birriwa Bus Route South Road into Birriwa. • April 2022 – face to face conversation with CWC Trail Inc to follow up on Birriwa Bus Route and construction traffic. • April 2022 – phone conversation with CWC to provide update on the project. • July 2022 – conversation with CWC Trail Inc to provide a project update prior to lodgement of the EIS.

Table 5.7 Engagement conducted to date

Stakeholder	Methods of engagement	Summary of engagement
Local service providers: • Gulgong, Mudgee and Dunedoo Health Councils • Gulgong Multipurpose service (MPS) Employment • Banardos • RFS • Police etc	In-depth interviews conducted by telephone Phone calls and emails	In depth interviews conducted in March to April 2022. Key themes from community stakeholder raised were: • housing and accommodation; • increased traffic (workforce travel and truck movements) on local roads may increase road noise, increase commuter journey times and road safety impacts; • concerns over potential impacts on agricultural farming activities such as stock movement across roads; • concerns over an Influx of temporary workforce could disrupt rural lifestyle and community; • employment and training opportunities as well as opportunities for new skilled workers coming into the local area to fill the shortages in health system; • population growth; • community benefit sharing program; • potential impacts to Aboriginal cultural heritage; • visual impact of the project and resulting impacts on sense of place, rural character, visual amenity and community values; • potential future impacts associated with project decommissioning and future land use; • public safety/fire risks – perceived public safety and health risks due to the project; • Impacts to local environmental values (eg erosion, noise, habitat loss); and • comments how ACEN could implement a workforce driver safety program to reduce driver fatigue and improve road safety.
Employment and labour hire agencies • AES • VERTO	In-depth interviews conducted by telephone Phone calls and emails	In-depth interviews conducted in March to April 2022. The employment and labour hire agencies offered insights into the local labour market and employment and training opportunities including: • training and upskilling opportunities in the local area; • exploring long term sustainable employment opportunities; • the potential for the project to offer apprenticeships; • feedback indicating the energy sector present as an attractive employment opportunity for Indigenous job seekers; and • ideas of the identification and commitment to community investment eg potential shared value opportunities for ACEN to include the direct provision of training programs, particularly targeting youth and Aboriginal and Torres Strait Islander People struggling to find employment.

Table 5.7 Engagement conducted to date

Stakeholder	Methods of engagement	Summary of engagement
Short-term accommodation providers in Dunedoo, Gulgong, Mudgee and Wellington	Telephone survey	In-depth interviews were conducted with 23 short-term accommodation providers across the centres of Mudgee, Gulgong, Dunedoo and Wellington. Although located outside the local area, the town of Wellington has a supply of short-term accommodation and is within a short commute of the local area. Accommodation in Wellington was explored to gain a more detailed understanding of the broader availability of short-term accommodation for the project and the experienced effects to date of other renewable energy projects (eg the construction of Wellington Solar Farm).
Real Estate Agents in Dunedoo, Gulgong and Mudgee	Telephone survey	In-depth interviews were conducted with 13 real estate agents. During the interviews, both real-estate agents and short-term accommodation providers offered insights into the local housing market and short-term accommodation market including demand, occupancy rates, vacancy rates and experienced impacts to data.
EnergyCo Central West Orana Rez (CWO REZ)	Face to face workshop meeting Phone calls and follow up emails	In June, several ACEN projects including the Birriwa Solar and Battery project were shortlisted as a CFG to engage with EnergyCo about issues related to developments in the CWO REZ including connection to the CWO REZ Network Infrastructure, traffic management, workforce and cumulative impacts.
Exploration and mineral title holders	Letter	In May 2022, letter correspondence with Gilmore Metals Pty Ltd advising of the project, as they held an exploration licence EL9268 which incorporated the study area.

5.3.7 Limitations

The following points identify limitations in the engagement process that may affect the outcomes:

- Change in engagement approach given the COVID-19 pandemic – face to face community sessions that were planned for August and September were postponed to a time when community members would be able to attend. Face-to-face meetings with associated and non-associated landholders were also delayed because of restrictions in place in NSW and other Australian states where ACEN representatives are operating.

- ACEN has been building a local presence in the region since early 2018 and leading the broader community consultation activities since the second half of 2021 with associated and non-associated landholders and the broader community. Feedback and outcomes completed by ACEN were provided to the SIA team for review and consideration in preparation of the communication and engagement activities carried out before and during the preparation of the EIS.

- Not all stakeholders contacted have been successfully consulted for the purposes of informing the assessment due to either a lack of stakeholder interest in participating and/or an inability to contact certain stakeholders; for example, no response to calls and messages or inaccurate contact information.

- During community engagement, some participants, when identifying and discussing social impacts, did not distinguish between the renewable projects in the region and expressed “consultation fatigue”.

5.4 Community views

A summary of the key findings of community engagement carried out to date including the preliminary community views on the project is provided in Table 5.8. A more detailed summary of the outcomes of engagement is included in Appendix D and Appendix O.

Stakeholder and community views regarding the project have been understood through:

- the ongoing consultation and engagement activities described above; and

- feedback received from organisations via responses to SEARs.

Feedback from stakeholders and the broader community has been varied and includes both positive and negative views on a range of topics.

Table 5.8 Key findings of community engagement

Stakeholder group	Likely level of project interest	Geographical extent of project interest[1]	Community views on the project					
			Strategic context	Alternatives	Statutory issues	EIS engagement	Key matters for EIS assessment	Issues beyond the project scope
Associated and non-associated landowners	High	Local Regional	None	None	None	Some landowners have requested to remain informed about the project.	Site access, consultation process and assessment process, traffic and transport, livestock and farming, renewable energy industry, noise, location of substation and BESS location and visual amenity, impacts to property prices, workforce accommodation and impacts to community groups such as the CWC Trail Inc, community benefit sharing and investment, compensation, updates on project progress and schedule and social fabric and social cohesion, hazards and safety, biodiversity and environment, employment opportunities, procurement/ local business participation and aboriginal heritage.	CWO REZ transmission infrastructure (new line routes, hub locations); cumulative impacts of the overall REZ, State energy and climate change policy settings including the need for the REZ itself.
Local community (incl community groups and organisations)	Low to medium	Local	Cumulative impacts	None	None	Some landowners have requested to remain informed about the project.	Impacts to CWC Trail Inc. impacts along cycle route along Birriwa Bus Route South and Barneys Reef Road during constructure, hazards and safety, visual amenity; traffic and transport; accommodation impacts and community benefit sharing; safety.	None

[1] Note: local ≤ 5 km from the site, regional = 5–100 km from the site, state ≥ 100 km from the site.

Table 5.8 Key findings of community engagement

Stakeholder group	Likely level of project interest	Geographical extent of project interest[1]	Community views on the project					
			Strategic context	Alternatives	Statutory issues	EIS engagement	Key matters for EIS assessment	Issues beyond the project scope
Service Providers	Low to medium-high	Local	None	None	None	-	Local housing market and short-term accommodation, traffic and transport, noise, increase commuter journey times and road safety impacts, agricultural livestock and farming activities, Influx of temporary workforce, employment and training opportunities, population growth, community benefit sharing program, Aboriginal cultural heritage, visual amenity future impacts associated with project decommissioning and future land use, hazards and safety biodiversity and environment.	
Local Government	Medium-high	Local, regional	Impacts to local roads, accommodation capacity, waste, cumulative impacts with other projects in the region, social impacts; cumulative impacts.	None	None	Councils requested information about the Project including future community engagement.	Construction impacts, transport and traffic, timeframes of development and EIS, alignment with REZ development, cumulative impacts and access to the site, access routes Birriwa Bus Route North, Birriwa Bus Route South and their intersection with the Castlereagh Highway, public roads and internal roads, community consultation, and internal road access, impacts to community groups such as CWCT and location of substation and BESS, neighbour benefit sharing and broader ACENs Central West Community Benefit Sharing scheme, design of upgrades, traffic management workforce management plans, accommodation for workers waste management.	CWO REZ coordination aspects (including greater need for consultation by EnergyCo)

Table 5.8 Key findings of community engagement

Stakeholder group	Likely level of project interest	Geographical extent of project interest[1]	Community views on the project					
			Strategic context	Alternatives	Statutory issues	EIS engagement	Key matters for EIS assessment	Issues beyond the project scope
State government and agencies	Medium	Regional	Impacts to local roads, accommodation capacity, waste, cumulative impacts with other projects in the region, social impacts; cumulative impacts.	Changes to physical layout to avoid biodiversity impacts	EPBC Act referral potentially required	As per relevant State guidelines.	Visual amenity and biodiversity impacts, land use, shared benefits with the community, long term sustainable economic participation, skills and training opportunities, neighbour payment models, workforce accommodation, REZ, transport and traffic.	None
Indigenous Stakeholders	Medium	Local	Employment and skills development. Partnerships with education.	None	None	As per relevant State guidelines.	The local Wiradjuri people note the study area has high historic values as there is clan and cultural connections, lore, song lines and the Dreamtime.	None
DPE	Medium	State	Cumulative impacts in relation to traffic and visual impacts.	None	None	Advised to consult with local Councils and TfNSW.	Visual amenity, construction traffic impacts, SIA, cumulative transport and traffic impacts, road upgrade, consultation and assessment process, biodiversity and environment, community benefit sharing and investment, Aboriginal and European heritage, noise and workforce accommodation.	None
Transport for NSW (TfNSW)	Low	State	The scope and method of assessment for the traffic impact assessment.	None	None	Continue ongoing consultation with TfNSW as the Project develops.	Traffic impact assessment, roads, hazards and safety, cumulative impacts.	None

5.5 Engagement to be carried out

This section provides a summary of the community engagement that will be carried out if the project is approved, having regard to the findings of the community engagement during the preparation of the EIS and the community participation objectives in the SSD Engagement Guidelines 2021.

Engagement with key stakeholders will continue through EIS exhibition and subsequent phases of the assessment, including:

- Ongoing consultation and negotiations with Mid-Western Regional Council and Warrumbungle Shire Council, and TfNSW relating to project planning and design issues, in particular associated with site access design (road and intersection upgrades), construction programming and contributions required for the project.
- Ongoing consultation with other agencies as required to address issues raised during exhibition of the EIS and as part of preparation of the response to submissions report.
- Ongoing consultation with special interest groups in particular with CWC Trail group.
- Ongoing consultation with adjoining neighbours, landowners and local businesses through provision of project updates via email, project website, community newsletter, and another information session planned to coincide with the EIS public exhibition.

If development consent is granted for the project, ACEN will continue with ongoing consultation activities with stakeholders, including community members, throughout the construction and operation of the project.

Principle engagement and consultation activities that will be considered beyond determination of the project, if approved, are:

- ongoing regular local stakeholder briefings and meetings, including:
    - Mid-Western Regional Council;
    - Warrumbungle Shire Council;
    - TfNSW;
    - CWC Trail group; and
    - adjoining neighbours and landowners;
- regularly updating and promoting information on the project website;
- regular community notifications and updates as the project progresses through construction and into operation; and
- ongoing operation of the community telephone line, email address, mailbox and website, with set response times for project queries and complaints.

5.5.1 Community Benefit Sharing

Across the CWO REZ and throughout the EIS community engagement process, ACEN has demonstrated its intention to establish a positive, long-term connection with the local communities. In the region, ACEN currently has two projects in the approvals phase (this project and the Valley of the Winds project) and one approved project (Stubbo Solar and Battery Project). ACEN is seeking to develop a community benefit sharing program with the local residents and the broader community proximate to ACEN projects aimed at building and supporting local projects and initiatives.

ACEN's intention is to design and implement benefit sharing programs in line with the community needs, the level of social impacts and tailored to the stage of the development, construction or operation of the project. ACEN also aims to have a consistent approach across all the solar projects in the CWO REZ. ACEN also notes that there may be a standardised set of requirements/obligations placed on developers as part of the Long Term Energy Services Agreement (LTESA) and/or Access Rights tenders being run by the NSW Consumer Trustee in the second half of 2022 through to early 2023. In short, these as-yet-undefined obligations may dictate the model and level of community related contributions expected of developers in the CWO REZ.

At the time of lodgement of this EIS, ACEN's contribution to the community involves the following programs:

- Stubbo Solar and Battery Project Social Investment Program, that aims to eventually transition into a CBSP;
- Central West Orana solar projects Community Benefit Sharing Program; and
- ACEN's Neighbour Benefit Sharing Program.

i ACEN Stubbo Solar and Battery Project Social Investment Program (SIP)

The Stubbo Solar Farm is a 400 MW renewable energy generator approved for construction by the New South Wales Government in 2021. Construction early works will start end of 2022/early 2023. A Voluntary Planning Agreement (VPA) delivering benefits to communities within the Mid-Western Regional Council will commence at construction. To complement this, in March 2022, ACEN announced the Stubbo Solar and Battery project SIP available to the Gulgong and local communities. The Birriwa and Merotherie localities are included in the area of benefit of this SIP.

Initial funding has been available since March 2022 to support activities that enhance the liveability and vibrancy of the Gulgong community. Funding may be provided by ACEN through financial grants, sponsorships and donations, or through partnerships. ACEN's approach to social investment is aligned with the United Nation's Sustainable Development Goals. Not-for-profit organisations, charities, incorporated community-based organisations, social enterprises and Government entities and profit organisations where a project demonstrates a strong contribution to the local community can all apply. Further information on the SIP is provided in Section 8 of the SIA (Appendix O).

While members of the Birriwa and Merotherie localities may directly benefit from the SIP established for the Stubbo project, ACEN's intention is to transition the SIP to a broader Community Benefit Sharing Program across ACEN's solar projects in the Central West Orana, including Stubbo and Birriwa. This transition is expected to occur as development activities of the Birriwa Solar and Battery project progress.

ii ACEN Central West Orana solar projects Community Benefit Sharing Program

The community benefit sharing program (CBSP) has been designed in consultation with the local communities (community drop-on sessions and other local events) and key stakeholders such as local Councils, State MPs and other relevant public agencies. The CBSP will be designed to deliver benefits to affected communities in response to a needs assessment and in a way that supports the community vision for the Mid-Western Regional LGA and Warrumbungle Regional LGA. When implemented, the CBSP is expected to supersede the Stubbo Solar and Battery Project SIP.

The objectives of the CBSP will include the following:

- to deliver meaningful improvements to the communities surrounding the ACEN projects;
- to ensure communities in closest proximity to the project's benefit from the presence of the projects; and
- to build support for renewable energy in the local area.

The CBSP is expected commence once the project is determined. Further engagement will be undertaken by ACEN with communities of the local area to determine what types of projects and initiatives the community would like to see funded through the CBSP. Community benefit funds may provide funding for local projects such as sports, clubs, tourism, heritage, arts and culture via a yearly competitive grants process and one-off sponsorship and donations.

As part of the program, ACEN will provide ongoing financial assistance to ensure that there is a direct benefit from the project to the local community. This could include support for local schools, training or education as well as grants or project support for local community or sporting groups.

The CBSP will be refined upon commencement of construction in consultation with councils and DPE and will be presented to all relevant stakeholders prior to commencement of construction.

The amount of the contribution is yet to be defined but is generally expected to be similar to other contribution programs in place for other ACEN projects. For instance, as part of the New England Solar and Battery project currently in construction near Uralla, ACEN has already committed to contribute $250 per year for every MW (AC) of solar power installed over a period of 25 years. For the Stubbo Solar and Battery Project, Mid-Western Regional Council and ACEN agreed on a contribution of $300 per MW installed per year in the VPA. These projects also include contributions during construction.

Ongoing engagement with the community around the CBSP will continue and additional feedback will also be sought during the feasibility and design periods. It is anticipated there will be a role for the community or its representatives in administering the CBSP throughout the life of the project.

iii Neighbour Benefit Sharing Program

ACEN has been developing and implementing a voluntary neighbour benefit sharing program (NBSP) for its solar projects within the CWO REZ. The objectives of the NBSP are to foster long-term positive relationships with the community and to contribute to addressing more 'perceived' impacts of the projects with the nearest neighbours (in particular, those with their primary residence being located within 2 km of the development footprint). These 'perceived' impacts may be difficult to fully address with mitigation measures as part of project design or refinement. The NBSP also aims to take into consideration some of the cumulative impacts generated by ACEN projects and other CWO REZ projects.

ACEN has initiated the NBSP with neighbours of the project that meet certain criteria such as distance of their dwelling from the development footprint or visual impact on the neighbour's views from their primary residence within a certain distance. The NBSP provides payment based on objective criteria when the project reaches construction and subject to mutual signing of a legal agreement between ACEN and the neighbour, with such agreements being optional and on a voluntary basis. ACEN has agreed to pay the landholder's reasonable legal costs associated with advising on and negotiating the neighbour agreement.

iv Other contributions requirements

Under the EP&A Act, there are two main kinds of contributions relevant to SSD solar projects, being either:

- Contributions made under Section 7.11 of the EP&A Act, payable when there is a demonstrated link between development and the use of local public amenities or services (specified in contributions plans prepared by Council) (Section 7.11 Contributions). These contributions are imposed as conditions of a development consent, specifying that consent is granted on the basis that a proponent will dedicate land free of cost, or pay a monetary contribution (or both), with the contribution to provide, extend or augment the concerned public amenities or services.

- Levies imposed under section 7.12 of the EP&A Act, expressed as a percentage of the proposed cost of carrying out the development (Section 7.12 Levies). As with Section 7.11 Contributions, Section 7.12 Levies are imposed as a condition of a development consent and are applied to assist in funding public amenities or services generally, rather than those which are demonstrably linked to the development.

The *Large-Scale Solar Energy Guideline* (DPE 2022) notes that large solar energy developments typically have limited impacts on local infrastructure with the exception of very specific impacts such as the requirement for road upgrades to facilitate site access. It further states that specific impacts of this nature should be addressed through conditions of development consent rather than through local contribution mechanisms or planning agreements. Notwithstanding, a local contribution mechanism or planning agreement can be used if there is a link between the development and the infrastructure to be funded.

The guideline (DPE 2022) further promotes benefit sharing programs by proponents, noting that such programs should:

- be informed by consultation with the community or community representatives;

- produce outcomes that align with the general values and priorities of the public;

- have a positive, lasting and meaningful impact for the local community and protect the overall public interest;

- be proportionate to the scale of the project and the level of change experienced by the community; and

- include public benefits that are not wholly unrelated to the development.

ACEN also notes the project is within the CWO REZ. It was unclear at the time of lodgement of this EIS whether a different regime of contribution will apply in lieu of the mechanism outlined above. Regardless, ACEN will comply with the mandatory contribution obligations for the Birriwa Solar and Battery project, under Section 7.11 and/or Section 7.12 of the EP&A Act in consultation with Mid-Western Regional Council, and/or with any requirements introduced specifically for the CWO REZ in place of such contributions/levies. The contributions paid under these requirements will be included in the global amount that constitutes the CBSP as outlined above.

5.5.2 Monitoring and Evaluation

To facilitate open communication and active complaint resolution, it is important that local stakeholders are able to raise issues and complaints in a formal way. A complaints and grievances management plan will be developed and implemented for the project which includes a complaints and grievance management process and provision of timely information to communities. This complaints and grievances management mechanism will allow anyone in the community to submit questions, comments, suggestions, and complaints if they believe a practice is having a detrimental impact on the community, the environment, or their quality of life. The complaints and grievances management process will be made publicly available and include a feedback process through which the complaint is provided with information relation to how their concern has been assessed, considered and where feasible addressed.

6 Assessment and mitigation of impacts

6.1 Introduction

Preliminary environmental investigations were carried out during the preparation of the scoping report (EMM 2021) to identify the relevant key matters to be addressed in the EIS, and the required level of assessment (detailed or standard). The preliminary impact identification and assessment was informed by the *State significant development guidelines – preparing a scoping report: Appendix A to the state significant development guidelines* (DPIE 2021e).

The level of assessment identified for relevant and key environmental aspects are listed in Table 6.1.

Table 6.1 Level of assessment for key environmental aspects

Detailed	Standard
Biodiversity	Noise
Visual	Land resources
Traffic	Water resources
Aboriginal heritage	Air quality
Hazards	Social
	Historic heritage

Notes: 1. While noise was identified in the scoping report as requiring a standard level of assessment, a detailed noise impact assessment has been prepared by EMM (Appendix K) for the EIS to ensure the predicted impacts associated with the BESS in particular are well understood, and appropriate mitigation measures identified.

Other matters including air quality and waste are addressed in Section 6.13.

This chapter provides a summary of the environmental, social and economic impacts of the project. Impacts have been assessed with detailed technical specialist reports prepared where appropriate. Specialist technical reports are provided as appendices to the EIS (Appendix F – Appendix Q) with the key impacts, outcomes and mitigation measures summarised in the following sections.

The length and detail of summaries are proportionate to the level of assessment (ie detailed versus standard). Mitigation measures have been identified to minimise, avoid and manage predicted impacts. A consolidated list of all mitigation measures contained in this EIS is provided in Appendix E.

6.2 Biodiversity

6.2.1 Introduction

A biodiversity development assessment report (BDAR) has been prepared for the project by EMM (2022a) and is provided in Appendix F. The BDAR assesses the potential residual impacts of the project on biodiversity in accordance with the Biodiversity Assessment Method (BAM 2020) under the NSW BC Act, the Commonwealth EPBC Act and the NSW *Fisheries Management Act 1994* (FM Act). It also documents the strategies implemented to avoid and/or minimise impacts of the project on threatened biodiversity and describes the biodiversity offset requirements. The relevant biodiversity related SEARs and how they are addressed are summarised in Appendix A of the EIS and Section 1.4 of the BDAR.

The term 'subject land' used in this chapter is the area subject to all proposed direct impacts (ie the project's 'impact footprint' as defined above in Section 1.6) in accordance with the 'subject land' described in the BAM (DPIE 2020).

This chapter provides a summary of the key findings of the BDAR.

6.2.2 Existing environment

i Landscape features

The subject land is within the NSW South Western Slopes Interim Biogeographic Regionalisation for Australia (IBRA) bioregion and the Inland Slopes IBRA subregion. The Talbragar – Upper Macquarie Terrace Sands and Gravels NSW (Mitchell) Landscape dominates the study area.

The subject land is considered highly fragmented with native vegetation often occurring in isolated patches surrounded by a matrix of agricultural land. A vegetated road corridor provides connectivity along the western extent of the subject land.

There are no areas of outstanding biodiversity value, as declared by the NSW Minister for Environment.

ii Rivers, streams, estuaries and wetlands

A number of named creeks occur within the subject land, in addition to multiple unnamed first and second order streams. The named creeks include Huxleys Creek (second order), Browns Creek (third order) and White Creek (third order) (refer to Figure 3.1). These creeks flow in a northerly direction into Talbragar River, approximately 2.4 km from the subject land.

Browns Creek and White Creek are mapped as key fish habitat (DPI 2021b). These creeks, in addition to Huxleys Creek, are also mapped within the freshwater threatened species distribution for the Purple-Spotted Gudgeon (*Mogurnda adspersa*). The aquatic habitat within these creeks occurs as slow-flowing creeks with no rocky habitat or substrate to provide refuge for aquatic species. Intermittent pools occur within these creeks, which provide aquatic vegetation in the form of sedges, rushes and a limited diversity of macrophytes. While the creeks provide limited aquatic habitat to aquatic species, these creek lines have been highly altered and degraded and are disconnected by man-made culverts and roads. Talbragar River is also mapped within the freshwater threatened species distribution of the Eel-tailed Catfish (*Tandanus tandanus*).

No nationally important or RAMSAR wetlands have been mapped within the subject land or are located within the locality.

iii Native vegetation

The subject land is dominated by exotic vegetation and native pasture. All vegetation has been impacted by past land use, particularly with ongoing grazing, and the grasslands support little native species cover and a lack of species diversity. Remnant vegetation is restricted to small patches, isolated paddock trees and a vegetated road corridor consisting primarily of Grey Box (*Eucalyptus microcarpa*), Blakely's Red Gum (*Eucalyptus blakelyi*) and Yellow Box (*Eucalyptus melliodora*).

A total of 226 species (132 native and 94 exotic) were recorded during field surveys within the study area. Most of these species were native and exotic groundcovers, with a small number of native shrub species present and a total of seven tree species. Of the 94 exotic species, 12 are high threat weeds and primarily include herbaceous groundcover and grasses.

a Plant community types

Two plant community types (PCTs) occur within the subject land, as described in Table 6.2 and illustrated in Photograph 6.1 and Photograph 6.2. These are also shown on Figure 6.1.

Table 6.2 Plant community types in the subject land/impact footprint

Vegetation type	Vegetation class	Vegetation formation	Percent cleared	Area (ha)
PCT 80 – Western Grey Box – White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion	Floodplain Transition Woodlands	Grassy Woodlands	83	76.80
PCT 281 – Rough-Barked Apple – red gum – Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	Western Slopes Grassy Woodlands	Grassy Woodlands	67	291.91
Exotic grassland	-	-	-	776.66
Exotic trees	-	-	-	4.73
Dam	-	-	-	5.02
Cleared	-	-	-	4.08
Total area				**1,159.19**

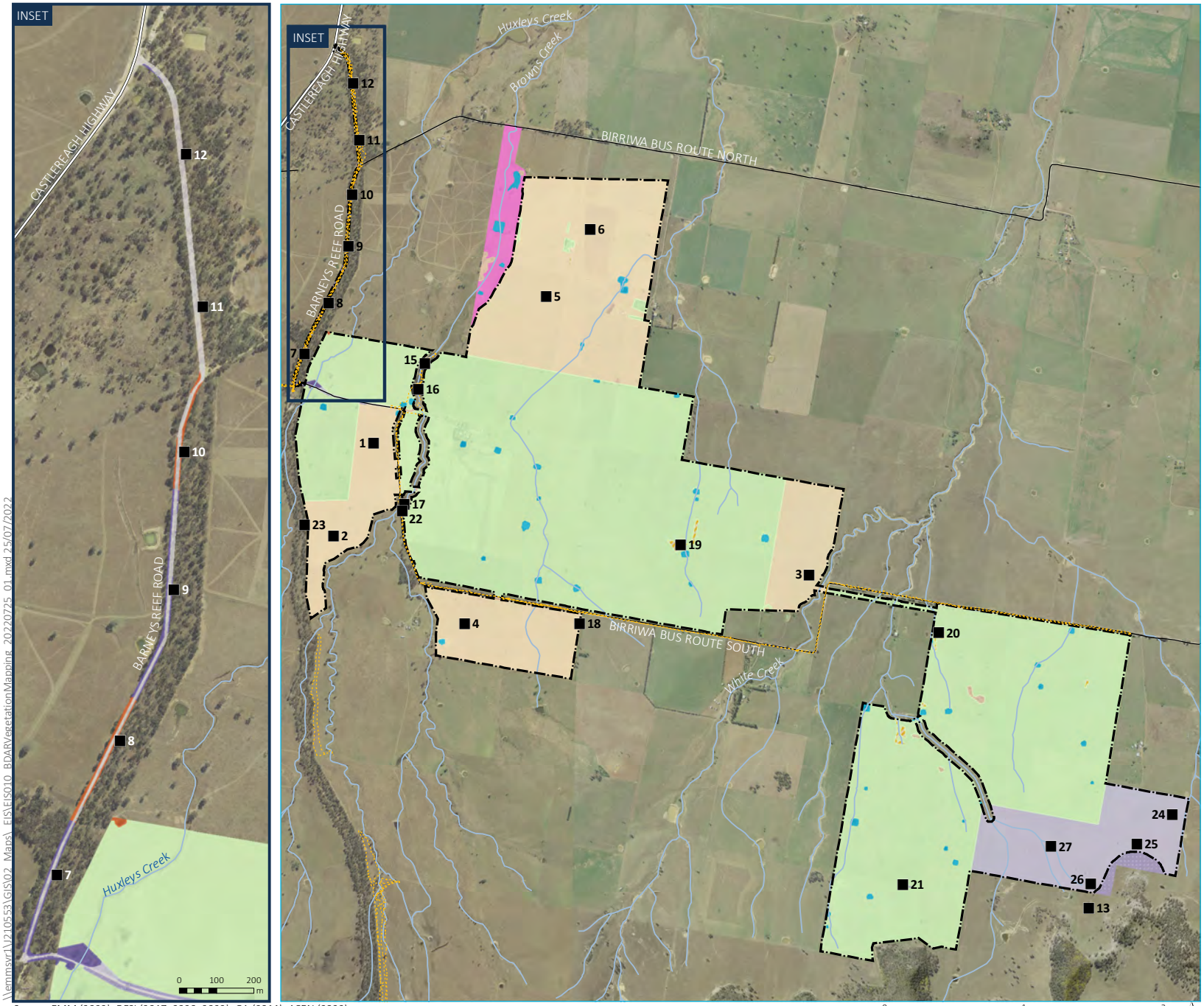
Each PCT recorded within the subject land is represented by multiple vegetation zones. Details of each vegetation zone are summarised in Table 6.3.

Table 6.3 Vegetation zones

Vegetation zone	PCT ID	PCT name	Condition	Extent in study area (ha)	Vegetation integrity score
1	80	Western Grey Box – White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion	High	1.01	95.3
2			Pasture	75.62	4.8
3			Poor	0.17	41.1
4	281	Rough-Barked Apple – red gum – Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	High	0.35	99.2
5			Medium	0.55	59.3
6			Pasture	284.46	2.7
7			Planted	2.59	55.5
8			Poor	3.95	39.5
Total area				**368.70**	-

Photograph 6.1 PCT 80 – Western Grey Box – White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion

Photograph 6.2 **PCT 281 – Rough-Barked Apple – red gum – Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion**



KEY

- Subject land/impact footprint
- Plot location
- Threatened species transect

Existing environment

- Major road
- Minor road
- Watercourse/drainage line
- Cleared
- Dam
- Exotic (trees, grassland)

Plant community type

PCT 80 | Western Grey Box - White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion

- High
- Poor
- Derived native grassland (DNG)
- Pasture

PCT 281 | Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion

- High
- Medium
- Poor
- Pasture
- Planted
- Tussock

Threatened ecological communities:

- **PCT 281**: White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highlands, NSW South Western Slopes, South East Corner and Riverina Bioregions (Critically Endangered) (BC Act and EPBC Act)
- **PCT 80**: Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions (Endangered) (BC Act)
- **PCT 80 (High; DNG)**: Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia (Endangered) (EPBC Act)

Plant community types and plot/transect locations

Birriwa Solar and Battery Project
Environmental Impact Statement
Figure 6.1

EMM creating opportunities

Source: EMM (2022); DFSI (2017, 2020, 2022); GA (2011); ACEN (2022)

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b Threatened Ecological Communities

The two PCTs identified within the subject land align with Threatened Ecological Communities (TECs) listed under the NSW BC Act:

- PCT 80: Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions (Endangered); and
- PCT 281: White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highlands, NSW South Western Slopes, South East Corner and Riverina Bioregions (Critically Endangered).

In addition, PCT 281 is a candidate entity for Serious and Irreversible Impacts (SAII).

The high condition vegetation zones of PCT 80 and PCT 281 mapped within the subject land also align with the following TECs listed under the Commonwealth EPBC Act:

- PCT 80: Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-Eastern Australia endangered ecological community (Endangered) (comprising 1.01 ha); and
- PCT 281: White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland Critically Endangered Ecological Community (Critically Endangered) (comprising 0.35 ha).

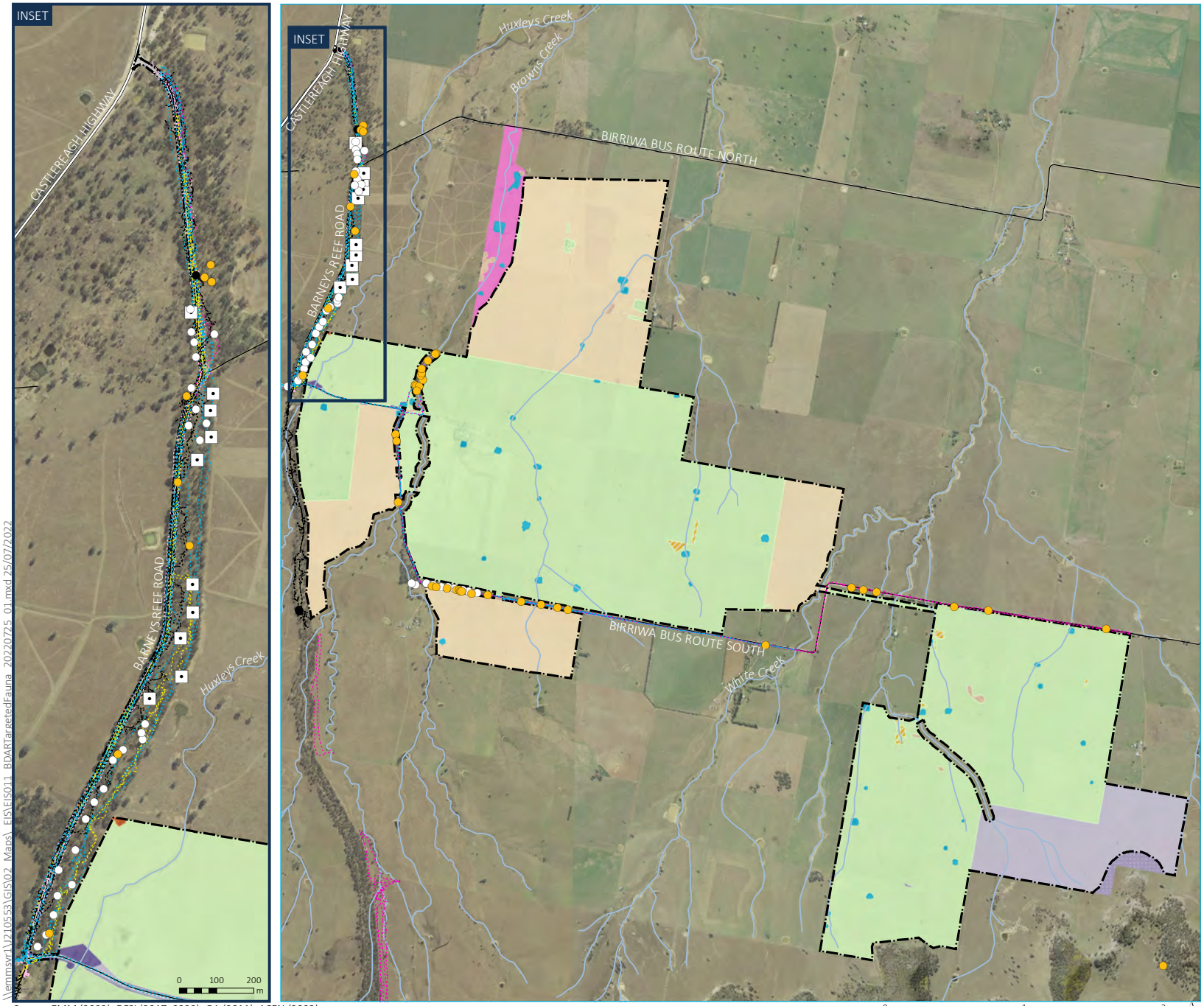
iv Threatened species

Habitat assessments within the study area concluded that targeted surveys were required for seven flora species and 14 fauna species (refer to Figure 6.2). No candidate flora species were recorded during the surveys. One candidate fauna species, the Koala, was recorded in the form of scats during dog detection surveys. The presence of the Koala is associated with the high condition vegetation zones of PCTs 80 and 281, which are also connected to the wider landscape. No other candidate fauna species were recorded during targeted surveys. For the purpose of impact assessment, presence has been assumed for *Chalinolobus dwyeri* (Large-eared Pied Bat), *Ninox connivens* (Barking Owl), *Ninox strenua* (Powerful Owl) and *Tyto novaehollandiae* (Masked Owl), due to potential habitat within the study area, and no targeted surveys being undertaken for these candidate fauna species due to the seasonal timing of surveys.

In relation to threatened species listed under the Commonwealth EPBC Act, one listed fauna species was recorded within the study area: the Koala. A further five EPBC Act listed fauna species were assessed as potential impact, due to their likelihood of occurrence; namely:

- Regent Honeyeater;
- *Callocephalon fimbriatum* (Gang-gang Cockatoo);
- *Grantiella picta* (Painted Honeyeater);
- *Hirundapus caudacutus* (White-throated Needletail); and
- Large-eared Pied Bat.

Assessments in accordance with the *Matters of National Environmental Significance – Significant Impact Guidelines 1.1* (DoE 2013) concluded that the project is unlikely to result in a significant impact on the above listed Matters of National Environmental Significance (MNES). However, referral of the project to the Commonwealth Minister for the Environment and Water will be undertaken post-EIS submission.



KEY

- Subject land/impact footprint
- Hollow-bearing tree

Mammal survey

- Camera trap - December 2021 - January 2022
- Arboreal Elliot B trapping - September 2021
- Koala scats
- Koala Detection Dog survey - May 2022
- Spotlight transect - January 2022

Diurnal bird survey

- September 2021

Targeted flora survey

- September 2021
- December 2021

Existing environment

- Major road
- Minor road
- Watercourse/drainage line
- Cleared
- Dam
- Exotic (trees, grassland)

Plant community type

PCT 80 | Western Grey Box - White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion

- High
- Poor
- Derived native grassland (DNG)
- Pasture

PCT 281 | Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion

- High
- Medium
- Poor
- Pasture
- Planted
- Tussock

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Source: EMM (2022); DFSI (2017, 2022); GA (2011); ACEN (2022)

Targeted fauna results and transects

Birriwa Solar and Battery Project
Environmental Impact Statement
Figure 6.2

EMM
creating opportunities

A likelihood of occurrence assessment for species listed under the FM Act was also conducted as part of the BDAR (refer to Appendix 5 in the BDAR (Appendix F)), which concluded that no aquatic threatened ecological communities, endangered populations or species have a moderate to high likelihood of occurring within the subject land.

6.2.3 Avoidance and minimisation through design

Avoidance of impacts to native vegetation was a key consideration in the project refinement process, resulting in the avoidance of significant biodiversity values. A key design principle adopted during project refinement was to maximise the placement of project infrastructure in cleared areas and, wherever possible, limit impacts to native vegetation of low quality only.

The resulting key avoidance measures that have been implemented by ACEN comprise:

- the exclusion of 4.9 ha of PCT 80 – DNG, which is an EEC, from the development footprint in the south-east corner of the study area (as also described in Section 2.5.4iii and shown in Figure 3.1 and Figure 6.2);
- avoidance of 20.7 ha of PCT 281 – tussock, in the northern portion of the study area (refer to Section 2.5.4iii and Figures 3.1 and 6.2);
- minimisation of impacts to PCT 281 – high and PCT 80 – high, wherever feasible;
- minimisation of direct impacts by utilising existing access tracks within the subject land;
- the location of public road crossings (shown in Figure 3.1) within areas of minimal vegetation, thereby avoiding the need to remove vegetation for these crossings; and
- the exclusion of third order streams (Huxleys Creek, Browns Creek and White Creek) from the development footprint, thereby avoiding impacts to associated riparian vegetation, with the exception of that required for the provision of fencing, access and electrical reticulation (ie private internal access roads and electrical cables), and avoidance of instream impacts as part of creek crossing designs.

In relation to the road upgrade corridor within the study area, the conceptual road upgrade design has sought to minimise the clearance of native vegetation as much as possible. The concept design was developed in consultation with EMM ecologists and with Mid-Western Regional Council and Warrumbungle Shire Council to develop a design that avoids as much of the native vegetation along the existing road verge as possible. Residual impacts to biodiversity values will be mitigated through pre-clearance surveys, planting locally native species characteristic of Box Gum woodland and Grey Box woodland in future landscaping, retention of logs and debris in the study area post-construction, and weed hygiene measures. ACEN will continue its consultation post EIS lodgement with both Councils to continue refinement of the road design wherever possible and further reduce its impacts on the roadside vegetation. An updated design is expected prior to determination of the project.

The original study area for the development design encompassed approximately 1,330 ha (Figure 3.1). The final design has been reduced to an impact footprint of approximately 1,159 ha, which is a reduction in the original design by 171 ha and will reduce impacts on the TECs within the study area. Accordingly, the reduction in impact on Box Gum Woodland and derived native grassland and Grey Box woodland and grassland also reduces the impact on native flora and fauna habitat.

6.2.4 Potential impacts

i Direct impacts

a Impacts requiring offsetting

After avoidance and minimisation, the project will result in residual impacts to:

- vegetation communities:
  - 76.80 ha of PCT 80, of which only 1.18 ha is of condition to require offsetting under the NSW Biodiversity Offset Scheme (BOS), and associated habitat for flora and fauna species; and
  - 291.91 ha of PCT 281, of which only 7.45 ha is of condition to require offsetting under the NSW BOS, and associated habitat for flora and fauna species;
- threatened species habitat:
  - direct impacts on 0.48 ha of foraging habitat for the Large-eared Pied Bat;
  - direct impacts on 3.88 ha of habitat for the Barking Owl;
  - direct impacts on 3.88 ha of habitat for the Powerful Owl;
  - direct impacts on 8.62 ha of habitat for the Koala; and
  - direct impacts on 3.88 ha of habitat for the Masked Owl.

One NSW BC Act listed TEC at risk of SAII occurs within the subject land, and two BC Act listed fauna species at risk of SAII have the potential to occur within the study area:

- White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highlands, NSW South Western Slopes, South East Corner and Riverina Bioregions;
- Large-eared Pied Bat; and
- Regent Honeyeater.

The TEC and species have been assessed in accordance with Section 9.1 of the BAM (DPIE 2020) and is presented in Section 6.4 of the BDAR.

b Impacts not requiring offset

Two vegetation zones identified within the subject land have a vegetation integrity score lower than the thresholds and consequently, do not require offsetting. These are shown in Figure 6.3 and include:

- vegetation zone 2: PCT 80 – Western Grey Box – White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion; and
- vegetation zone 6: PCT 281 – Rough-Barked Apple – red gum – Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion.

ii Indirect impacts

Without any measures to avoid, minimise or mitigate impacts, the project could result in the following indirect impacts on biodiversity:

- erosion and sedimentation;
- weed introduction and spread;
- potential inadvertent disturbance of retained habitats; and
- increased noise, vibration and dust levels resulting in disturbance of fauna species, and consequent abandonment of habitat, or changes in behaviour (including breeding behaviour).

Mitigation measures are proposed, as described in Section 6.2.6, to minimise the potential for indirect impacts to occur.

6.2.5 Biodiversity offset strategy

A biodiversity offset strategy will be implemented for the project to ensure that all residual impacts on biodiversity of the project are appropriately offset.

Regarding the satisfaction of credit obligations prior to commencing any on-ground works for the project, it is ACEN's intent to upgrade the site access (ie undertake the required works within the road upgrade corridor) before the solar component, to enable a staged biodiversity offset delivery model. This strategy is based on clearly defined stages of vegetation clearing for the project, with the road upgrade corridor to be constructed first, followed by the solar components (all other development areas). It is ACEN's intent therefore to meet the offset obligations for the road upgrade corridor, then separately meet offsets for the solar components. This allows flexibility in starting construction for the road and solar components separately to each other.

A summary of the credit requirements for the project is provided in Table 6.4, and areas requiring offset are shown in Figure 6.3. A credit report is provided in Appendix 7 of the BDAR (refer to Appendix F).

Offsets will be provided in accordance with the biodiversity offset scheme.

Table 6.4 Summary of biodiversity credit requirements

PCT/species	1 – road corridor		2 – all other development areas		Total project credits
	Area (ha)	Credits[1]	Area (ha)	Credits[1]	
PCT 281	0.56	19	291.34	211	230
PCT 80	0.73	23	76.07	28	51
Total PCT credits		**42**		**239**	**281**
Large-eared Pied Bat	0.00	0	0.48	17	17
Barking Owl	0.41	20	3.47	13	33
Powerful Owl	0.41	20	3.47	13	33
Koala	0.79	38	7.83	196	234
Masked Owl	0.41	20	3.47	13	33
Total species credits		**98**		**252**	**350**

Notes: 1. All zones of PCTs 281 and 80 requiring offset, require Hollow Bearing Tree (HBT) credits (refer to like-for-like credit report, Appendix 7 of the BDAR (in Appendix F).

KEY

- Subject land/impact footprint
- Impacts requiring offsets
- Impacts not requiring offsets

Existing environment

- Major road
- Minor road
- Watercourse/drainage line
- Cleared
- Dam
- Exotic (trees, grassland)

Plant community type

PCT 80 | Western Grey Box - White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion

- High
- Poor
- Derived native grassland (DNG)
- Pasture

PCT 281 | Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion

- High
- Medium
- Poor
- Pasture
- Planted
- Tussock

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Source: EMM (2022); DFSI (2017, 2020, 2022); GA (2011); ACEN (2022)

Biodiversity offset requirements

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Figure 6.3

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6.2.6 Mitigation measures

In addition to the biodiversity offset strategy, to further minimise residual impacts to biodiversity values in the study area, the mitigation measures detailed in Table 6.5 will be implemented for the project.

Table 6.5 Biodiversity mitigation measures

ID	Mitigation measures
BIO1	A biodiversity management plan (BMP) will be prepared for the project. The BMP will document the measures to avoid and minimise direct and indirect impacts to ecological values and natural assets.
BIO2	Following construction, species consistent with PCT 80 and PCT 281 will be included in landscaping to increase the floristic and structural diversity of the land.
BIO3	Pre-clearance surveys will be conducted prior to removal of hollow bearing trees to mitigate injury to potential fauna species inhabiting hollows.
BIO4	Hollow logs and debris will be retained to be used post construction. This will improve potential fauna habitat within the indirect impact area and study area.
BIO5	Exclusion fencing ('no go' zones) will be used to avoid indirect impact to retained trees. This includes temporary fencing, bunting tape or similar and signage to protect or avoid habitats to be retained. This will be maintained and checked daily through construction.
BIO6	All workers will be made aware of ecologically sensitive areas and the need to avoid impacts including adjacent native vegetation. This will avoid unintentional impacts to Box Gum woodland, Grey Box woodland and native vegetation.
BIO7	Chemicals and fuel will be managed in accordance with Safe Work Australia guidelines (eg employ use of barriers, inspecting tanks and containers, etc).
BIO8	Appropriate spill containment materials (or spill kits) will be used to clean-up spills if they occur. This will avoid unintentional impacts to Box Gum woodland, Grey Box woodland and native vegetation due to chemical or fuel runoff.
BIO9	Sediment controls, including fencing and sediments traps, will be installed in any areas where works will occur in proximity to waterways to avoid increased sedimentation and erosion of watercourses.
BIO10	Dependent on the weed species and cover in any particular construction area, weeds will be removed prior to clearing. Weeds will be stockpiled appropriately prior to removal from the study area to avoid the spread/introduction of seed and other propagules.
BIO11	Weed hygiene protocols will be put in in place prior to entering the site including wash-down procedures to all plant and machinery. This will avoid weed introduction from outside of the site.
BIO12	Coolatai Grass (*Hyparrhenia hirta*), and St. Johns Wort (*Hypericum perforatum*) are to be managed as per the *Biosecurity Act 2015* and their regional recommended measures (Section 7.3 of BDAR). If any other priority weeds of NSW are identified in the study area during construction, they will be removed from the site.
BIO13	Dust levels will be monitored by visual inspection and dust suppression strategies implemented where required ie wetting down dirt roads or reducing vehicle speeds.

6.2.7 Conclusion

The mitigation actions recommended within the BDAR have been developed in parallel with, and have informed the evolution of, the project design. This process has ensured the avoidance and minimisation of biodiversity constraints as far as practicable. Residual impacts include:

- loss of 76.80 ha of PCT 80 (Western Grey Box – White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion), of which 1.18 ha requires offsetting, and associated habitat for flora and fauna species; and
- loss of 291.91 ha of PCT 281 (Rough-Barked Apple – red gum – Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion), of which 7.45 ha requires offsetting, and associated habitat for flora and fauna species.

ACEN will compensate for these residual impacts through the implementation of a biodiversity offset strategy.

The BDAR has also considered impacts on species and ecological communities listed under the EPBC Act. The project is not expected to result in significant impacts to MNES including threatened ecological communities and species, and migratory species.

6.3 Visual

6.3.1 Introduction

A visual impact assessment (VIA) has been prepared for the project by EMM (2022f) and provided in Appendix G. The VIA has been prepared in accordance with the relevant SEARs, guidelines and policies, and in consultation with the relevant government agencies.

There are no Commonwealth, NSW or local government planning policies, guidelines or standards directly applicable to the VIA, which was therefore prepared with reference to the methods outlined in the following:

- *Draft Large-Scale Solar Energy Guideline* (DPIE 2021a) (the Draft Guideline);
- *Guidelines for Landscape and Visual Impact Assessment Third Edition* (Landscape Institute and Institute of Environmental Management and Assessment 2013) (the GLVIA); and
- *Wind Energy: Visual Assessment Bulletin AB 01 For State significant wind energy development* (DPIE 2016a) (the VA Bulletin).

It is noted that the VA Bulletin specifically relates to assessment of visual impacts of wind farms in NSW; however, a number of the methods for describing visual sensitivity and landscape character are considered to be relevant to this assessment. In the absence of other directly applicable guidelines/standards, the relevant elements from the VA Bulletin have been adopted for this assessment.

6.3.2 Existing environment

The project is in a semi-rural setting, with the wider region characterised by grazing and cropping with scattered rural dwellings and villages, the closest of which is Birriwa. Census data (2016) indicates there are 49 people living in Birriwa, which includes residents in the surrounding area (including the study area). The project is approximately 1.5 km at its closest point from Birriwa village. Dunedoo is the nearest town centre and is 18 km north of Birriwa, by road. The closest town centre to the project within the Mid-Western LGA is Gulgong, some 30 km south of Birriwa.

The main transport infrastructure in the surrounding area comprises the Castlereagh Highway (B55) and the Golden Highway (B84). The Castlereagh Highway runs north-south approximately 1.2 km west of the project at the closest point. The Golden Highway runs east-west approximately 4 km north of the project. There is a rail line connecting Birriwa to Dunedoo to the north and Gulgong to the south. The rail line is approximately 1.5 km west of the project at the closest point.

Much of the development footprint has been extensively cleared of trees and has been highly modified by historic farming practices. The landscape typical of the region is predominantly cleared, open grazing land with scattered groupings of remnant native trees. Existing vegetation is generally found along drainage lines, roadsides and along the perimeter of paddocks and property boundaries.

The project sits within the Dark Sky Region surrounding the Siding Spring Observatory. Developments within this area are required to apply good lighting design principles in accordance with the *Dark Sky Planning Guideline* (DPE 2016b).

i Sensitive receptors

a Rural dwellings

A number of non-associated and associated residences have been identified within and surrounding the study area. The locations of these sensitive receptors (residences) and representative viewpoints considered as part of this assessment are shown on Figure 6.4.

There are four associated residences within or in close proximity to the study area (A2, A4, A6 and A8). There are 21 non-associated residences within 2 km of the study area, many of them in the township of Birriwa, and another 22 between 2 km and 5 km away.

b Heritage items

There are no listed or known historic heritage items within the study area or immediate surrounds.

As mentioned in Section 6.5.3, there are no registered sites on the Aboriginal Heritage Information Management system (AHIMS) within the study area. However, field surveys performed as part of the Aboriginal Cultural Heritage Assessment for the project (OzArk 2022a) identified five previously unrecorded sites within the study area. These sites include two artefact scatters (White Creek OS-1 and Mangarlowe OS-1), two isolated finds (Mangarlowe IF-1 and Mangarlowe IF-2) and one scarred tree (Barneys Reef Road ST-1) (refer to Figure 6.9).

6.3.3 Avoidance and minimisation through design

Development of the project design has included, and will continue to include general measures to minimise the degree of contrast between project infrastructure and the surrounding rural landscape. This is done primarily through careful siting of project elements to take advantage of the topography and existing vegetation.

The scale of the solar panels (up to 4.7 m in height) means that in some cases, visual screens can be used effectively. Vegetation planting along boundaries that border residences and roads offer effective screening.

Views from further away and higher in elevation will benefit more from trees planted within the development footprint. Enhancing the tree canopy along waterways can emphasise the natural landforms and hydrology of the site, reducing the manufacture appearance across the site.

The visual impact of the BESS and associated structures can be minimised by careful selection of materials and colours. Neutral colours that blend in with the surrounding landscape will be used where possible, such as khaki, green, beige or similar.

The project sits within the Dark Sky Region surrounding the Siding Spring Observatory. The detailed design of the project will therefore include the lighting principles as per the requirements of the *Dark Sky Planning Guideline* (DPE 2016b). The project will not impact on the Siding Spring Observatory provided the project lighting follows the Dark Sky Guidelines and AS 4282 Control of obtrusive effects of outdoor lighting.

Glint and glare from the project is not expected to impact on air traffic due to the distance from any aerodrome.

6.3.4 Potential impacts

Table 6.6 details the representative viewpoints which were selected from representative residences and main roadways near the project. The zone of visual influence of the project, which also informed the selection of viewpoints, is provided in Section 5.1 of the VIA. In addition to the viewpoint analysis, the potential impact to all non-associated residences within 2 km of the development footprint (refer to Figure 6.4) was also assessed based on viewshed analyses and the production of photomontages where possible.

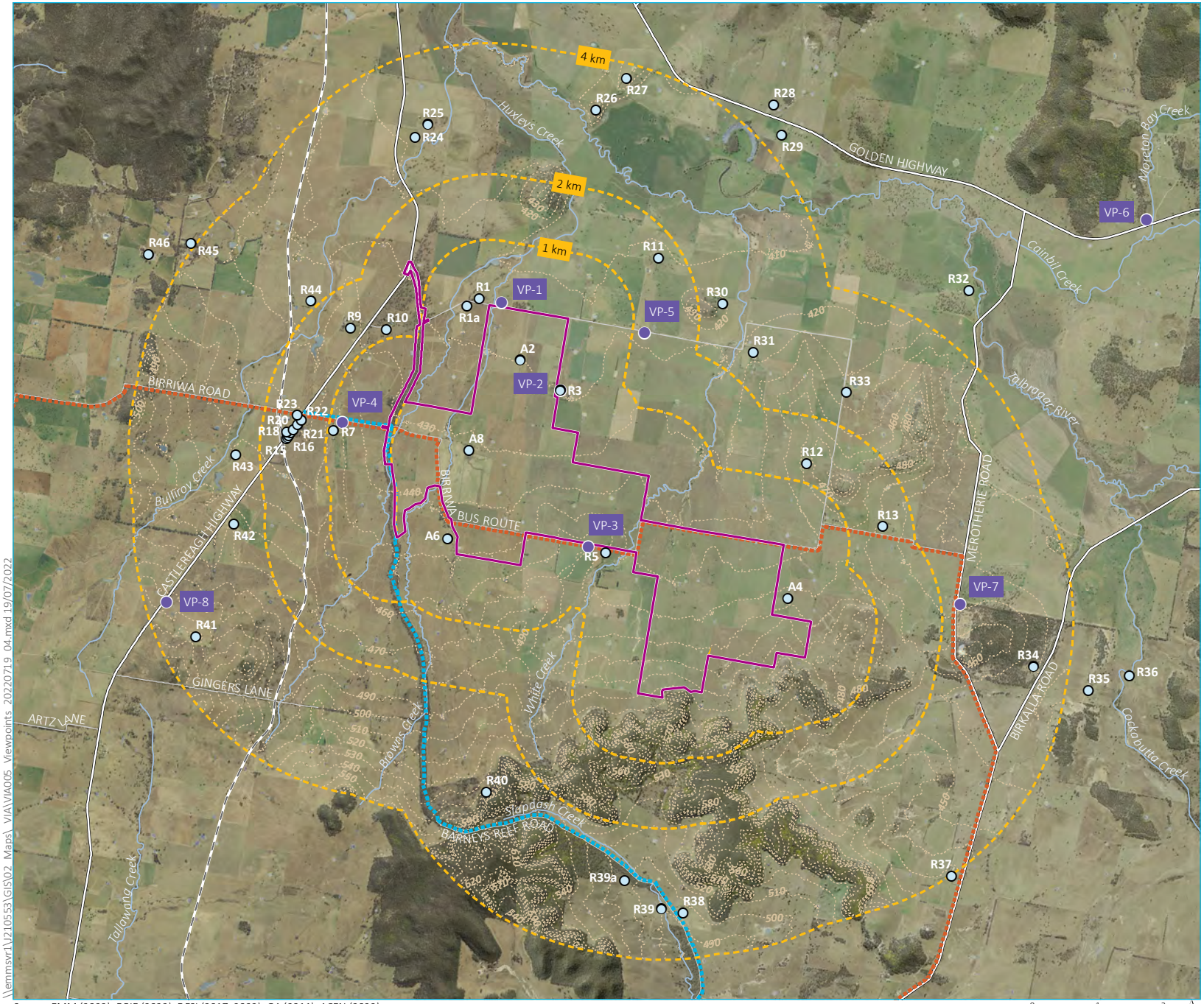
The locations of the eight viewpoints considered as part of the assessment are shown on Figure 6.4, as well as the locations of surrounding residences, and local and regional roads. Figure 6.4 also shows the topographic contours, which demonstrate the undulating nature of the landscape surrounding the project.

Visual assessments were not conducted from the residences associated with the project. Landholder agreements between the landholder and ACEN include acceptance of visual impacts by virtue of being associated with the project.

Table 6.6 Assessed viewpoints and rational for selection

Assessment location	Viewpoint type(s)	Representative receptors	Distance to site *	Rationale for selection
Viewpoint 1 – 261 Birriwa Bus Route North	Dwellings and motorists	R1, R1a, motorists along Birriwa Bus Route North	0.5 km	This view is from Birriwa Bus Route North, which travels along the north boundary of the study area. The view is also representative of views from residences north of the project.
Viewpoint 2 – Receptor R3	Dwelling	R3	0.05 km	This view is from a single residence along the eastern boundary of the development footprint. It is potentially one of the most impacted dwellings in relation to views of the project.
Viewpoint 3 – Birriwa Bus Route South	Dwellings, cyclists and motorists	R5, motorists along Birriwa Bus Route South	0.1 km	This view is from the roadway adjacent to a single dwelling along the southern boundary of the development footprint. Unmitigated, it is potentially one of the most impacted dwellings in relation to views of the project (noting a buffer has been included in the project design to minimise and avoid impacts). This viewpoint is also representative of views experienced by cyclists on the CWCT, which runs along Birriwa Bus Route South.
Viewpoint 4 – 50 Birriwa Bus Route South	Dwelling and cyclists	R7, Motorists along Birriwa Bus Route South	0.9 km	This is the view to the west of the study area. It is representative of potential views from the Birriwa village and dwellings along the Castlereagh Highway. This viewpoint is also representative of views experienced by cyclists on the CWCT, which runs along Birriwa Bus Route South.
Viewpoint 5 – Birriwa Bus Route North	Dwellings and motorists	R11, R30, R31	2.25 km	This is the view from a road north/north-east of the project. It is representative of views from dwellings and locations approximately 1 km from the development footprint.
Viewpoint 6 – Golden Highway	Motorists	Motorists along highway	7.0 km	This represents the typical view from the Golden Highway travelling west with distant views toward the project.
Viewpoint 7 – Merotherie Road	Cyclists and motorists	R13, Motorists along Merotherie Road	2.5 km	This represents the typical view from Merotherie Road, which runs approximately 2 km east of the project. This viewpoint is also representative of views experienced by cyclists on the Central West Cycle Trail, which runs along Birriwa Bus Route South.
Viewpoint 8 – Castlereagh Highway	Motorists	R41, R42, Motorists along Castlereagh Highway	4.0 km	This represents the typical view from the Castlereagh Highway with distant views toward the project.
Central West Cycle Trail	Cyclists	Cyclists	0.02 km	This considers views for cyclists along the length of the CWCT that extends adjacent to the development footprint for 7.5 km.
Birriwa village	Dwellings	R14, R15, R16, R17, R18, R19, R20, R21, R22	1.4 km	This view is from the rural township consisting of residential buildings.

* The distances shown in the table are taken from the development footprint, not specific project elements.



KEY

- Study area
- Viewshed buffer
- Viewpoint location

Existing environment

- Sensitive receptor
- Rail line
- Major road
- Minor road
- Topographic contour (10 m interval)
- Named watercourse
- Waterbody

Central West Cycle (CWC) trail

- CWC main route - Gulgong to Dunedoo
- CWC alternate route - Slap Dash Creek side trail

Source: EMM (2022); DPIE (2022); DFSI (2017, 2022); GA (2011); ACEN (2022)

0 1 2 km

GDA 1994 MGA Zone 55

N

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Viewpoint locations and receptors

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Figure 6.4

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i Construction impacts

Due to their temporary nature, the project establishment works and construction activities are considered unlikely to have any significant visual impacts on passing motorists or nearby receptors. The main temporary visual impacts associated with construction include:

- **Traffic and vehicle movements** – vehicle movements will be a daily occurrence during construction with most traffic into the development footprint expected from the north (Dunedoo and the Golden and Castlereagh Highways). Access to the project will be via Barneys Reef Road, which leaves the Castlereagh Highway some 2.7 km north of the Birriwa village. The residences most likely to be affected are the residences at R10, R1 and R7, due to their proximity to Barneys Reef Road and the entry to the development footprint. However, due to topography and vegetation, visual impacts from traffic are not expected at these locations. As construction work proceeds, vehicles may be visible along internal access tracks.

- **Temporary laydown area** – the laydown area for the project during construction will be located east of the vegetated watercourse, as shown in Figure 3.1. A second, smaller laydown area for road upgrades may be located near the intersection of the Castlereagh Highway and Barneys Reef Road. This may be visible from the highway, but it will be a short-term impact.

- **Machinery installing solar panels** – as construction progresses, machinery movement will be visible in various locations across the development footprint. While the activity will be contained within the development footprint, movement of vehicles and any dust generated will attract the human eye and may seem more noticeable. This is due to the human eye and its response to movement.

- **Construction of BESS enclosure and buildings** – the BESS compound will be made up of many components, including battery enclosure units, inverters, transformers, ventilation systems and fire protection systems. Construction of the BESS will include ground-levelling, cabling and installation of standalone racks, shipping containers or dedicated use buildings. The BESS will be adjacent to the substation within one of two proposed operational infrastructure areas and will be housed within either outdoor standalone racks, shipping containers or dedicated use buildings. The specific design details for the BESS and their respective enclosure types have not been confirmed.

Motorists travelling along the local road network will also experience views of the development footprint during construction. It is assumed the focus of these motorists will be in line with their direction of travel along the affected road corridors, minimising their views into the development footprint.

As the project establishment works and construction activities are unlikely to have any significant visual impacts, landscaping is not proposed to mitigate visual impacts during the construction stage of the project.

ii Operation impacts

To determine the potential visibility of project infrastructure, a viewpoint analysis study was performed. This used GIS data to simulate the visibility of the project from a specific viewing location. In addition, viewshed analyses and the production of photomontages (where possible) were used to assess potential visual amenity impacts to all residences within 2 km of the development footprint.

The identification of visual impacts from the project did not rely solely on GIS data analysis and electronic modelling. Field work and photographic evidence was also used to examine the human experience of the visual changes proposed.

The results of the analysis are summarised in Table 6.7 and Table 6.8, and shown in Plate 6.1 to Plate 6.6.

Table 6.7 Summary of visual impacts during the operational phase

Viewpoint	Distance to study area	Representative receptors	Residential or public	Project infrastructure visible based on viewshed analysis	Magnitude of change	Visual sensitivity	Visual impact rating	Significant impact	Mitigation proposed	Visual impact rating after mitigation	Potential for cumulative impacts
Viewpoint analysis											
Viewpoint 1	550 m	R1, R1a and motorists	Residential and public	Yes	Moderate	Low	**Low**	No	None	**Low**	No
Viewpoint 2	50 m	R3	Residential	Yes	High	Low	**Moderate**	Yes	Screen planting and vegetation retention	**Low**	No
Viewpoint 3a	65 m	Cyclists and motorists	Public	Yes	High	Low	**Moderate**	Yes	Screen planting along Birriwa Bus Route South	**Low**	No
Viewpoint 3b	65 m	R5, cyclists and motorists	Residential and public	Yes	High	Low	**Moderate**	Yes	Screen planting to residence	**Low**	No
Viewpoint 4	900 m	R7, Cyclists and motorists	Residential and public	Yes	Moderate	Low	**Low**	No	None	**Low**	No
Viewpoint 5	2.25 km	R11, R30, R31 and motorists	Residential and public	Yes	Moderate	Low	**Low**	No	None	**Low**	No
Viewpoint 6	6.8 km	Motorists	Public	Yes	Low	Low	**Low**	No	None	**Low**	No
Viewpoint 7	2.5 km	R13, cyclists and Motorists	Public	Yes	Low	Low	**Low**	No	None	**Low**	Yes
Viewpoint 8	3.8 km	Motorists	Public	Yes	Low	Low	**Low**	No	None	**Low**	Yes
Central West Cycle Trail	20 m	Cyclists	Public	NA	High	Low	**Moderate**	Yes	Screen planting along Birriwa Bus Route South	**Low**	Yes

Table 6.7 Summary of visual impacts during the operational phase

Viewpoint	Distance to study area	Representative receptors	Residential or public	Project infrastructure visible based on viewshed analysis	Magnitude of change	Visual sensitivity	Visual impact rating	Significant impact	Mitigation proposed	Visual impact rating after mitigation	Potential for cumulative impacts
Birriwa village	1.6 km	R14, R15, R16, R17, R18, R19, R20, R21, R22, R23, cyclists and motorists	Residential and public	NA	Low	Low	**Low**	No	None	Low	No
Residences within 1km of the development footprint											
R3	55 m	R3	Residential		High	Low	**Moderate**		Screen planning is proposed along the development footprint boundary to reduce the potential visual impact. Retaining existing trees within the development footprint, near the residence, will provide screening.	**Low**	No
R5	250 m	R5	Residential		High	Low	**Moderate**		Additional mitigation measures such as screen planting within the property may be considered in a separate agreement.	**Low**	No

Table 6.7 Summary of visual impacts during the operational phase

Viewpoint	Distance to study area	Representative receptors	Residential or public	Project infrastructure visible based on viewshed analysis	Magnitude of change	Visual sensitivity	Visual impact rating	Significant impact	Mitigation proposed	Visual impact rating after mitigation	Potential for cumulative impacts
R7	910 m	R7	Residential	Yes	Moderate	Moderate	**Moderate**	No	Screen planting could be considered at residence depending on outcome of consultation, as part of a separate agreement	**Low**	No
R9	1.4 km	R9	Residential	Yes	Low	Low	**Low**	No	None	**Low**	No
R10	1.12 km	R10	Residential	Yes	Low	Low	**Low**	No	None	**Low**	No
R11	1.7 km	R11	Residential	Yes	High	Low	**Moderate**	No	Screen planting could be provided at residence depending on outcome of consultation	**Low**	No
R12	1.26 km	R12	Residential	Yes	High	Low	**Moderate**	No	Screen planting could be provided at residence depending on outcome of consultation	**Low**	No
Residences between 1 km and 2 km of the development footprint											
R13	1.52 km	R13	Residential	Yes	Low	Low	**Low**	No	None	**Low**	No
R14	1.68 km	R14	Residential	Yes	Low	Low	**Low**	No	None	**Low**	No
R15	1.59 km	R15	Residential	Yes	Low	Low	**Low**	No	None	**Low**	No

Table 6.7 Summary of visual impacts during the operational phase

Viewpoint	Distance to study area	Representative receptors	Residential or public	Project infrastructure visible based on viewshed analysis	Magnitude of change	Visual sensitivity	Visual impact rating	Significant impact	Mitigation proposed	Visual impact rating after mitigation	Potential for cumulative impacts
R16	1.58 km	R16	Residential	Yes	Low	Low	**Low**	No	None	**Low**	No
R17	1.56 km	R17	Residential	Yes	Low	Low	**Low**	No	None	**Low**	No
R18	1.60 km	R18	Residential	Yes	Low	Low	**Low**	No	None	**Low**	No
R19	1.53 km	R19	Residential	Yes	Low	Low	**Low**	No	None	**Low**	No
R20	1.50 km	R20	Residential	Yes	Low	Low	**Low**	No	None	**Low**	No
R21	1.46 km	R21	Residential	Yes	Low	Low	**Low**	No	None	**Low**	No
R22	1.42 km	R22	Residential	Yes	Low	Low	**Low**	No	None	**Low**	No
R23	1.48 km	R23	Residential	Yes	Low	Low	**Low**	No	None	**Low**	No

Table 6.8 Summary notes on potential visual impacts

Viewpoint	Potential visual impacts
Viewpoint 1	From this location, the development footprint is located east and south. Views are screened by a low rise and the long grass in the foreground. The development footprint sits on the hills beyond the visible tree line. Some distant views of the project components may be visible on the lower slopes of Barneys Reef.
Viewpoint 2	From this location, the project is located to the west of the viewer. Views of the project components may be visible to the west and south of the dwelling, with potential distant views toward the south along Barneys Reef.
Viewpoint 3a	The project infrastructure will be close to the road and therefore visible in the foreground with the land sloping down away from this viewpoint.
Viewpoint 3b	Distant views may be available over the tree line to project infrastructure located 1 km away or more.

Table 6.8 Summary notes on potential visual impacts

Viewpoint	Potential visual impacts
Viewpoint 4	Project infrastructure may be visible above the tree line located along Barneys Reef Road. PV arrays will stretch from Barneys Reef Road toward the south-east and along the base of Barneys Reef. From this location, the existing trees screen views into the closest portions of the development footprint.
Viewpoint 5	Views of the project infrastructure may be visible along distant slopes (2.25 km). PV arrays will stretch along the base of Barneys Reef and may be visible in the distance.
Viewpoint 6	Views of the project infrastructure may be visible along distant slopes (8 km away). PV arrays located at the base of Barneys Reef may be visible in the distance.
Viewpoint 7	Views of the project components may be visible along the ridge line, with the development footprint beyond the hill and out of sight.
Viewpoint 8	Views of the project components may be visible in the distance. PV arrays will be located beyond the dominant tree line 3.8 km away. This location also has the potential for cumulative impacts. The western-most wind turbines proposed for the Barneys Reef Wind Farm may be visible from this portion of the Castlereagh Highway.
Central West Cycle Trail	The project infrastructure will be close to the road and therefore visible in the foreground. However, there are roadside trees along most of Birriwa Bus Route South. Only 2.3 km of the distance is not screened by roadside trees. This 7.5 km portion of the CWCT is part of a 58 km section of trail running between Gulgong and Dunedoo. The estimated time spent on this section of the CWCT is 20–30 minutes, whereas the time on the 58 km section is estimated at 3–3.5 hours. The relative time spent with views of the project is relatively short. The CWCT also has potential for cumulative impacts since the Barneys Reef Wind Farm has proposed wind turbine locations southeast of the project. Travelling south, cyclists will leave the project and come into view of the wind farm.
Birriwa village	The project elements are not visible from locations in Birriwa Village.

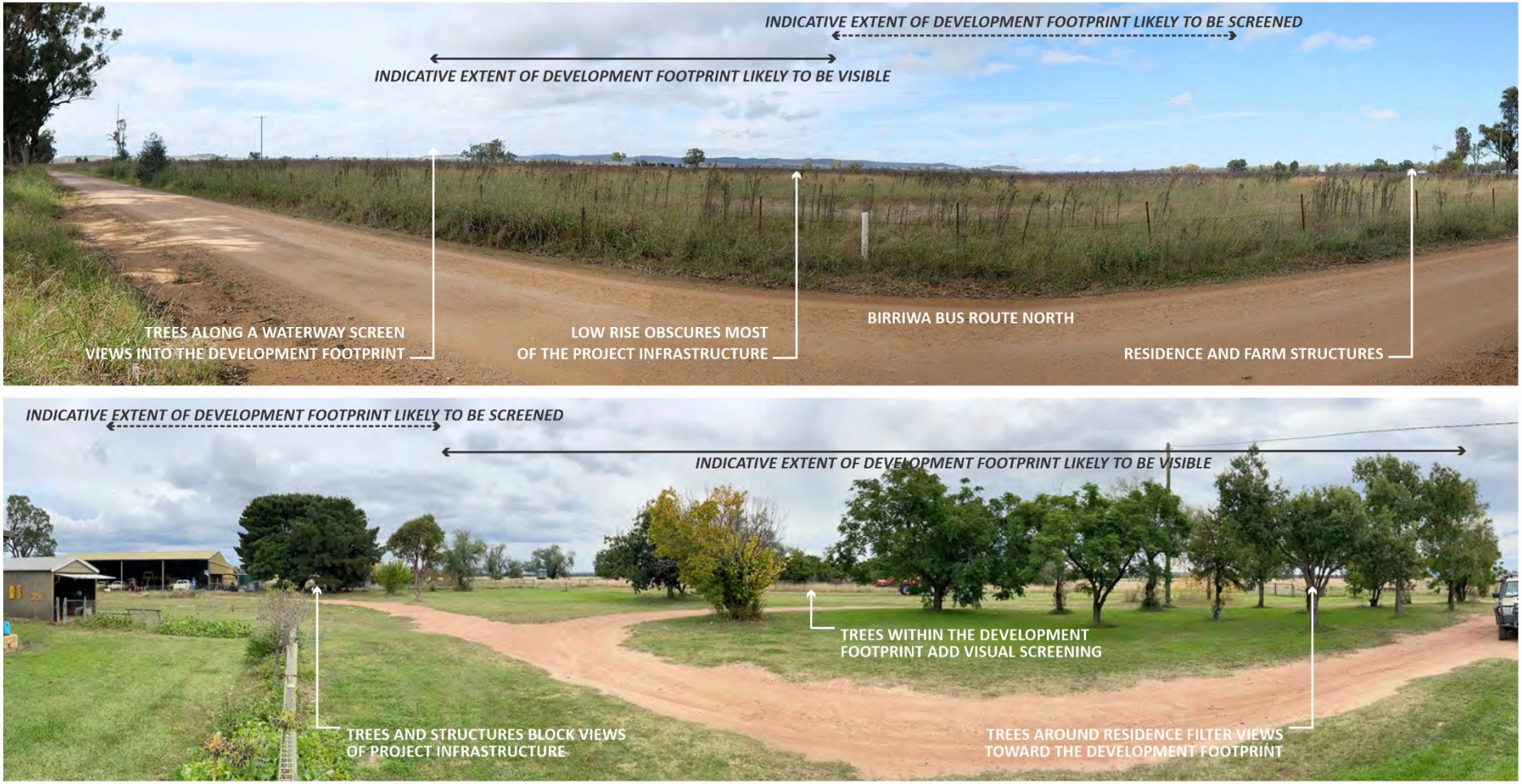


Plate 6.1 **Viewpoint 1 (261 Birriwa Bus Route North) and viewpoint 2 (receptor R3)**

Plate 6.2 **Viewpoint 3a (Birriwa Bus Route South) and 3b (Birriwa Bus Route South and R5)**

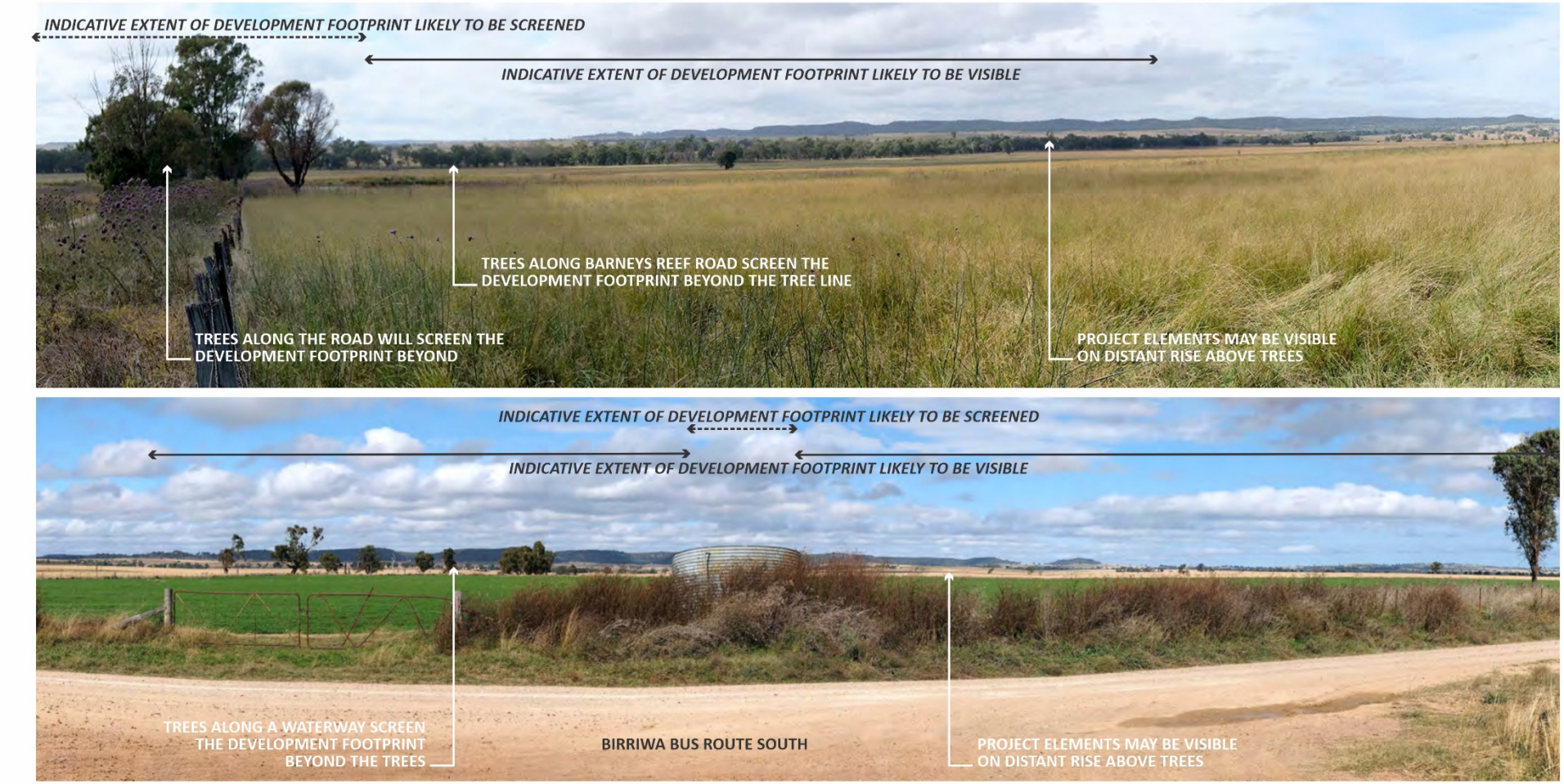


Plate 6.3 **Viewpoint 4 (Birriwa Bus Route South) and viewpoint 5 (Birriwa Bus Route North)**

Plate 6.4 **Viewpoint 6 (Golden Highway) and viewpoint 7 (Merotherie Road)**

Plate 6.5 **Viewpoint 8 (Castlereagh Highway) and the Central West Cycle Trail**

Plate 6.6 Birriwa village

iii Reflectivity and glare

The potential impacts of sunlight reflecting off the proposed project elements are glint and glare impacts.

With regard to reflected light, trackers will be used to maximise the sunlight absorbed by the solar panels. The trackers are designed to keep the panel perpendicular to the sun. It can therefore be assumed that the sunlight will reflect perpendicular to the cell and directly back toward the sun. At times when the tracking system has reached the limit of its tracking range, the angle of incidence moves from perpendicular and the light that is reflected is expected to reflect up and away from the ground. Given that the tracking stops when the panel is 60° from horizontal, the reflection will be at a minimum of 30° above the horizon.

The glare analysis was performed using specialised software (ForgeSolar). Glare impacts were assessed against visual receptors at surrounding residence locations, Castlereagh Highway, the railway, Golden Highway, Merotherie Road, Birriwa Bus Route North and Birriwa Bus Route South (Central West Cycle Trail).

The software calculates the minutes of potential glare on visual receptors every day through the course of a year. The results indicate the number of minutes a receptor may receive along with the type of glare. The classifications of glare from the software are:

- Green glare – glare is present with only a low potential for temporary after-image or flash blindness;
- Yellow glare – glare has a moderate potential for temporary after-image or flash blindness; and
- Red glare – glare with high potential for permanent eye damage.

Table 6.9 details the results of the glare analysis.

Table 6.9 Glare analysis results

Location	Location name assigned by software	Glare from solar arrays		Glare from BESS structures	
		Green glare (minutes	Yellow glare (minutes)	Green glare (minutes)	Yellow glare (minutes)
R1, R1a	OP: OP 1	0	0	17	0
R3	OP: OP 2	0	0	137	0
R5	OP: OP 3	0	0	77	0
R7	OP: OP 4	0	0	30	0
R9	OP: OP 22	0	0	35	0
R10	OP: OP 20	0	0	52	0
R11	OP: OP 5	0	0	0	0
R12	OP: OP 8	0	0	0	0
R13	OP: OP 9	0	0	0	93
R14 and Birriwa Village	OP: OP 13-19	0	0	35	0
R30	OP: OP 6	0	0	0	0
R31	OP: OP 7	0	0	0	0
Castlereagh Highway	ROUTE: Castlereagh Highway	0	0	0	0

Table 6.9 Glare analysis results

Location	Location name assigned by software	Glare from solar arrays		Glare from BESS structures	
		Green glare (minutes	Yellow glare (minutes)	Green glare (minutes)	Yellow glare (minutes)
Golden Highway	ROUTE: Golden Highway	0	0	0	0
Railway	ROUTE: Railway	0	0	209	0
Merotherie Road	ROUTE: Merotherie Rd	0	0	204	0
Birriwa Bus Route North	ROUTE: Birriwa Bus Route North	0	0	40	0
Birriwa Bus Route South (Central West Cycle Trail)	ROUTE: Birriwa Bus Route South – Cycle Trail	7872	0	5,801	14,669

Based on the glare analysis, the risk of glint and glare related impacts experienced by receptors as a result of the project is limited.

The glare from the solar arrays is limited in location and intensity. As indicated in Table 6.9, there is a potential for green glare for 7,872 minutes along Birriwa Bus Route South over the course of the year. The glare is limited to approximately 400 m of the road at the top of a rise. The predicted glare occurs between 8.00 am and 9.30 am during the months of April, May, July and August as well as between 1.30 pm–3.00 pm during June.

The potential glare from the BESS structures is also limited in location, but more intense. It should be noted that this estimate is conservative because both Option A and Option B locations for the BESS structures have been included in the glare analysis, whereas only one option will be chosen and installed if the project is approved and goes to construction. Further, the designs of the BESS infrastructure have yet to be finalised. Nevertheless, glare from the BESS structures is most intense along the roadway adjacent to the structures. Most of this glare is predicted to occur along Birriwa Bus Route South (Central West Cycle Trail). There is, therefore, the potential to impact residences located east of the BESS locations as well as motorists and cyclists traveling west in the morning. It should be noted that there is only one residence east of the Option A location (R5) that may be affected, and one non-associated residence east of Option B location (R13) that may be affected.

In the evening residences located west of the BESS locations will be similarly affected along with motorists and cyclists travelling east. The only non-associated residences west of the Option A location are along Castlereagh Highway and Birriwa Village, which are 2.9 km from the glare source. There is only one residence west of Option B locations that may be affected. With the refinement in the design of the BESS infrastructure and choice of location finalised, the amount of potential glare is expected to substantially decrease.

Given the parameters of reflection and the movement of the solar panels, there are limited locations surrounding the site where glint or glare from the solar arrays are geometrically possible. Based on the glare analysis, glint and glare from the project infrastructure is not expected to significantly impact the following:

- residences within the vicinity of the development footprint;
- people engaged in agricultural activities in the surrounding landscape;
- motorists travelling along the local road network;
- motorists travelling along a number of minor, unsealed rural property access roads and farm tracks;

- cyclists riding along the CWCT, which runs along Birriwa Bus Route South; and
- aircraft arriving at or departing from local airfields (Dunedoo, Dunedoo Hospital).

Note that users of Birriwa Bus Route South may experience low levels of glare from the solar arrays and may experience low levels of glare from the BESS enclosures.

6.3.5 Mitigation measures

Table 6.10 outlines the mitigation measures applicable to landscape character and visual amenity which will be implemented as part of the project.

Table 6.10 Landscape character and visual mitigation measures

ID	Mitigation measures
VIS1	Mitigation measures will be undertaken in accordance with Table 5.2 and Table 5.3 of the VIA.
VIS2	Landscape planting will be undertaken in accordance with the Landscape Plan (Figure 6.1 of VIA).
VIS3	Laydown areas will be located in areas with limited visibility from residences and public roads.
VIS4	Clearing and trimming of vegetation will be kept to a minimum.
VIS5	Finishes and products that minimise or eliminate surface glare will be selected as part of design. Neutral colours that blend in with the surrounding landscape ie khaki, green, beige, or similar, will also be selected, where possible.
VIS6	The principles of the *Dark Sky Planning Guideline* will be implemented in the detailed project design.

6.3.6 Conclusion

As described in Section 2.2, the project location was carefully selected based on a number of factors, making it suitable for the development of the project. In relation to visual amenity, these factors included the location of residences and other sensitive local features, the positioning of regional and local roads and potential impacts on passing motorists, local topography and presence of vegetation with potential to provide screening.

The VIA (Appendix G) determined that infrastructure may be visible to varying degrees from the viewpoints assessed. Based on variable elevation and undulation in the landscape and the presence of vegetation, combined with the height of the solar arrays, the assessment predicts:

- a low visual impact from viewpoints 1, 4, 5, 6, 7, 8 and Birriwa Village;
- a moderate visual impact from viewpoints 2 (R3) and 3 as well as the CWCT; and
- no viewpoint locations will experience a high impact rating.

In addition to the viewpoint assessments, each resident within 2 km of the development footprint was assessed for visual impacts. The assessment for residences predicts:

- a low visual impact from R1, R1a, R9, R10, and R13 – R23 (inclusive);
- a moderate visual impact from R3, R5, R7, R11 and R12; and
- no residences with a high impact rating.

Landscape screening is proposed to mitigate visual impacts at the following locations, as illustrated in the project layout figure (refer to Figure 3.1):

- screen planting approximately 800 m long along the development footprint boundary at the north-west corner of the study area adjacent to Birriwa Bus Route North, R1 and R1a;
- tree planting along the northern side of Birriwa Bus Route South from viewpoint 3 (along the CWC trail) extending approximately 1 km; and
- screen planting along the development footprint boundary at R3, comprising approximately 350 m of screening along the boundary.

Additional mitigation measures such as screen planting within properties may be considered in a separate agreement with landholders at R5, R7, R11 and R12.

The results of the glint and glare assessment indicate that low levels of glare may be experienced along approximately 400 m of Birriwa Bus Route South (Central West Cycle Trail) for short periods during the winter.

Night lighting is not expected to impact receptors as all night lighting would be inwardly focused and shielded so it does not result in light spill impacts to neighbouring properties or the *Dark Sky Planning Guideline*.

6.4 Traffic and transport

6.4.1 Introduction

A traffic impact assessment (TIA) has been prepared for the project by EMM (2022e) and is provided in Appendix H. The TIA has been prepared in accordance with the NSW Government's (RTA) *Guide to Traffic Generating Developments* (2002). The relevant SEARs and how they are addressed are summarised in Appendix A and Chapter 1.2 of the TIA.

6.4.2 Existing environment

i Site access

The study area can be accessed via the Castlereagh Highway, Barneys Reef Road and Birriwa Bus Route South, as shown in Figure 6.5.

ii Road network

An overview of the surrounding road network and traffic characteristics is presented in Figure 6.5.

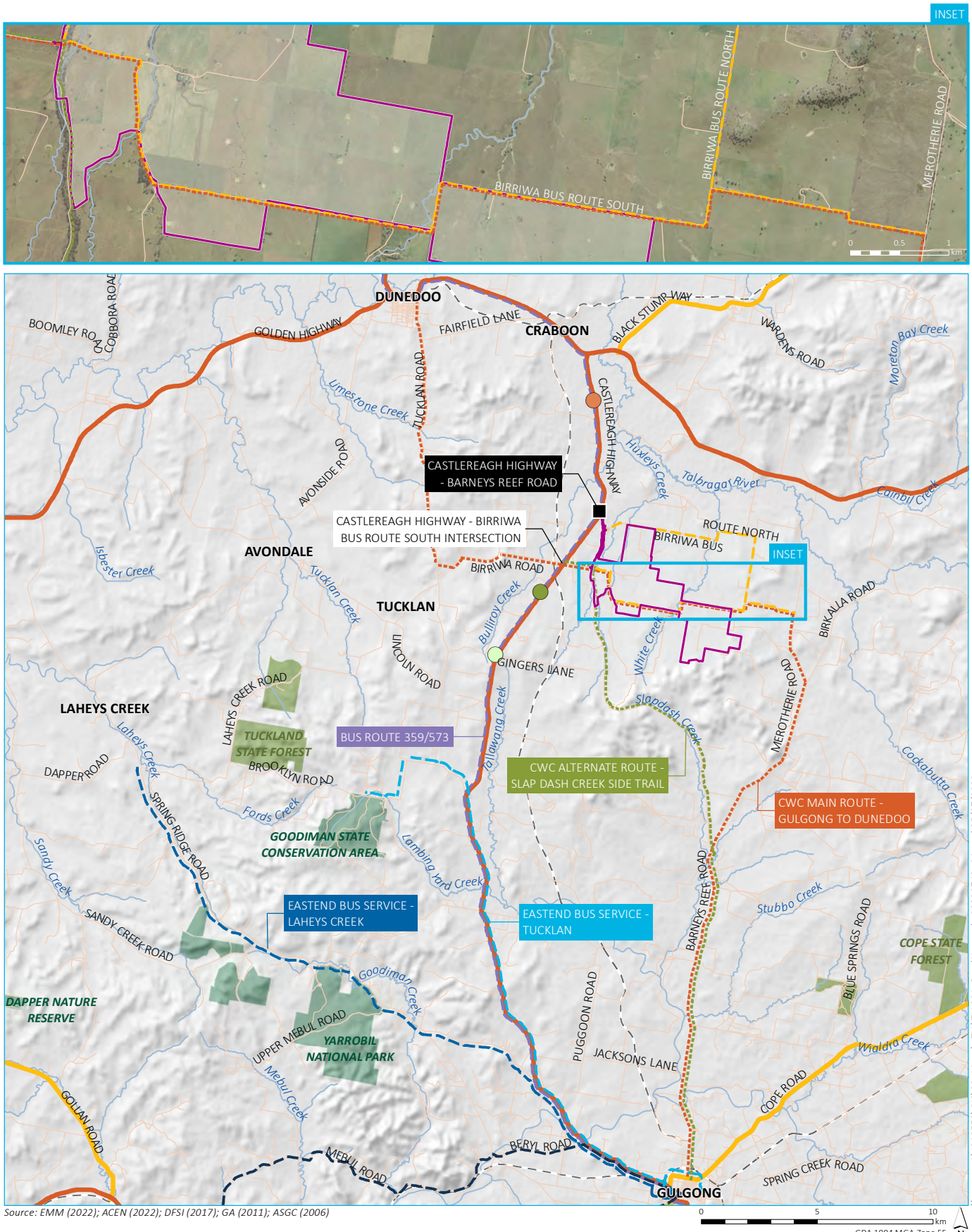
Key roads in the vicinity of the project include:

- Castlereagh Highway – a State road which starts at the Great Western Highway in Lithgow and extends to the Carnarvon Highway in St George in Queensland. The Castlereagh Highway is a sealed road which generally runs north-south and is one lane each way. It is approximately 7 m wide at its intersection with Barneys Reef Road and 6.2 m wide at its intersection with Birriwa Bus Route South, with 1 m wide shoulders on both sides. The posted speed limit is 80 km/h at intersection with Birriwa Bus Route South and 100 km/h at intersection with Barneys Reef Road. The Castlereagh Highway is approved for 26 m B-doubles.

- Barneys Reef Road – a local road which extends between the Castlereagh Highway in Birriwa and Tallawang Street in Gulgong. It generally runs north-south and has one lane each way in its section between Castlereagh Highway and Birriwa Bus Route South. Barneys Reef Road is sealed for the first 80 m from the Castlereagh Highway and south of Merotherie Road and unsealed for the rest of the route. It is approximately 6 m wide and the default speed limit is 100 km/h. It is approved for heavy vehicles up to 19 m long under 50 tonnes.

- Birriwa Bus Route South – a local road which extends between the Castlereagh Highway and Merotherie Road. Birriwa Bus Route South is an unsealed road and is approximately 5 m wide. The default speed limit is currently 100 km/h and heavy vehicles up to 19 m long under 50 tonnes are approved to use Birriwa Bus Route South.

The project will be accessed via Barneys Reef Road, off the Castlereagh Highway. The Castlereagh Highway/Barneys Reef Road intersection has a wide geometry and complies with current Basic Right Turn (BAR) and Basic Left Turn (BAL) standards. The Castlereagh Highway/Birriwa Bus Route South intersection has narrow geometry and does not comply with current BAR and BAL standards.



Source: EMM (2022); ACEN (2022); DFSI (2017); GA (2011); ASGC (2006)

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KEY

- Study area
- Rail line
- Named watercourse
- NPWS reserve
- State forest
- Intersection assessed in the TIA

Degree of crash (site vicinity only)

- Serious Injury
- Minor/Other Injury
- Non-casualty (towaway)

NSW classified road

- State road
- Regional road
- Local road

Bus route - public

- Bus route 359/573

Eastend Bus Service - school

- Goolma
- Laheys Creek
- Tucklan

Hodgen's Bus Service - school

- Dunedoo (approximate route)

Central West Cycle (CWC) trail

- CWC main route - Gulgong to Dunedoo
- CWC alternate route - Slap Dash Creek side trail

Road network and traffic characteristics

Birriwa Solar and Battery Project
Environmental Impact Statement
Figure 6.5

EMM creating opportunities

iii Existing traffic volumes

The Castlereagh Highway/Barneys Reef Road and Castlereagh Highway/Birriwa Bus Route South were surveyed between 7.00 am and 9.00 am, as well as between 4.00 pm and 6.00 pm, from 7 to 9 December 2021.

The survey results indicate that the peak hours are:

- Castlereagh Highway/Barneys Reef Road:
    - AM peak hour: 8.00 am to 9.00 am; and
    - PM peak hour: 4.00 pm to 5.00 pm;
- Castlereagh Highway/Birriwa Bus Route South:
    - AM peak hour: 8.00 am to 9.00 am; and
    - PM peak hour: 4.15 pm to 5.15 pm.

The surveyed traffic volumes during the AM and PM peak hours are summarised in Figure 6.6.

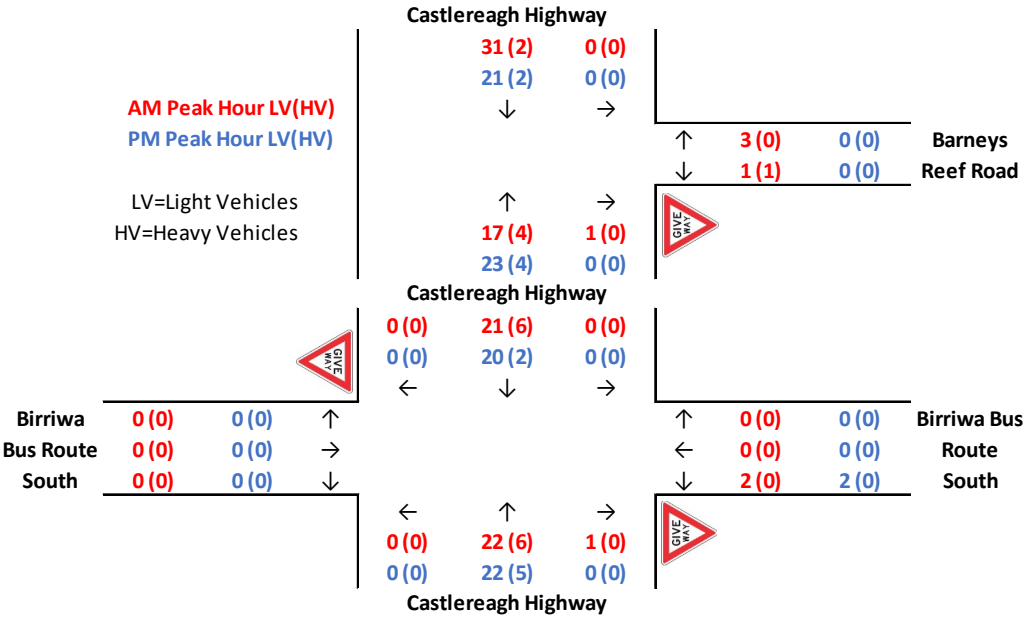


Figure 6.6 Existing AM and PM peak hourly traffic volumes

iv Crash analysis

Three crashes have been recorded in the last five years in the vicinity of the study area on the Castlereagh Highway. The nearest crash occurred in 2016 on the Castlereagh Highway, 1.5 km south of Birriwa Bus Route South. The crash resulted in minor/other injury and involved trucks. There were no fatal incidents.

This overall crash rate is considered low over the five-year period, which indicates there are no current road safety issues affecting the identified access roads for the project.

v Public transport

There are NSW TrainLink coach services which travel along the Castlereagh Highway. Several school bus routes also operate along the highway, which are operated by Eastend Bus Service. Hodgen's Bus Service (Dunedoo) operates a service along Barneys Reef Road, Birriwa Bus Route South and Birriwa Bus Route North providing student transport to local schools in Dunedoo.

There are no train stations in close proximity of the study area. The Gwabegar railway line which has a level crossing on the Castlereagh Highway near Birriwa is not in use by passenger trains but may occasionally be used by freight trains.

vi Active transport

The site passes through the CWCT. This cycling trail is 400 km long and generally follows quiet tracks, away from the traffic. Birriwa forms part of the Gulgong to Dunedoo track which is approximately 50 to 60 km long.

The cycle trail overlaps Castlereagh Highway for a short section between Birriwa Bus Route South and Birriwa Road. There are two routes at the vicinity of the site. The main and alternative cycle trail routes are shown in Figure 6.5.

The alternative route of the cycle trail intersects with the project access route only at the Barneys Reef Road and Birriwa Bus Route South intersection which predominantly follows Slapdash Creek to the south.

There are no pedestrian facilities in the vicinity of the study area due to the rural nature of the area.

vii Parking

There are no formal parking facilities in the vicinity of the study area given the rural nature of the area.

6.4.3 Potential impacts

i Traffic generation and distribution

Construction traffic for the project will consist of light vehicles transporting construction staff, heavy vehicles for various construction activities and OSOM vehicles for deliveries of transformers and other major equipment.

It is anticipated that construction staff will be arriving to the site in a combination of light vehicles and shuttle buses from Mudgee, Gulgong, Dunedoo, Dubbo, other areas of NSW and some from outside of NSW, as presented in Table 6.11.

Table 6.11 Estimated construction staff source locations and light vehicle and shuttle bus splits

Workforce sourcing assumptions	Workforce	% Total workforce	Travelling by light vehicles	Travelling by shuttle buses
MWRC LGA (Gulgong/Mudgee)	160	20%	80	80
Warrumbungle LGA (Dunedoo)	80	10%	80	-
Dubbo Regional Council LGA (Dubbo)	200	25%	200	-
Other areas of NSW	280	35%	140	140
Outside of NSW	80	10%	40	40
Total workforce	**800**	**100%**	**540**	**260**

During the peak stages of construction, there will be up to 135 heavy vehicle trips per day. Heavy vehicle trips will be spread throughout the construction hours during the day. It is assumed that up to 10% of heavy vehicle trips will occur during the peak hour.

A total of 40 OSOM vehicle trips are expected to take place during the 28 month construction period, with a maximum of 1 OSOM vehicle delivery (round trip) per day.

Details of estimated daily and peak hourly construction vehicle trips are presented in Table 6.12.

Table 6.12 Estimated daily and peak hourly construction trips

Peak construction stage	Daily		Peak hour	
	Trips[1]	Movements	Trips	Movements
Light vehicles	360	720	360	360[2]
Shuttle buses	13	26	13	13[2]
Heavy vehicles	120	240	14	28
Total	**493**	**986**	**387**	**401**

Note:

1. A 'trip' is defined as a vehicle entering the site once (1 movement) and a vehicle exiting the site once (1 movement)
2. Light vehicle and shuttle bus movements will be incoming during morning and outgoing during evening peak hours

In relation to traffic distribution, as per Table 6.12, it is expected that approximately 65% of the light vehicle traffic will be coming from the south (Mudgee and Gulgong) and the remaining 35% from the north (Dunedoo and Dubbo). All shuttle buses will be coming from the south (Mudgee and Gulgong). It is expected the majority of heavy vehicle deliveries will come from the port of Newcastle via the Golden Highway, with some also from Sydney via the Castlereagh Highway.

The expected project traffic volumes during the AM and PM peak hours are summarised in Figure 6.7 and the combined existing + project traffic volumes shown in Figure 6.8.

The operational traffic generation will be significantly lower than during project construction. Hence operational traffic impacts were not considered further by the TIA.

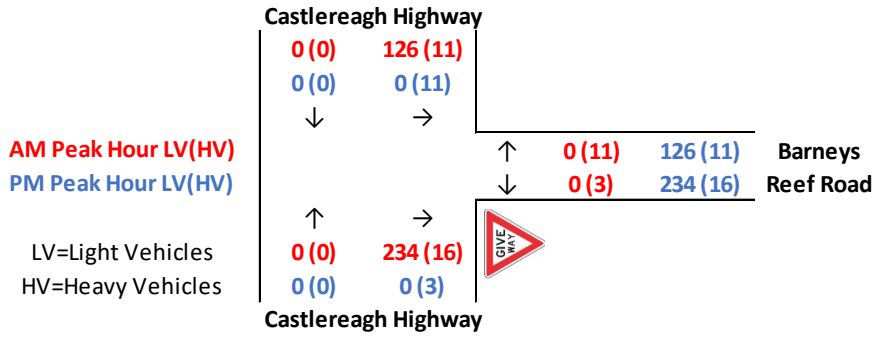


Figure 6.7 Project AM and PM peak hourly traffic volumes

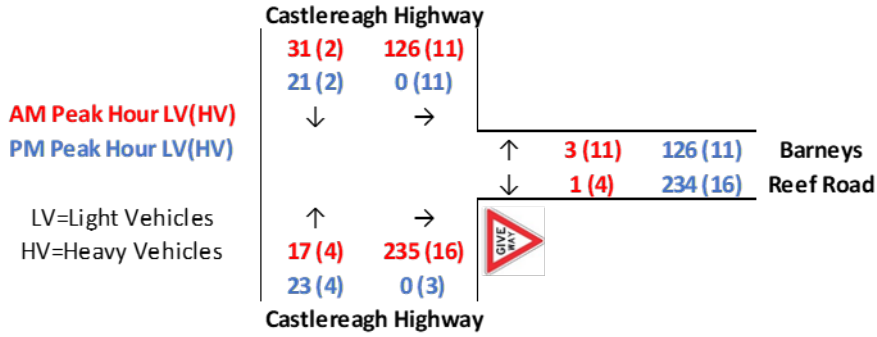


Figure 6.8 Existing + project AM and PM peak hourly traffic volumes

ii Intersection performance

The Castlereagh Highway/Barneys Reef Road intersection has been modelled with the SIDRA Intersection 9.0 software; a micro-analytical tool for individual intersections and linked intersection-network modelling. SIDRA provides the following performance indicators:

- Degree of saturation (DOS) – the total usage of the intersection expressed as a factor of 1 with 1 representing 100% use/saturation (eg 0.8 = 80% saturation). In practice the target degrees of saturation of 0.90 for signals, 0.85 for roundabouts and 0.80 for unsignalised intersections are generally agreed to.
- Average delay (DEL) – the average delay in seconds encountered by all vehicles passing through the intersection.
- Level of service (LOS) – this is a categorisation of average delay and is a good indicator of overall performance for individual intersections.
- 95% queue lengths (Q95) – is defined to be the queue length in metres that has only a 5% probability of being exceeded during the analysed time period.

SIDRA modelling was conducted for the following scenarios:

1. Existing – surveyed traffic volumes only.
2. Existing + project – combined surveyed and project traffic volumes.
3. Cumulative – includes combined existing, project and nearby development traffic.

SIDRA results are provided in Appendix H.

Table 6.13 SIDRA modelling result for Castlereagh Highway/Barneys Reef Road intersection

Control scenarios	AM Peak					PM Peak				
Priority controlled	**Intersection volume**	**DEL(s)**	**LOS**	**DOS**	**Q95 in m (approach)**	**Intersection volume**	**DEL(s)**	**LOS**	**DOS**	**Q95 in m (approach)**
Existing	61	5.9	A	0.018	0.11 (east approach)	54	5.6	A	0.016	0.0
Existing + project	461	9.6	A	0.181	6.8 (south approach)	451	6.9	A	0.278	9.7 east approach)
Cumulative	608	11.5	A	0.219	8.6 (south approach)	598	7.1	A	0.301	10.4 (east approach)

Key findings include:

- in AM and PM, the intersection performs satisfactorily within capacity with LOS A (ie good operation) and DOS < 0.3 for all scenarios; and
- in the highest traffic (cumulative impacts) scenario, the intersection still has approximately 70% additional capacity after accommodating the additional traffic generated by all the proposed project development considered herein.

iii Mid-block capacity analysis

The mid-block level of service on rural and urban roads is assessed based on a vehicle's average travel speed.

Based on existing data, the two-way traffic volumes for the Castlereagh Highway are less than 100 vehicles per hour in both the AM and PM peaks. Hence, the Castlereagh Highway is understood to currently operate at LOS B or better.

In the existing + project scenario, two-way traffic volumes for the Castlereagh Highway are anticipated to be approximately 450 vehicles per hour with 10% heavy vehicles in both the AM and PM peaks. Hence, the Castlereagh Highway is expected to operate at LOS B generally during the existing + project traffic scenario.

In the cumulative scenario, two-way traffic volumes for the Castlereagh Highway are expected to be approximately 600 vehicles per hour with 12% heavy vehicles in both the AM and PM peaks. Hence, the Castlereagh Highway is expected to operate at LOS C during the cumulative construction traffic scenario.

Overall, the Castlereagh Highway as part of the major road network will still be able to efficiently cater for the additional vehicular traffic generated by the project and other nearby developments.

iv Road safety assessment for Castlereagh Highway and Barneys Reef Road

The Castlereagh Highway has a speed limit of 100km/h near the Barneys Reef Road intersection and therefore, a presumed design speed of 110 km/hr is considered. In accordance with *Austroads Guide to Road Design Part 4A (Unsignalised and Signalised Intersections)* (Austroads 2017), for a road with a design speed of 110 km/h, the minimum SISD required for a general minimum 2 second driver reaction time is 285 m.

The sight distances on Barneys Reef Road at Castlereagh Highway have been estimated based on the line of sight. Based on the sight distance analysis, the sight distances to the left (400 m) and to the right (850 m) meet the minimum requirement (285 m) as stipulated in Austroads (2017).

v Intersection operation

Intersection operations are assessed from a combination of the peak hourly through and turning traffic movements that occur at each intersection.

The assessment found that, in accordance with current design standards (Austroads 2017), the following turn treatments will be required for the project construction traffic access at the Castlereagh Highway/Barneys Reef intersection:

- the existing left lane turn treatment (BAL) will continue to be adequate for the existing + project scenario for left turning traffic from the Castlereagh Highway southbound to Barneys Reef Road; and
- a channelised right turn treatment (CHR) will be required for the existing + project and cumulative scenario for right turning traffic from the Castlereagh Highway northbound to Barneys Reef Road.

When cumulative impacts are considered with other proposed developments in the area (ie the proposed Tallawang Solar and Barneys Reef Wind Farm), an auxiliary left lane turn treatment (AUL) may also be required for left turning traffic from the Castlereagh Highway southbound to Barneys Reef Road. However, it is noted that this is based on preliminary available information and will need to be refined when the construction timeframe is confirmed for the three projects, if approved.

vi Road corridor upgrade

To accommodate the construction traffic movements associated with the project, an upgrade of Barneys Reef Road and Birriwa Bus Route South along the project access route will be required. A preliminary concept plan has been prepared in this regard (Appendix C), in consultation with Mid-Western Regional Council and Warrumbungle Shire Council. To minimise the impacts on native vegetation triggered from upgrade works along this road corridor, it has been agreed with Council that speed limits will be reduced to 80 km/hr (and potentially further for all construction traffic, to be defined in a Traffic Management Plan prior to road upgrades and project construction) along Barneys Reef Road.

vii Impact on rail corridor and railway crossings

The Gwabegar railway report is occasionally used by freight trains. There will be limited impact on the railway line due to low frequency of the trains. Railway crossing protection in terms of railway crossing signs and flashing lights are already present at the Castlereagh Highway railway crossing for construction traffic crossing during the construction period.

viii Impact on public transport, pedestrians and cyclists

There are school bus routes passing along Castlereagh Highway and Birriwa Bus Route South. The potential impacts on school buses associated with construction of the project will be limited to heavy vehicles only as construction staff travelling in light vehicles will be arriving and departing from the site outside of school bus operating hours. Potential impacts from heavy vehicles will be limited as the majority (75%) of the heavy vehicles will be travelling from the north towards the project.

As discussed in Section 6.4.2v, there are no pedestrian facilities due to the rural location of this site.

6.4.4 Mitigation measures

Table 6.14 summarises the mitigation measures to be implemented in relation to traffic and transport for the project.

Table 6.14 Traffic and transport mitigation measures

ID	Mitigation measures
TT1	A channelised right turn treatment (CHR) will be installed at the Castlereagh Highway/Barneys Reef Road intersection northbound approach.
TT2	Resurfacing and widening will be completed on Barneys Reef Road and Birriwa Bus Route South in compliance with Austroads rural roads design standards, and in further consultation with relevant authorities during subsequent phases of project design and assessment.
TT3	A detailed construction traffic management plan (CTMP) will be developed in consultation with TfNSW, Mid-Western Regional Council and Warrumbungle Shire Council to the satisfaction of the Secretary, prior to the commencement of road upgrades and construction of the project. The CTMP is expected to be required in the Development Consent and to include a Driver Code of Conduct addressing: • informing drivers about the school bus routes along Castlereagh Highway; • direction to avoid compression braking near residential receptors; • direction to avoid trips during school zone times (8.00 am–9.20 pm and 2.30 pm–4.00 pm); • in consultation with relevant councils and road authorities, install school bus signs at suitable locations along construction routes if necessary to warn heavy vehicle drivers of student drop-off and pick-up areas; and • responding to local climate conditions that may affect road safety such as fog, dust and wet weather. The CTMP will be prepared by suitably qualified persons in accordance with the TfNSW (2022) *Traffic Control at Work Sites Manual*.
TT4	If practicable, the portion of the CWCT within the study area will be safely separated during the two year construction period onto an approximately 2 m dust lane in accordance with relevant cycling guidelines and standards and in consultation with the CWCT Inc. In addition to the above following measures will be implemented: • in consultation with the CWC Trail Inc, a signage plan will be prepared, highlighting the CWCT within and in the vicinity of the project; • within the site induction and driver's code of conduct, the CWCT will be highlighted to increase awareness of cyclists' presence in the area; and • any site-specific circumstance eg peak construction activities, a traffic controller may be required to manage the vehicular traffic and cyclists which is subject to site supervisor's safety assessment and discretion.
TT5	A permit will be obtained (from NHVR) to allow oversize or overmass vehicles to use the road network as part of construction.
TT6	ACEN will design up to three public road crossings to Mid-Western Regional Council's satisfaction, generally in accordance with the design considerations approved at the traffic committee on 17 June 2022.
TT7	A road maintenance program will be developed in consultation with the relevant road authorities to be undertaken during construction and will include route inspections of all the affected local roads. Any new road pavement damage which occurs to these roads during the project construction period from construction activities, which represent a potential traffic safety risk to the travelling public, will be restored to their pre-construction condition at the completion of construction.

6.4.5 Conclusion

The project will be accessed via Barneys Reef Road and Birriwa Bus Route South, off the Castlereagh Highway.

Up to 493 peak daily and 387 peak hourly vehicle trips are anticipated throughout the construction phase of the project. Construction vehicles will include light vehicles and shuttle buses transporting workers, along with heavy vehicles for deliveries.

The impact of project-related vehicles on the key intersection of the Castlereagh Highway and Barneys Reef Road has been assessed. SIDRA modelling results showed that the LOS will remain good at LOS A and will have approximately 70% spare capacity to accommodate any additional traffic. Sight distance towards the left and right at the Castlereagh Highway/Barneys Reef Road intersection currently meets the minimum requirement as stipulated in the Austroads (2017).

Upgrades to the local roads along the site access route will be required to accommodate the increase in traffic associated with the construction phase. These upgrades will be applied to the Castlereagh Highway/Barneys Reef Road intersection and to Barneys Reef Road/Birriwa Bus Route South as follows:

- an Austroads Type CHR right turn treatment on the Castlereagh Highway at the Castlereagh Highway/Barneys Reef Road intersection will be required on the northbound approach; and
- road upgrading such as resurfacing and widening along Barneys Reef Road and Birriwa Bus Route will be required. A preliminary concept plan has been prepared in consultation with Mid-Western Regional Council.

A CTMP, including a Driver Code of Conduct, will be prepared prior to commencement of road upgrades and project construction, which will incorporate traffic measures to be implemented throughout the project's construction period.

6.5 Aboriginal heritage

6.5.1 Introduction

An Aboriginal cultural heritage assessment (ACHA) has been prepared for the project by OzArk and is provided in Appendix I.

The ACHA documents the results of archaeological investigations undertaken to identify the extent and significance of any physical remains and intangible values of past Aboriginal visitation, use and occupation within the development footprint.

The ACHA was prepared in general accordance with the *Code of Practice for Archaeological Investigation in NSW* (DECCW 2010) and guided by the *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in New South Wales* (OEH 2011). The relevant SEARs and how they have been addressed, are summarised in Appendix A and Section 2.1.2.3 of the ACHA (Appendix I).

A summary of the Aboriginal consultation, existing environment, impact assessment and mitigation measures are provided in this section.

6.5.2 Consultation

OzArk undertook consultation in accordance with the *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (DECCW 2010), which included the stages described below.

i Stage 1 — notification and registration of Aboriginal parties

The aim of Stage 1 is to identify the Aboriginal parties who wish to be consulted about the project.

Relevant government agencies were contacted and asked to provide a list of Aboriginal parties to contact in relation to the project, including Heritage NSW, Mudgee Local Aboriginal Land Council (LALC), MWRC, Mudgee Local Land Services, Office of the Registrar NSW *Aboriginal Land Rights Act 1983*, and National Native Title Service Services Corporation Ltd.

A notification was placed in the Mudgee Guardian on 3 September 2021 detailing the project name, proponent, location, description and a request for Aboriginal knowledge holders to register interest in the project.

Nine Aboriginal parties subsequently registered their interest in the project (ie registered Aboriginal parties (RAPs)):

- Paul Brydon;
- Woka Aboriginal Corporation;
- Mudgee LALC;
- Murong Gialinga Aboriginal & Torres Strait Islander Corporation;
- Warrabinga Native Title Claimants Aboriginal Corporation;
- Wellington Valley Wiradjuri Aboriginal Corporation (WVWAC);
- North-Eastern Wiradjuri;
- Gallanggabang Aboriginal Corporation; and
- [name withheld, referred to ‘Stakeholder 1’ in the ACHA].

ii Stages 2 and 3 – presentation of information and gathering cultural information

OzArk issued a letter to all RAPs which included an overview of the project and the proposed assessment methods. One response was received, from the WVWAC, stating they agreed with the document in principle; however, requested increased survey coverage if possible, where exposures or possible cultural sensitivity areas are identified. OzArk agreed that spacing between surveyors would be decreased if areas of exposure were present.

iii Stage 4 – review of draft Aboriginal cultural heritage assessment

A draft version of the ACHA, which included all background information, results, draft significance assessments and draft management recommendations, was issued to all RAPs for review. WVWAC provided feedback on the draft ACHA on 12 May 2022 and a second response on 26 May 2022. OzArk provided responses to WVWAC on 26 and 30 May 2022. The feedback and responses are provided in full in Appendix 1 of the ACHA (OzArk 2022a, Appendix I). A response was also received from Stakeholder 1 on 20 May 2022, noting that they agreed with the draft ACHA. No other responses were received from the RAPs.

6.5.3 Existing environment

The environmental characteristics of an area influenced the way Aboriginal people used the landscape. Understanding these environmental factors assists with predicting where Aboriginal sites are likely to occur. Additionally, natural and cultural (human-made) site formation processes that occur after the deposition of archaeological material influence the way archaeological material is distributed and preserved across a landscape.

i Topography and hydrology

Gentle slope and flat landforms dominate the study area and would have been hospitable to Aboriginal people. Relative to surrounding landscapes, the study area does not contain features such as a permanent water supply or shelter that are most likely to encourage substantial Aboriginal occupation of the landscape.

The Talbragar River is the closest permanent watercourse to the study area (approximately 3 km north). Several drainage lines intersect the study area in a general north–south direction, including Huxleys Creek, Browns Creek and White Creek, as well as associated tributaries.

ii Geology and soils

The geology of the study area is predominately undulating and low hills with granite outcropping as tors and sloping pavements. Soils within the study area consist primarily of siliceous sands.

iii Vegetation and land use

The study area has been disturbed by past land clearing for agricultural purposes and is now generally dominated by exotic pasture with isolated areas of native vegetation, mostly along drainage lines. Livestock grazing and cultivation are currently the primary land uses within the study area.

iv Ethno-history

The study area is within the territory of people belonging to the Wiradjuri tribal and linguistic group. The Wiradjuri is one of the largest language groups within NSW. While the area was noted to have a single basic language, various dialects could be found throughout the region. Within the Wiradjuri region, the presence of Aboriginal people has been dated to 40,000 years ago.

v Archaeological context

A search of the AHIMS register identified 86 Aboriginal sites within a 10 km x 10 km area centred on the study area. There are no previously recorded sites within the study area. There are no sites in the study area currently or previously listed on the Commonwealth Heritage List or the National Heritage List.

One Native Title Claim covers the study area, Warrabinga-Wiradjuri #7 (NC2018/002, NSD857/2017). This native title claim covers an area from Dunedoo to Lithgow.

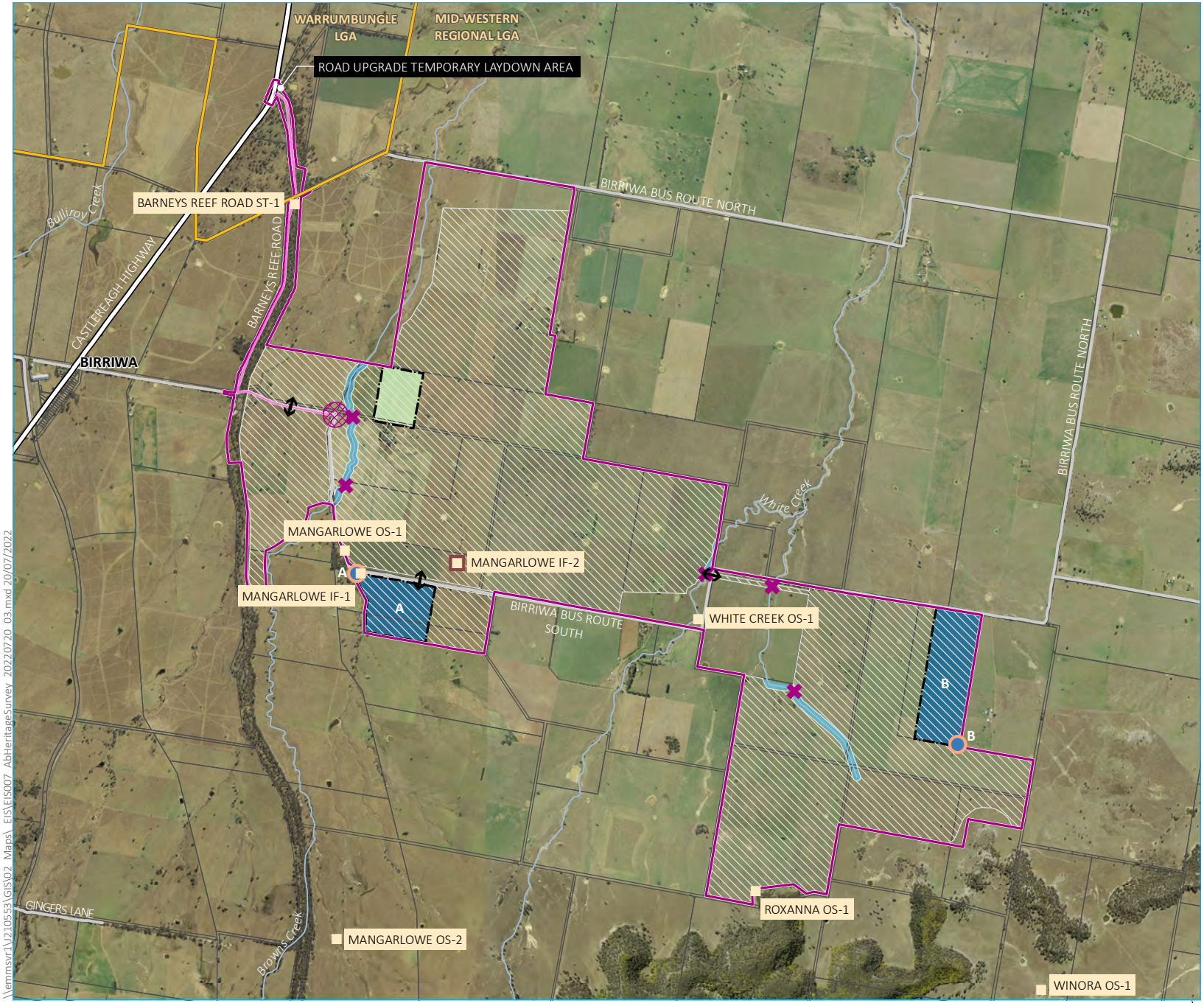
a Field survey

A field survey of the study area and surrounds was undertaken by OzArk with the assistance of RAP site officers and was completed over eight days. To offset the lack of visibility during field surveys (due to dense ground cover), the assessment also relied on an examination of the archaeological potential of the landforms present, which were broken into three survey units (drainages, flats and gentle slopes). The low survey efficacy on the flats and gentle slopes did not prevent the archaeological potential of these landforms being understood.

Eight Aboriginal sites were identified during the field survey (shown on Figure 6.9), five of which are within the study area:

- within the study area:
    - White Creek OS-1 (artefact scatter with potential archaeological deposit (PAD));
    - Mangarlowe OS-1 (artefact scatter);
    - Mangarlowe IF-1 (isolated find);
    - Mangarlowe IF-2 (isolated find); and
    - Barneys Reef Road ST-1 (scarred tree).
- outside of the study area:
    - Mangarlowe OS-2 (artefact scatter);
    - Roxanna OS-1 (artefact scatter); and
    - Winora OS-1 (artefact scatter).

The dominant site type recorded was low-density stone artefact sites (predominantly consisting of unmodified flakes) and the dominant raw material was quartz with small quantities of basalt, quartzite, silcrete, mudstone and volcanic materials also identified. Six of the recorded sites were within 200 m of an ephemeral drainage line.



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Source: EMM (2022); DFSI (2017, 2022); GA (2011); ACEN (2022)

Aboriginal cultural heritge field survey results

Birriwa Solar and Battery Project
Environmental Impact Statement
Figure 6.9

EMM
creating opportunities

Table 6.15 provides a summary of the significance assessment for Aboriginal sites recorded during the field survey.

Table 6.15 Significance assessment for identified Aboriginal sites

Site name	Social or cultural value	Archaeological/scientific value	Aesthetic value	Historic value
Within the study area				
White Creek OS-1	High	Low-moderate	Low	Nil
Mangarlowe OS-1 (site 4)	High	Low	Low	Nil
Mangarlowe IF-1 (site 3)	High	Low	Low	Nil
Mangarlowe IF-2 (site 2)	High	Low	Low	Nil
Barneys Reef Road ST-1 (site 5)	High	Low	Low	Nil
Outside study area				
Mangarlowe OS-2 (site 6)	High	Low	Low	Nil
Roxanna OS-1 (site 7)	High	Low	Low	Nil
Winora OS-1 (site 8)	High	Low	Low	Nil

The survey findings align with the regional archaeological context, which indicated that the landforms within the study area would have low archaeological potential and the most likely site types to be recorded would be isolated finds, low-density artefact scatters or scarred trees. The type of artefacts, the raw materials they are manufactured from and the range of tool types identified does not present a unique or distinguishing paradigm to the archaeological context that has been established in the region.

Given the nature of the landforms within the study area (ie generally undifferentiated and with widespread disturbances), no landforms were considered to have potential subsurface archaeological deposits of conservation value. The exception is the area of PAD associated with White Creek OS-1, which will not be impacted by the project. As such, test excavation within the study area was not warranted.

6.5.4 Avoidance and minimisation through design

Of the eight Aboriginal sites identified during the field survey, three are outside of the study area and will not be impacted as part of the project. Based on the outcomes of the field survey, ACEN refined the development footprint to avoid impacts to a further four Aboriginal sites (White Creek OS-1, Mangarlowe OS-1, Barneys Reef Road ST-1 and Mangarlowe IF-1). Therefore, impacts to seven Aboriginal sites have been avoided.

6.5.5 Potential impacts

Impacts to Aboriginal sites are summarised in Table 6.16. Only one Aboriginal site, Mangarlowe IF-2, will be directly impacted by the project.

Table 6.16 Level of impact on identified Aboriginal sites

Site name	Type of harm (direct, indirect or none)	Degree of harm (total, partial or none)	Consequence of harm (total, partial or no loss of value
White Creek OS-1	None	None	No loss of value.
Mangarlowe OS-1	None	None	No loss of value.
Mangarlowe OS-2	None	None	No loss of value.
Roxanna OS-1	None	None	No loss of value.
Winora OS-1	None	None	No loss of value.
Mangarlowe IF-1	None	None	No loss of value.
Mangarlowe IF-2	Direct	Total	Total loss of value.
Barneys Reef Road ST-1	None	None	No loss of value.

6.5.6 Mitigation measures

Table 6.17 outlines the mitigation measures applicable to Aboriginal heritage.

Table 6.17 Aboriginal heritage mitigation measures

ID	Mitigation measures
AH1	Prior to commencement of construction, an ACHMP will be developed in consultation with DPE, the RAPs and Heritage NSW.
AH2	During construction, temporary fencing will be installed around sites identified in the study area in the vicinity of the development footprint (Mangarlowe OS-1 and Mangarlowe IF-1) and the location of all known sites will be shown on appropriate plans to ensure that they are not inadvertently harmed.
AH3	One Aboriginal site, Mangarlowe IF-2, will be salvaged prior to the commencement of construction. The methodology for collection of this site will be finalised as part of the ACHMP.
AH4	In the event of discovery of new Aboriginal sites within the study area, the procedure detailed in Section 9.3.1 of the ACHA (Appendix I) will be followed. In the event that newly identified sites will be impacted by the construction of the project and cannot be avoided, they will be managed in a manner commensurate with their assessed significance.

6.5.7 Conclusion

There are no AHIMS registered Aboriginal heritage sites within the study area. Field surveys performed as part of the ACHA identified four previously unrecorded sites within the study area.

Avoidance of Aboriginal cultural heritage values has been a key aspect of the project refinement process. Subsequently, only one Aboriginal site, Mangarlowe IF-2, will be impacted by the project, and will be collected prior to commencement of construction.

An ACHMP will be developed for the project in consultation with DPE, RAPs and Heritage NSW. The ACHMP will detail the management of known Aboriginal sites and mitigation measures to further avoid impacts to Aboriginal heritage values in the study area, along with unanticipated finds procedures and training and reporting protocols.

6.6 Hazard and risk

6.6.1 Introduction

A preliminary hazard analysis (PHA) has been prepared for the project by Sherpa Consulting and is provided in Appendix J.

The PHA summarises potential hazards and risks associated with the project and details management measures which, when implemented, will reduce these hazards and risks to acceptable levels. The PHA considered all hazards and risks associated with the project including battery enclosures and electrical conversion systems (eg inverters and transformers), the on-site substation, transmission line connection infrastructure and ancillary infrastructure.

The relevant requirements of the SEARs and how they are addressed, are summarised in Appendix J. The PHA was prepared in accordance with the following guidelines:

- *Hazardous Industry Planning Advisory Paper No 6 – Guidelines for Hazard Analysis* (DoP 2011a) (HIPAP 6);
- *Assessment Guideline – Multi-level Risk Assessment* (DoP 2011b) (Multi-level Risk Assessment Guideline);
- *Hazardous Industry Planning Advisory Paper No 4 – Risk Criteria for Land Use Safety Planning* (DoP 2011c) (HIPAP 4);
- Review of *AS/NZS 5139:2019 Electrical installations – Safety of battery systems for use with power conversion equipment*;
- The *Hazardous and Offensive Development Application Guidelines: Applying SEPP 33* (DoP 2011d) (Hazardous and Offensive Development Guideline); and
- *Guidelines for limiting exposure to Time-varying Electric, Magnetic and Electromagnetic Fields* (International Commission on Non-Ionizing Radiation Projection (ICNIRP) 2010).

i Preliminary risk screening

The SEARs for the project required a PHA to be undertaken, irrespective of the outcomes of a risk screening process, which is typically undertaken first to determine if a development is potentially hazardous or offensive. However, a preliminary risk screening (including transport of dangerous goods) has been undertaken for the project to satisfy the request from TfNSW in their assessment recommendations provided to DPE.

a Potentially offensive development

Potentially offensive industry is where in the absence of safeguards and controls, the project could 'emit a polluting discharge that could cause a significant level of offence'. Examples of this may include depositional dust, or operational noise impacts on adjacent residents or land uses.

The Resilience and Hazards SEPP 2021 defines potentially offensive industry as:

> a development for the purposes of an industry which, if the development were to operate without employing any measures (including, for example, isolation from existing or likely future development on other land) to reduce or minimise its impact in the locality or on the existing or likely future development on other land, would emit a polluting discharge (including for example, noise) in a manner which would have a significant adverse impact in the locality or on the existing or likely future development on other land, and includes an offensive industry and an offensive storage establishment.

The minimum test for a 'potentially offensive industry' is based on two factors:

1. Does the proposal require a licence under any pollution control legislation?

2. If a pollution control instrument is not required, will the proposal cause any offence having regard to the sensitivity of the receiving environment?

Granting of a licence by the EPA is sufficient to demonstrate that emissions can be effectively managed and, therefore, a project is unlikely to be offensive. However, the project is not a 'scheduled activity' under the POEO Act and an EPL is not required.

In addition, with respect to point 2 above, the project will not cause any offensive emissions resulting from dust, odour, surface water run-off and noise during operation. During construction, any potential impacts resulting from emissions to air, land and waterways will be controlled via environmental mitigation and management. These measures, included in this EIS, have been designed to respond to the specific impacts predicted and the sensitivity of the receiving environment to ensure that impacts are avoided altogether, minimised or ameliorated to below any level of significance.

As such, the project is unlikely to qualify as offensive development under the Resilience and Hazards SEPP.

b Potentially hazardous development

The Resilience and Hazards SEPP defines potentially hazardous industry as:

> a development for the purposes of an industry which, if the development were to operate without employing any measures (including, for example, isolation from existing or likely future development on other land) to reduce or minimise its impact in the locality or on the existing or likely future development on other land, would pose a significant risk in relation to the locality:
>
> (a) to human health, life or property; or
>
> (b) to the biophysical environment, and:
>
> includes a hazardous industry and a hazardous storage establishment.

The risk screening process in the *Hazardous and Offensive Development Guideline* considers the type and quantity of hazardous materials to be stored on site, distance of the storage area to the nearest site boundary, as well as the expected number of transport movements. 'Hazardous materials' are defined within the *Hazardous and Offensive Development Guideline* as substances that fall within the classification of the Australian Dangerous Goods Code (ADGC), ie have a Dangerous Goods (DG) classification.

Risk screening is undertaken by comparing the storage quantity and the number of road movements of the hazardous materials with the screening threshold specified in the *Hazardous and Offensive Development Guideline*. The screening threshold presents the quantities which it can be assumed that significant off-site risk is unlikely.

A review of the expected types and quantities of hazardous materials to be transported to-and-from the project, as well as stored or handled within the development footprint, identified that none of the relevant screening thresholds will be exceeded. This included consideration of liquified petroleum gas (LPG), refrigerant, gasoline, diesel and batteries that may be housed within the BESS (refer to Table 6.18 and Table 6.19).

Table 6.18 Risk Screening Summary - Storage

Material/usage	DG Class	Category	Project storage (tonne)	SEPP threshold (tonne)	Exceed threshold?
Liquefied Petroleum Gas (LPG)	2.1	Flammable gas	9.5	For above ground storage, the screening threshold is 10 tonnes.	No
Refrigerant	2.2	Non-flammable Non-toxic gas	10	No threshold identified based on the SEPP and excluded from risk screening. Class 2.2 are not considered to be potentially hazardous with respect to offsite risk.	N/A
Gasoline	3 PG II	Flammable liquids	5	Above 5 tonne triggering above 'sensitive' threshold.	No
Diesel	C1	Combustible liquids	17 (20,000 litres)	No threshold identified based on SEPP 33. Diesel will be stored in different location/bund to other flammables (eg, gasoline), hence it is not considered to be potentially hazardous based on the SEPP and excluded from risk screening.	N/A
BESS battery	9	Miscellaneous dangerous goods	4,800	No threshold identified based on SEPP 33 and excluded from risk screening. Class 9 is not classified as potentially hazardous material as per the SEPP.	N/A PHA undertaken

Table 6.19 Risk Screening Summary - Transport

Material/usage	DG Class	Category	Vehicle movements		Minimum quantity per load (tonne)		Exceed threshold?
			Cumulative annual	Peek Weekly	Bulk	Packages	
Liquefied Petroleum Gas (LPG)	2.1	Flammable gas	>500	>30	2	5	Threshold will not be exceeded. Movements are expected to occur during construction only.
Refrigerant	2.2	Non-flammable Non-toxic gas	-	--	-	-	No threshold identified based on the SEPP and excluded from risk screening.
Gasoline	3 PG II	Flammable liquids	>750	>45	3	10	Threshold will not be exceeded. Movements are expected to occur mainly during construction and commissioning. Number of movements will be lower for operation.
Diesel	C1	Combustible liquids	-	-	-	-	No threshold identified based on the SEPP and excluded from risk screening.
BESS battery	9	Miscellaneous dangerous goods	>1,000	>60	No limit	-	Threshold will not be exceeded. Movements are expected to occur during construction/commissioning only and will be less than the threshold level. Minimal movement expected during operation and maintenance (eg battery replacement).

Other materials considered as part of the risk screening include:

- transformer oil – not classified as hazardous material and excluded from risk screening; and
- MCPA (2-methyl-4-chlorophenoxyacetic acid) (for use as herbicide/pesticide) – not classified as hazardous material and excluded from risk screening.

These materials will not be stored with other flammable materials and hence are not considered to be potentially hazardous.

Appendix 2 of the *Hazardous and Offensive Development Guideline* outlines other risk factors for consideration to identify hazards outside the scope of the risk screening method. A review of these risk factors identified that the project would not involve:

- storage or transport of incompatible materials (ie hazardous and non-hazardous) – hazardous materials will be stored in dedicated areas and storage protocols in accordance with standard and guidelines will be followed;
- generation of hazardous waste;
- possible generation of dusts within confined areas;
- type of activities involving hazardous materials with potential to cause significant offsite impacts;
- incompatible, reactive or unstable materials and process conditions that could lead to uncontrolled reaction or decomposition;
- storage or processing operations involving high (or extremely low) temperature and/or pressures; or
- hazardous materials and processes with known past incidents (or near misses) that resulted in significant offsite impacts at similar solar farm developments.

Appendix 3 of the *Hazardous and Offensive Development Guideline* provides a list of industries that may be potentially hazardous and potentially offensive. It is noted that this list is illustrative rather than exhaustive. The current edition of the guideline does not include solar projects or power generation facilities in the example industry listings that may be considered as potentially hazardous.

The risk screening assessment concluded:

- the storage and transport of hazardous materials for the project will not exceed the relevant risk screening thresholds;
- there is no other risk factor identified that could result in significant offsite impacts; and
- the project is not considered as 'potentially hazardous' with respect to storage and transportation within the meaning of the Resilience and Hazards SEPP. Notwithstanding, to satisfy the SEARs issued for the project, a PHA focussed on the operation of the BESS has been prepared, as discussed in this chapter.

6.6.2 Preliminary hazard analysis

i Nearest receptors

In operation, the project will occupy an area of approximately 1,330 ha within a rural landholding currently occupied by vacant paddocks and scattered rural residences. From the operational areas associated with the project (the BESS compound Option A/B, and on-site substation), an associated residence (A6) is approximately 150 m west of BESS Option A, and an associated residence (A4) is approximately 195 m east of BESS Option B. The closest non-associated residence (R12) is approximately 1.3 km north of BESS Option B; and the closest non-associated residence (R5) is approximately 1.7 km east of Option B.

The nearest non-associated residence is approximately 60 m from the closest development footprint boundary (R3).

ii Hazard identification and risk analysis

Potential hazards associated with operation of the project were identified through a hazard identification process involving a review of controls detailed in the brochures, product specification and fire safety design documents for prospective technology providers. Further, a literature review of past incidents involving similar BESS systems and previous risk assessments for similar BESS systems was completed by Sherpa, along with consultation with ACEN.

The assessment identified numerous scenarios/events with potential for offsite impacts, which were subject to a qualitative risk analysis in accordance with the *Multi-level Risk Assessment Guideline* (DoP 2011b), the results of which are presented in Table 6.20.

Table 6.20 Qualitative risk assessment results

Hazard	Event	Consequence	Offsite consequence	Significant offsite impact?	Risk analysis (offsite and public impact)		
					Severity	Likelihood	Risk
Electrical	Exposure to voltage	Electrocution. Injury and/or fatality to onsite employees. Injury and/or fatality to member of public due to touch and step potential.	No offsite impact expected for member of the public.	No	Insignificant	Unlikely	Very low
Energy	Arc flash	Arc blasts and resulting heat, may result in fires and pressure waves. Burns. Exposure to intense light and noise. Injury and/or fatality to onsite employees.	Localised effects. The effects are not expected to have an offsite impact.	No	Insignificant	Unlikely	Very low
Fire	Fire on electrical conversion system equipment	Localised fire. Escalation to adjacent infrastructure. Injury and/or fatality to onsite employees.	Localised effects. The effects are not expected to have an offsite impact.	No	Insignificant	Unlikely	Very low
	BESS fire	Release of toxic and/or explosive combustion products. Escalation to the entire BESS. Injury and/or fatality to onsite employees.	As the BESS will be located within the operational infrastructure area and there is a large separation distance to the nearest non-associated residential dwelling, the effects are not expected to have an offsite impact.	No	Insignificant	Unlikely	Very low
	Substation fire	Release of toxic combustion products. Escalation to adjacent infrastructure. Injury and/or fatality to onsite employees.	As the substation will be located within the operational infrastructure area and there is a large separation distance to the nearest non-associated residential dwelling, the effects are not expected to have an offsite impact.	No	Insignificant	Unlikely	Very low

Table 6.20 Qualitative risk assessment results

Hazard	Event	Consequence	Offsite consequence	Significant offsite impact?	Risk analysis (offsite and public impact)		
					Severity	Likelihood	Risk
	Bushfire	Escalation to adjacent infrastructure. Injury and/or fatality to onsite employees.	As there is a large separation distance from the operational infrastructure area to the nearest non-associated residential dwelling, the effects are not expected to have an offsite impact.	No	Insignificant	Unlikely	Very low
Chemical	Loss of containment of gasoline from storage or during handling	Fire, if ignited. Injury to onsite employees.	Localised effects (minor storage quantity), the effects are not expected to have an offsite impact.	No	Insignificant	Unlikely	Very low
	Loss of containment of diesel from storage or during handling	Fire, if ignited. Injury to onsite employees.	Localised effects (minor storage quantity), the effects are not expected to have an offsite impact.	No	Insignificant	Unlikely	Very low
	Loss of containment of LPG from storage or filling point	Fire and/or explosion. Injury or fatality to onsite employees.	Localised effects (minor storage quantity), the effects are not expected to have an offsite impact.	No	Insignificant	Unlikely	Very low
	Exposure to hazardous material (herbicide/ pesticide)	Irritation/injury for personnel on exposure.	Localised effects, the effects are not expected to have an offsite impact.	No	Insignificant	Unlikely	Very low
	Release of battery electrolyte (liquid/vented gas) from the battery cell	Release of flammable liquid electrolyte. Vapourisation of liquid electrolyte. Release of vented gas from cells. Fire and/or explosion in battery enclosure. Release of toxic combustion products. Injury and/or fatality to onsite employees.	As the BESS will be located within the operational infrastructure area and there is a large separation distance to the nearest non-associated residential dwelling, the effects are not expected to have an offsite impact.	No	Insignificant	Unlikely	Very low

Table 6.20 Qualitative risk assessment results

Hazard	Event	Consequence	Offsite consequence	Significant offsite impact?	Risk analysis (offsite and public impact)		
					Severity	Likelihood	Risk
	BESS chiller unit or coolant leak	Irritation/injury to onsite employee on exposure to leak (eg inhalation and skin contact). Ingress of coolant to battery or other electrical components (battery enclosure) leading to short circuit and fire, resulting in injury and/or fatality to onsite employees.	As the BESS will be located within the operational infrastructure area and there is a large separation distance to the nearest non-associated residential dwelling, the effects are not expected to have an offsite impact.	No	Insignificant	Unlikely	Very low
Explosive Gas	Generation of explosive gas	Fire and/or explosion in battery enclosure. Release of toxic combustion products. Injury and/or fatality to onsite employees.	As the BESS will be located within the operational infrastructure area and there is a large separation distance to the nearest non-associated residential dwelling, the effects are not expected to have an offsite impact.	No	Insignificant	Unlikely	Very low
Reaction	Thermal runaway in battery	Fire in the battery cell and enclosure. Escalation to the entire BESS. Injury and/or fatality to onsite employees.	As the BESS will be located within the operational infrastructure area and there is a large separation distance to the nearest non-associated residential dwelling, the effects are not expected to have an offsite impact.	No	Insignificant	Unlikely	Very low
EMF	Exposure to electric and magnetic fields	High level exposure (ie exceeding the reference limits) may affect function of the nervous system (ie direct stimulation of nerve and muscle tissue and the induction of retinal phosphenes). Injury to onsite employees.	EMF created from the project will not exceed the ICNIRP reference level for exposure to the general public. Impact to the general public in surrounding land uses will be negligible.	No	Insignificant	Rare	Very low
External factors	Water ingress (eg rain, flood)	Electrical fault/short circuit. Fire. Injury and/or fatality to onsite employees.	As the BESS and substation will be located within the operational infrastructure area and there is a large separation distance to the nearest non-associated residential dwelling, the effects are not expected to have an offsite impact.	No	Insignificant	Unlikely	Very low

Table 6.20 Qualitative risk assessment results

Hazard	Event	Consequence	Offsite consequence	Significant offsite impact?	Risk analysis (offsite and public impact)		
					Severity	Likelihood	Risk
	Vandalism due to unauthorised personnel access and deliberate damage to project infrastructure	Asset damage and potential hazard to unauthorised person (eg electrocution).	Effects to unauthorised person are expected to be localised and not expected to have an offsite impact. The impact is to a member of public but occurs onsite. For a fire event at the operational infrastructure area (eg BESS and substation), the effects are not expected to have an offsite impact as there is a large separation distance to the nearest non-associated residential dwelling.	No	Major	Unlikely	Medium
	Lightning strike	Fire. Injury and/or fatality to onsite employees.	As there is a large separation distance from the operational infrastructure area to the nearest non-associated residential dwelling, the effects are not expected to have an offsite impact.	No	Insignificant	Unlikely	Very low

iii Assessment against risk acceptance criteria

Using the study risk matrix referenced from AS/NZS 5139, the identified hazardous events were qualitatively risk profiled. Of the 18 events identified, all were rated as “Very Low” risks except for one “Medium” risk event. This event is related to an unauthorised person accessing the proposed BESS/development footprint, resulting in vandalism/asset damage to the infrastructure with the potential for self-injury during the act.

The PHA noted that the controls for this event are well understood and will be implemented accordingly. In addition to the rural location of the site, the project infrastructure will be located within a secure area with fencing and cameras, and warning signs will be provided. Mitigation measures would also include onsite security protocols and presence of staff during operational hours. In combination, these prevention and mitigation measures are expected to significantly reduce the likelihood of this event. The likelihood rating for this event was rated as ‘Unlikely’.

All identified events are not expected to have significant offsite impacts. Based on the study risk acceptance criteria, the risk profile for the project is considered to be tolerable.

The analysis found that the project is compliant with the HIPAP 4 qualitative risk criteria, in particular:

- the proposed location is suited for the project; it is situated in a rural area with considerable separation distance to nearby sensitive receptors and will therefore avoid off-site risks;
- based on the separation distance to sensitive receptors, consequence impacts from the identified hazardous events are not expected to have significant off-site impacts;
- for all events the impacts are expected to be localised and contained within the boundaries of the installation with no significant off-site impacts; and
- there is no other additional hazardous development in the vicinity and the project will be situated within a designed REZ suitable for the project.

6.6.3 Mitigation measures

i Electric and magnetic fields

The following factors and controls are identified to limit exposure to electric and magnetic fields (EMF):

- the design, selection and procurement of electrical equipment for the project will comply with relevant international and Australian standards;
- location selection for the project infrastructure (ie accounts for separation distance to surrounding land uses including neighbouring properties and agricultural operations) and fencing within the project boundary will assist to limit the exposure to EMF for the general public;
- exposure to EMF (specifically magnetic fields) from electrical equipment will be localised and the strength of the field attenuates rapidly with distance; and
- duration of exposure to EMF for personnel onsite will be transient.

ii Battery energy storage system

The BESS will be located within the operational infrastructure area. Approval is sought for two locations for the operational infrastructure area (as shown in Figure 3.1), although only one will be constructed. The land areas required for the BESS and other infrastructure Options A and B are approximately 25 ha.

A review of *NFPA 855 Standard for the Installation of Stationary Energy Storage Systems* (refer to Section 20 in PHA) was undertaken by Entura as part of the BESS design considerations study. This included a review to determine the required separation distances between the BESS units and the BESS and other infrastructure (refer to Table 6.1 of Appendix J). The review of the BESS separation distances found they complied with the standard recommended separation distances (refer to Section 6.6 of Appendix J).

iii Other hazard mitigation measures

The hazard register (Table 4.4 of Appendix J) identifies a range of controls that are required to ensure that hazard consequence and/or the likelihood is reduced or maintained for the project. These measures include, but are not limited to, the implementation of the following during subsequent stages of the project:

- fire management plan (FMP);
- emergency response plan (ERP);
- design and procurement procedures;
- testing and maintenance procedures;
- signage and personal protective equipment;
- minimum of 10 m asset protection zone (APZ) to be provided for all structures and associated buildings/infrastructure; and
- appropriate boundaries and fencing.

Table 6.21 summarises the mitigation measures for the project relating to hazard and risk.

Table 6.21 Hazard and risk mitigation measures

ID	Mitigation measure
HR1	Onsite security protocols will be implemented and staff will be present during operational hours.
HR2	BESS units will be certified to UL 9540A and installed in accordance with the manufacturer's instructions for best practice to mitigate fire propagation.
HR3	ACEN will keep a copy of deflagration hazard studies undertaken by manufacturer in accordance with UL 9540 or include explosion control measures such as passive safe ventilation of flammable gases under pressure.
HR4	If a containerised BESS is installed, a minimum one-hour fire rating (REI60) will be applied.
HR5	If the BESS is installed within a dedicated use building, the detailed design will consider: • compartmentalisation; • occupancy and means of egress; • fire barriers; • exhaust and ventilation system; • sprinkler system and required water volume; and • containment system for the expected fire protection system discharge.
HR6	The requirements of the National Construction Code and regulated Australian standards and codes will be met for an indoor BESS within dedicated use buildings (e.. fire rating of materials, fire detection systems).
HR7	ACEN will consult with Fire and Rescue NSW (FRNSW) during detailed design of the facility to ensure that the relevant aspects of fire protection measures have been included. These may include: • type of firefighting or control medium; and • demand, storage and containment measures for the medium.
HR8	ACEN will review the investigation reports on the Victorian Big Battery Fire (occurred on 31 July 2021) and implement relevant findings for the BESS component of the project.
HR9	Security fencing, cameras, and warning signs will be installed, and onsite security protocols implemented to deter trespassers and minimise unauthorised person access resulting in vandalism/asset damage to the infrastructure with the potential for self-injury during the act.
HR10	ACEN will engage with Mid-Western Local Emergency Management Committee (LEMC) to discuss how the site will be considered under the Mid-Western Local Disaster Plan (DISPLAN).

6.6.4 Conclusion

The PHA concluded that:

- the project isn't classed as potentially offensive or potentially hazardous development;
- for all identified events associated with the proposed operation of the project, the resulting consequences are not expected to have significant offsite impacts; and
- the project meets the HIPAP 4 qualitative risk criteria.

6.7 Noise and vibration

6.7.1 Introduction

A noise and vibration impact assessment (NVIA) has been prepared for the project by EMM (2022c) and is provided in Appendix K. The NVIA has been prepared in accordance with the relevant SEARs and with reference to the methods outlined in:

- NSW Department of Environment and Climate Change (DECC) 2009, *Interim Construction Noise Guideline* (ICNG);
- NSW Environment Protection Authority (EPA) 2017, *Noise Policy for Industry* (NPfI);
- NSW Department of Environment Climate Change and Water (DECCW) 2011, *Road Noise Policy* (RNP);
- NSW Department of Environment and Conservation (DEC) 2006, *Assessing Vibration: A Technical Guideline*; and
- relevant Australian and international standards.

6.7.2 Existing environment

i Ambient noise

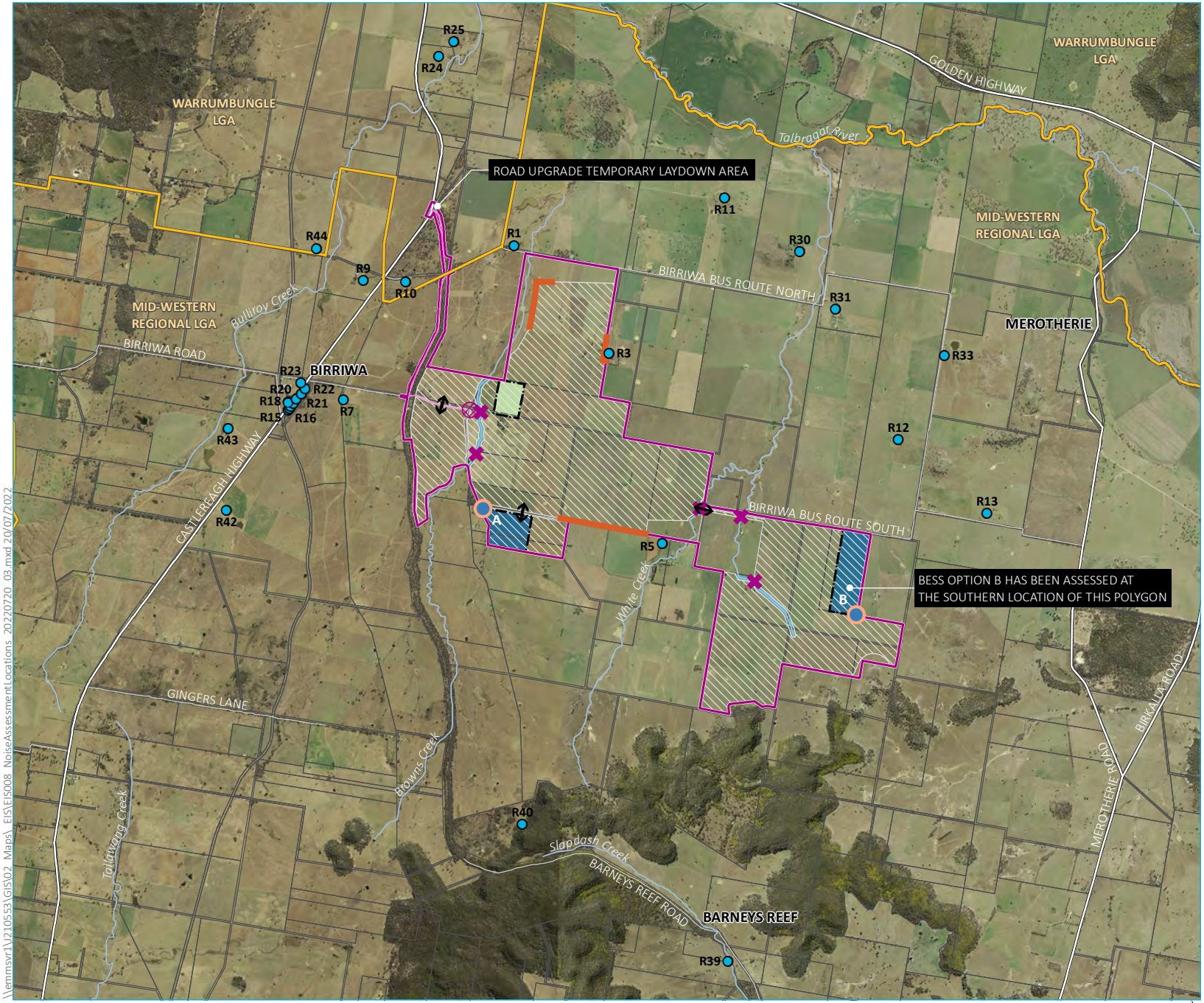
Land uses within the study area and surrounds are primarily agricultural. Given the rural landscape and surrounding agricultural land uses, existing ambient noise levels at assessment locations are likely to be dominated by rural noise sources with limited traffic and industry. The rating background noise levels (RBLs) at assessment locations are expected to be low. Therefore, the NPfI (EPA 2017) minimum RBLs of 35 dB and 30 dB have been adopted for this assessment for the day and evening/night period, respectively.

ii Assessment locations

The closest assessment locations to the project are residential dwellings. Noise and vibration impacts have been assessed at non-associated residences.

There are four associated residences within or in close proximity to the study area (A2, A4, A6 and A8). These four associated residences have agreed to noise impacts under a landholder agreement with ACEN. There are 21 non-associated residences within 2 km of the study area, many of them in the township of Birriwa, and another 22 non-associated residences between 2 km and 5 km from the study area (refer to Figure 6.10). The closest non-associated residence, R3, is approximately 60 m from the development footprint at its closest point.

It is considered that if noise criteria can be satisfied at the assessment locations (ie non-associated residences and one active recreation area) closest to the development footprint, then noise criteria will be satisfied at other noise-sensitive receivers that are further from the development footprint.



KEY

- Study area

Impact footprint

- Development footprint
- Road upgrade corridor
- Restricted development area
- Potential public road crossing location

Project layout

- Potential creek crossing point
- Proposed access point to the project
- Connection point (option A or B)
- Proposed operational infrastructure area including substation, operational facility and BESS (option A or B)
- Temporary construction compound
- Landscape screen planting

Existing environment

- Major road
- Minor road
- Watercourse
- Cadastral boundary
- Local government area boundary

Noise assessment location

- Non-assiociated residence

Source: EMM (2022); DFSI (2017, 2022); GA (2011); ACEN (2022)

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GDA 1994 MGA Zone 55

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Noise assessment locations

Birriwa Solar and Battery Project
Environmental Impact Statement
Figure 6.10

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6.7.3 Potential impacts

i Construction noise

Construction noise levels have been predicted using a computer-generated model that calculates total noise levels at each assessment location from the concurrent operation of multiple noise sources. Predicted noise levels over a typical worst case 15 minute scenario have been modelled and assessed for comparison against the relevant noise management levels (NMLs). Plant and equipment items, sound power levels and quantities adopted in the noise modelling are provided in Appendix K.

Construction works will be undertaken during standard hours of 7.00 am to 6.00 pm Monday to Friday and 8.00 am to 6.00 pm Saturday.

The results of the modelling demonstrate predictions of compliance with the construction NML for all assessment locations during daytime standard construction hours.

Exceedance of the ICNG noise goals is predicted at R3 during Saturday afternoon works (ie 1.00 pm to 6.00 pm). To achieve compliance, the following mitigation measures will be implemented:

- during site establishment works, a construction exclusion zone of 650 m from non-associated residences will be incorporated on Saturdays from 1.00 pm to 6.00 pm; and
- during infrastructure delivery and installation, a construction exclusion zone of 300 m from non-associated residences will be incorporated on Saturdays from 1.00 pm to 6.00 pm.

ii Construction vibration

Construction activities involving vibration are not proposed within 100 m of any non-associated residences. At this distance, non-associated residences are beyond the safe working distances for structural damage and, subject to size of vibratory roller required on-site, likely below the levels for human response. Vibration impacts from construction at non-associated residences are considered unlikely.

iii Operational noise

Operational noise levels have been predicted using a computer-generated model and have been assessed for day, evening and night periods. The assessment predicted noise levels for each assessment location over a 15-minute period and assumed all plant operating concurrently under adverse meteorological conditions. Predictions have been assessed for six scenarios. These six scenarios were based on whether battery racks would be located outside, within a containerised solution or within a dedicated building. Additionally, two different locations for the BESS were assessed. The assessed scenarios were:

- Scenario 1: BESS within Operational Infrastructure Area A with containerised racks;
- Scenario 2: BESS within Operational Infrastructure Area A with non-containerised racks;
- Scenario 3: BESS within Operational Infrastructure Area A with dedicated building;
- Scenario 4: BESS within Operational Infrastructure Area B with containerised racks;
- Scenario 5: BESS within Operational Infrastructure Area B with non-containerised racks; and
- Scenario 6: BESS within Operational Infrastructure Area B with dedicated building.

Each scenario also considered operational noise generated by other project infrastructure, including tracker motors, PCUs and high voltage transformers. Plant and equipment items and sound power levels adopted in the operational noise model are provided in Appendix K.

The assessment criteria for all non-associated residences are L_{Aeq} 40 dB day and L_{Aeq} 35 dB for evening and night periods. To achieve compliance with operational noise criteria at all assessment locations, the following mitigation measures have been applied in the model:

- no electrical infrastructure (ie transformers or inverters) will be installed within 250 m of the property boundary of R3; and
- the 1,200 MVA grid transformer, which will form part of the BESS, was modelled with a 6.5 m high barrier, positioned (to the east, west and north within the BESS and Operational Infrastructure Area locations) to reduce noise impacts on nearby sensitive receivers (ie non-associated residences).

With the implementation of these measures, compliance with the NPfI (EPA 2017) criteria is predicted at all assessment locations.

iv Road traffic noise

Road traffic noise during construction has been calculated at 13 non-associated residences and one non-associated active recreational area within 500 m of Castlereagh Highway (refer Table 6.2 of Appendix K). The assessment has focused on these residences due to limitations of prediction accuracy at residences beyond these distances. Non-associated residences that have not been assessed are expected to experience lower levels of road traffic noise.

Project-related traffic on Castlereagh Highway is predicted to increase existing road traffic noise by more than 2 dB during construction; however, daytime traffic noise levels ($L_{Aeq,15hour}$) from light and heavy vehicle movements on Castlereagh Highway will remain below the minimum threshold of $L_{Aeq,15hr}$ 55 dB(A) for arterial roads under the RNP (DECCW 2011).

Following completion of construction, light vehicle traffic movements are expected to fall to around 20 per day, resulting in negligible changes in road traffic noise levels from existing movements on Castlereagh Highway.

v Cumulative noise and vibration

A review of nearby developments identified Barneys Reef Wind Farm as the closest to the project, which is proposed approximately 6 km south of the study area. However, due to the separation distance between the development footprint and the closest infrastructure proposed as part of Barneys Reef Wind Farm, cumulative noise and vibration impacts are not anticipated to be significant.

6.7.4 Mitigation measures

Table 6.22 outlines the mitigation measures for the project relating to noise and vibration.

Table 6.22 Noise and vibration mitigation measures

ID	Mitigation measure
NV1	If the actual fleet of plant and equipment required during construction varies significantly from that assumed within the NVIA, a risk assessment of the proposed works will be undertaken to determine the likelihood of noise impacts on surrounding residential assessment locations. Appropriate management and mitigation measures will be used, where required. A CEMP will be developed as part of the project and will include the risk assessment protocol and detail the management and mitigation measures to be implemented during construction consistent with best practice requirements.
NV2	To achieve compliance during construction with the ICNG noise goals, the following will be implemented: • during site establishment works, a construction exclusion zone of 650 m from non-associated residences will be incorporated on Saturdays from 1.00 pm to 6.00 pm; and • during infrastructure delivery and installation, a construction exclusion zone of 300 m from non-associated residences will be incorporated on Saturdays from 1.00 pm to 6.00 pm.
NV3	The safe working distances for cosmetic damage will be monitored throughout the construction process. If construction is within 25 m of sensitive structures, then work practices will be reviewed so that safe working distances are followed. If safe working distances need to be encroached, real time vibration monitoring with audible and visual alarms will be installed at vibration sensitive structures so actual vibration levels can be monitored and managed appropriately in real-time.
NV4	To achieve compliance with operational noise criteria, the following mitigation measures will be incorporated into the project design: • no electrical infrastructure (ie transformers or inverters) will be installed within 250 m of the property boundary of R3; and • the 1,200 MVA grid transformer, which will form part of the BESS, will be installed with a 6.5 m high barrier (noise wall), positioned to reduce noise impacts on nearby sensitive receivers (ie non-associated residences). The location of the transformer and associated barrier has not been selected, and exact geometry of the transformer is not yet known. However, the barrier has been designed to break line of sight from the top of the transformer, and to provide returns either side of the transformer. Exact lengths and dimensions of the transformer are not shown as these are subject to change based on final equipment selections.

6.7.5 Conclusion

Significant impacts in relation to noise on non-associated residents are not anticipated as a result of the project during construction or operation.

Construction noise levels from the project are predicted to be less than NMLs at all non-associated residences during standard construction hours. To maintain compliance during works outside of standard construction hours on Saturday afternoons (1.00 pm to 6.00 pm), a construction exclusion zone of 650 m from non-associated residences will be established during site establishment works, and a construction exclusion zone of 300 m will also be established from non-associated residences during infrastructure delivery and installation.

Operational noise has been assessed under adverse weather conditions and noise mitigation measures have been included in the modelling. With the implementation of these measures, compliance with the NPfI (EPA 2017) criteria is predicted at all non-associated residences.

Road traffic associated with the construction of the project will increase road traffic noise levels by more than 2 dB; however, levels will remain below the minimum thresholds for arterial roads under the RNP.

6.8 Land resources

6.8.1 Introduction

A land use, soils and erosion assessment (LUSEA) has been prepared by EMM (2022b) and is attached as Appendix L. The LUSEA identifies and assesses potential land capability, soil erosion and sedimentation impacts associated with project construction and operation. It also provides an assessment of the potential impacts of the project on the agricultural resources of the site and on agricultural production.

The LUSEA satisfies the requirements of the relevant SEARs provided in Appendix A.

6.8.2 Existing environment

i Soils

Figure 6.11 identifies the Australian Soil Classification (ASC) soils mapped in the study area. Of the soil classifications identified, the Sodosols have the highest erosion risk (particularly gully and tunnel erosion) and the highest risk of generating turbid runoff, though the soil chemistry of the site-specific soils. The Tenosol soil types, as poorly developed profiles, typically have lower constraints though they are often sandy with weak structure and therefore can be highly susceptible to erosion from concentrated flows.

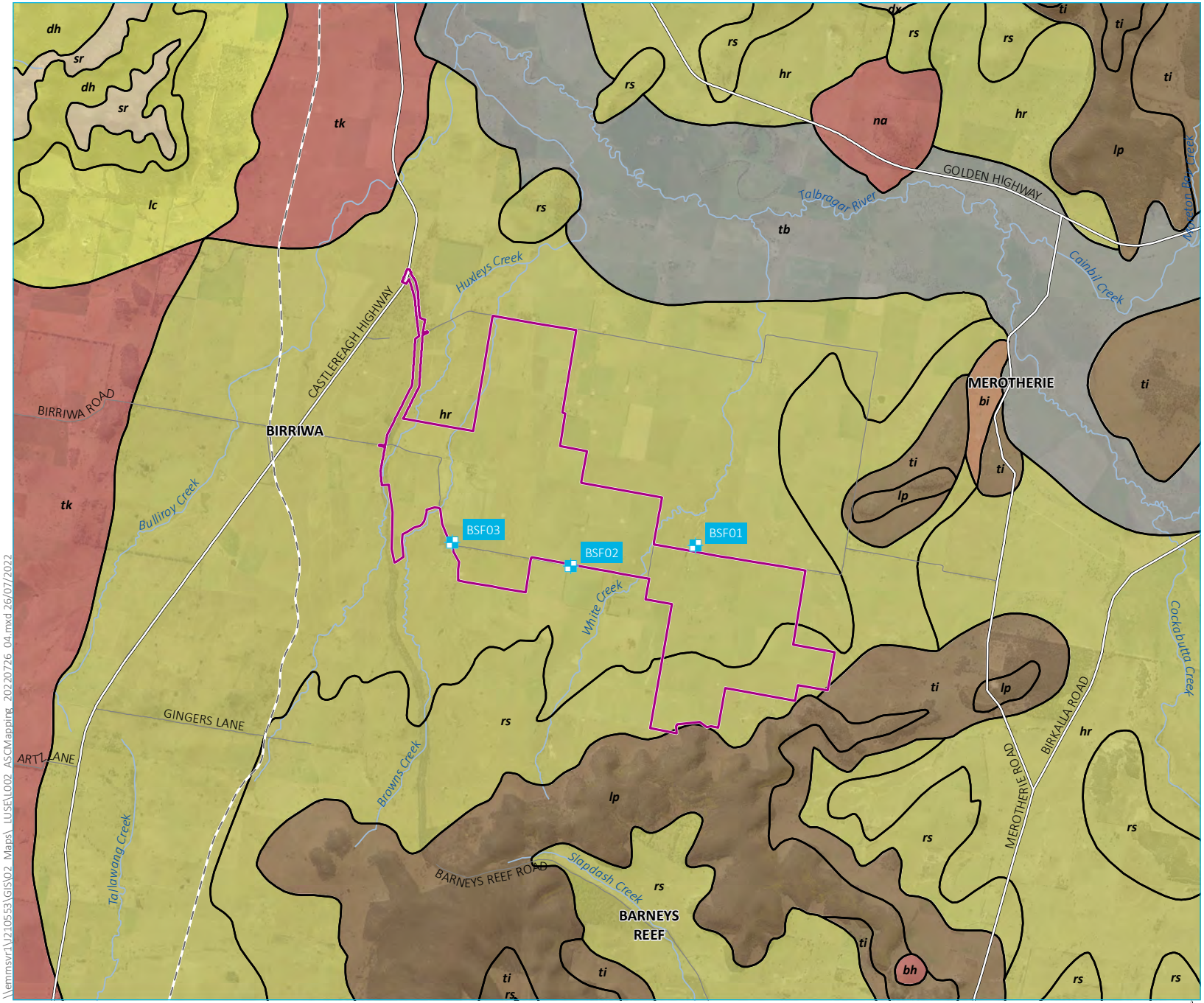
The dominant soil landscapes across the study area, as shown in Figure 6.11, and their limitations include:

- Home Rule (hr) – very low fertility, very low waterholding capacity, high permeability, existing minor sheet erosion and acid surface soils.
- Rouse (rs) – very low fertility, acidic surface soils, low available waterholding capacity, seasonal waterlogging, sodic subsoils on lower slopes, high to very high erosion hazard under cultivation, existing minor sheet and gully erosion, and some areas of severe gully erosion.

Inherent soil fertility is used as a general indication of a soil's capacity to retain and release nutrients and soil water for use by vegetation and is a function of the interrelationship between physical, chemical and biological components in the soil. The soil fertility applicable to the study area is outlined in Table 6.23.

Table 6.23 Inherent soil fertility

Inherent soil fertility	ASC	Description
Low	Tenosols	Soils which, due to their poor physical and/or chemical status, only support limited plant growth. The maximum agricultural use of these soils is sparse grazing.
Moderately low	Sodosols	Soils with low fertilities that, generally, will only support vegetation suited to grazing with large inputs of fertiliser required to improve the soils and make them suitable for arable purposes.



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ASC mapping

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Figure 6.11

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ii Land and soil capability

The *Land and Soil Capability Assessment Scheme* (OEH 2012) ('LSC Scheme') assesses the inherent physical capacity of the land to sustain a range of land uses (and management practices) in the long term without leading to degradation of soil, land, air and water resources. Land is classified between an LSC class of 1 (best, highest capability land) and 8 (worst, lowest capability land).

The state scale mapping of LSC classes for NSW, as documented in the NSW government eSPADE database, shows the study area is mapped as LSC classes 5 and 7, representing land with moderate-low capability to very low capability, respectively, as shown in Figure 6.12.

iii Strategic agricultural land

The status of mapped strategic agricultural land in the vicinity of the study area is as follows, and is shown in Figure 6.12:

- Biophysical Strategic Agricultural Land (BSAL) – there is no BSAL mapped within the study area. The nearest mapped BSAL is mapped approximately 820 m north of the study area;
- State significant agricultural land (SSAL) – there is no SSAL mapped within the study area. The nearest mapped SSAL is approximately 820 m north of the study area, associated with the BSAL mapping; and
- Critical Industry Clusters (CICs) – no CICs are present within the study area.

iv Soil chemistry

During the site inspection conducted on 2 December 2021, opportunistic sampling of soils was undertaken at three sites (Birriwa Solar Farm (BSF) 1, BSF 2 and BSF 3) (refer to Figure 6.12) from across the study area to determine soil characteristics and the potential for erosion to occur. Soil samples were tested at a National Association of Testing Authorities (NATA) accredited laboratory. Detailed laboratory results are found in Table 3.10 of the LUSEA (Appendix L).

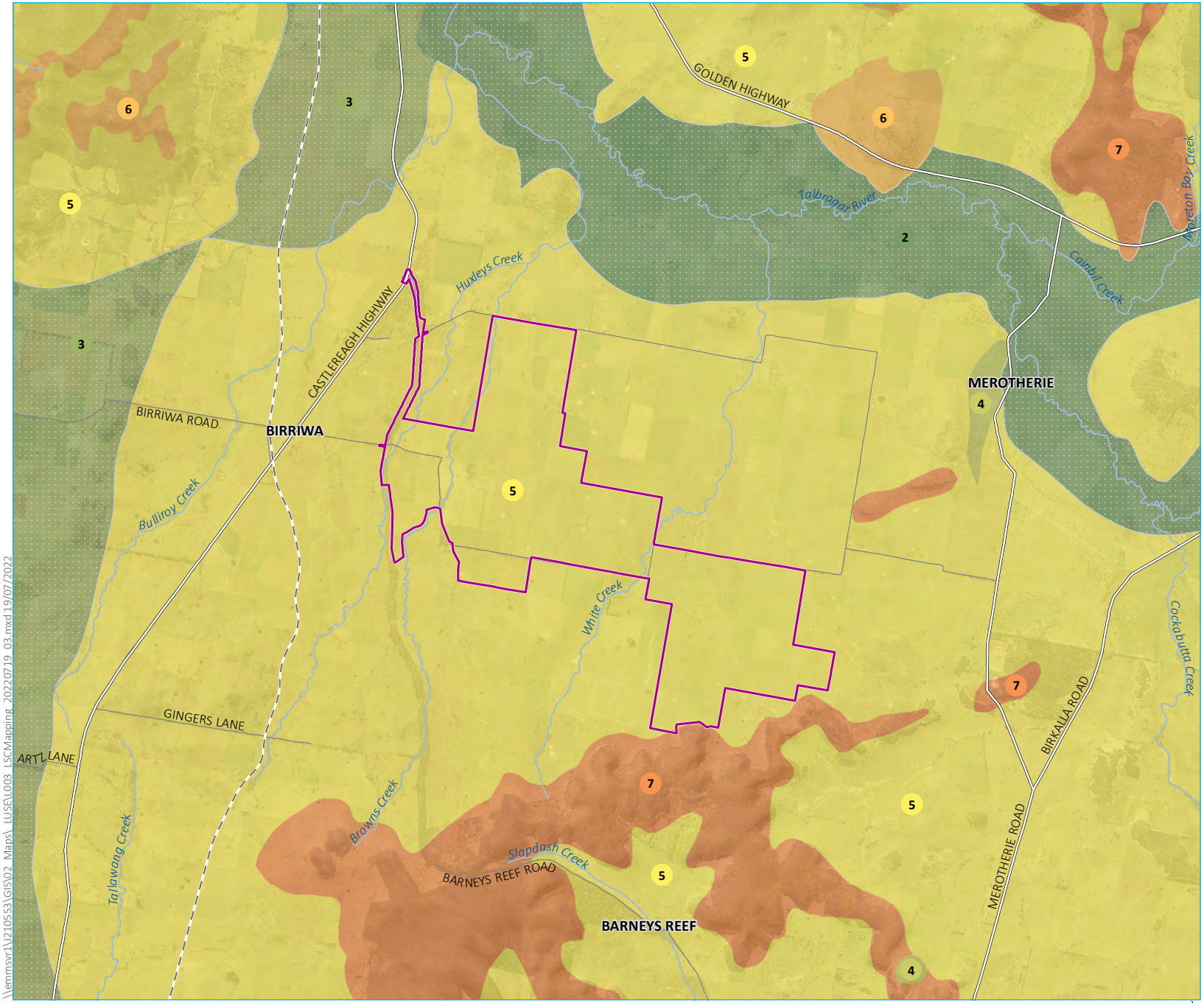
The soil chemistry results indicates that some soils (represented by BSF1 and BSF3) likely have dispersive characteristics that will present a high erosion risk, as indicated by the exchangeable sodium percentage and low Ca:Mg ratio. The erosion risk is consistent with the presence of rilling and gullying present within the study area, as observed during the site inspection.

In relation to acid sulphate soils (ASS), the NSW OEH Acids Sulphate Risk Map indicates that the nearest site with a high probability of ASS is approximately 285 km south-east of the study area and as such the study area is at little risk from ASS. Acid sulfate soils are typically found in coastal areas which does not apply to the study area.

v Land use

Land use mapping is characterised in accordance with the Australian Land Use and Management (ALUM) Classification (version 8). Under the ALUM classification and mapping, the study area is predominantly mapped as ALUM 3.2.0 - grazing modified pastures and ALUM 3.3.0 – cropping. There are areas of ALUM 2.1.0 – grazing native vegetation, and small areas of ALUM 5.4.0 – residential and farm infrastructure and ALUM 1.3.0 – other minimal use, with a tertiary class of 1.3.3 – residual native cover, associated with Barneys Reef.

This mapping is consistent with the known land uses in the study area, which is currently primarily comprise sheep and cattle grazing as well as low intensity dry land cropping.



Source: EMM (2022); DFSI (2017, 2022); DPE (2017); GA (2011); OEH (2017); ACEN (2022)

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Modelled land and soil capability and BSAL mapping

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Figure 6.12

EMM creating opportunities

6.8.3 Potential impacts

i Construction

Soil disturbance during construction has the potential to result in the following impacts:

- reduction in soil stability and increase susceptibility to erosion due to vegetation removal or soil exposure, especially as the subsoil is sodic and dispersive;
- erosion of soil due to exposing soils, disturbing dispersive subsoils and concentration of flow;
- loss of structure and water holding capacity due to mechanical compaction;
- loss or degradation of topsoil material viable for use in rehabilitation;
- introduction of salinity or sodicity into the topsoil material if soil is inadequately managed;
- risk of exposing buried contaminants (pesticides and hydrocarbons); and
- introduction of contaminants into soil material (eg hydrocarbons from plant).

ii Operation

Impacts to soils during operation are expected to be minimal; however, legacy issues from inappropriate design and construction could include:

- erosion of soil resources to excessive concentration of flow and inappropriate channel lining and flow energy dissipation;
- tunnel erosion in cable trenches due to inadequately compacted and ameliorated dispersive subsoils;
- exposure of dispersive soils in cut and fill batters and excavations; and
- splash erosion of solar array footings due to inadequate soil surface cover under the arrays.

iii Changes to project land and soil capability

Lands where solar arrays and other permanent infrastructure such as the substation, electrical collection systems, switchyard, control room or management hub and roads have been constructed will not be able to be used for cropping or cattle grazing once constructed.

The land will not be available for cropping during the life of the project, though sheep grazing will be able to be undertaken and is being considered by ACEN in consultation with landholders. However, the LSC status of lands subject to infrastructure with a small footprint or temporary disturbances will be able to be maintained or reinstated following appropriate landform design and rehabilitation.

It is expected the LSC status of most of the project related disturbance will be able to be re-established if the recommended management and mitigation measures are implemented.

iv Agricultural productivity impacts

The site suitability with respect to agriculture considers the inherent low LSC class in addition to the extensive amount of land utilised for agriculture within the LGA, of which the project is a very minor area. Project impacts to agriculture are primarily due to the loss of access to the land for use in intensive cultivation such as cropping or cattle grazing for the duration of the project. These impacts are considered to be low due to the inherently poor land capability of the study area as well as the potential for ongoing agricultural practices, such as sheep grazing.

Impacts to the inherent capability of the land and subsequent agriculture after project completion should be minimal if mitigation measures are utilised.

Cumulative impacts to adjacent land relevant to agriculture are expected to be minimal, with the only potential impact being associated with sediment deposition or erosion from the project, which can be suitably managed. Other impacts to adjacent agriculture are considered in other technical reports completed as part of the EIS, such as the Traffic Impact Assessment (refer to Section 6.4) and Social Impact Assessment (refer to Section 6.10).

6.8.4 Mitigation measures

The mitigation measure detailed in Table 6.24 will be implemented for the project.

Table 6.24 Land resources mitigation measures

ID	Mitigation measures
LR1	Prior to the commencement of construction, a Soil and Water Management Plan (SWMP) will be prepared and will include management measures to cover: • erosion and sediment control; • soil preservation; • dispersive subsoils; • any cut and fill activities; and • drainage and landform design. The SWMP will be implemented during construction and operation of the project.
LR2	As part of the CEMP, land disturbance processes will be developed to ensure unnecessary land disturbance does not occur, including provision for site inspection by the site Environmental Manager or delegate prior to disturbance, to identify any necessary drainage and erosion and sediment controls are planned and implemented as required.

6.9 Water resources

6.9.1 Introduction

Alluvium prepared a water quality impact assessment (WQIA) (2022b) and hydrology and flood risk assessment (HFRA) (2022a) for the project, which are attached as Appendix N and Appendix M, respectively. The SEARs and how they are addressed, are summarised in Chapter 1 of the WQIA and Section 1.2 of the HFRA.

6.9.2 Existing environment

i Hydrology and water resources

The development footprint is located within the Macquarie-Bogan River catchment. Three drainage lines and their associated tributaries traverse the study area, Huxleys Creek (a second order stream within the study area), Browns Creek (third order) and White Creek (third order). These drainage lines discharge into the Talbragar River, a major tributary of the Macquarie River.

The study area is within the area covered by the *Water Sharing Plan for the Macquarie Bogan Unregulated Rivers Water Sources 2012*. This plan dictates water sharing, extraction, diversion, and all associated details, as set out in the WM Act.

A summary of key aspects of the existing environment with respect to water resources is summarised in Table 6.25.

Table 6.25 Water resources – existing environment

Feature	Discussion
Drainage lines	Three local drainage lines, Huxleys Creek (second order), Browns Creek and White Creek (both third order), traverse the study area, flowing in a northernly direction into the Talbragar River. Being third order streams, a riparian buffer of 30 m either side of the drainage line has been applied to Browns Creek and White Creek in the project design (ie restricted areas, see Section 1.6).
Wetlands	No wetlands have been mapped across the study area.
Groundwater	The study area is within the Lachlan Fold Belt Murray Darling Basin (MDB) groundwater source. Groundwater in the vicinity of the Huxleys Creek and Browns Creek through the study area has been classified as vulnerable by the NSW Government's regional mapping. Groundwater vulnerability is the level of risk of aquifers to contamination due to the physical characteristics of a location, such as depth to the water table or soil type.
Acid sulfate soils	No acid sulfate soils are mapped across the study area.

ii Flooding

The development footprint sits within a catchment with two main creeks, Huxleys Creek and White Creek. The development footprint also comprises several ephemeral overland flow paths running along and through the site extents that will influence flooding characteristics at the site.

Flood modelling of existing conditions was undertaken by Alluvium for a range of annual exceedance probability (AEP) events, including 5%, 1%, 0.5%, 0.2% and 0.05% for the study area. The outputs of this modelling provides guidance on the planning of project infrastructure and enables the assessment of external impacts which may occur dur to the project.

Results of the modelling show that the moderately sloping nature of the catchment results in relatively shallow flood depths across the study area, with deeper, faster moving flows in the creeks and narrow floodplain, as expected. In most of the modelled events, the flood depth in the major flow paths is generally over 1.0 m deep, with overland flow paths typically less than 0.25 m. There are pockets of trapped ponding distributed across the study area, but these are associated with existing farm dams in a 1% AEP event.

Flow velocities of modelled flood events are highest along the main channels and branches of Huxleys Creek, Browns Creek and White Creek, with values of between 1.0–2.0 m/s in the 1% AEP event. In the adjacent floodplain areas, the flow velocities are typically in the range of 0.5–0.8 m/s, whereas velocities in most of the overland flow paths are generally under 0.5 m/s and pose a low risk.

6.9.3 Potential impacts

i Surface water

A calibrated catchment model was used to predict the potential impacts of the project on the local flow regime and water quality.

Overall, the results indicate that the relative flow discharging from the development footprint is likely to increase slightly, with a 5% increase modelled in annual average flow over the modelled period. The primary reason for this is the small decrease in 'rural residential land' and an increase in the operational infrastructure area.

Conversely to the above, a slight decrease in the concentrations of pollutants modelled from the study area is anticipated, due to the primary landscape being altered from cropping and grazing to solar panels. Of the loads discharged, a marginal increase in the total nitrogen (TN) load discharged is anticipated, while a decrease in discharge of total phosphorus (TP) and total suspended solids (TSS) loads is predicted.

ii Groundwater and GDEs

The modelling results show there is anticipated to be a minor increase in the volume of surface flow being discharged from the study area. When considering a conceptual water balance approach, there is likely to be a slightly lower percentage of infiltration through the soil profile and into the groundwater with a greater surface runoff from the study area. Given the minor increase and that the location of GDEs are primarily upstream of the study area, this change is likely to have a negligible impact on GDEs at the study area.

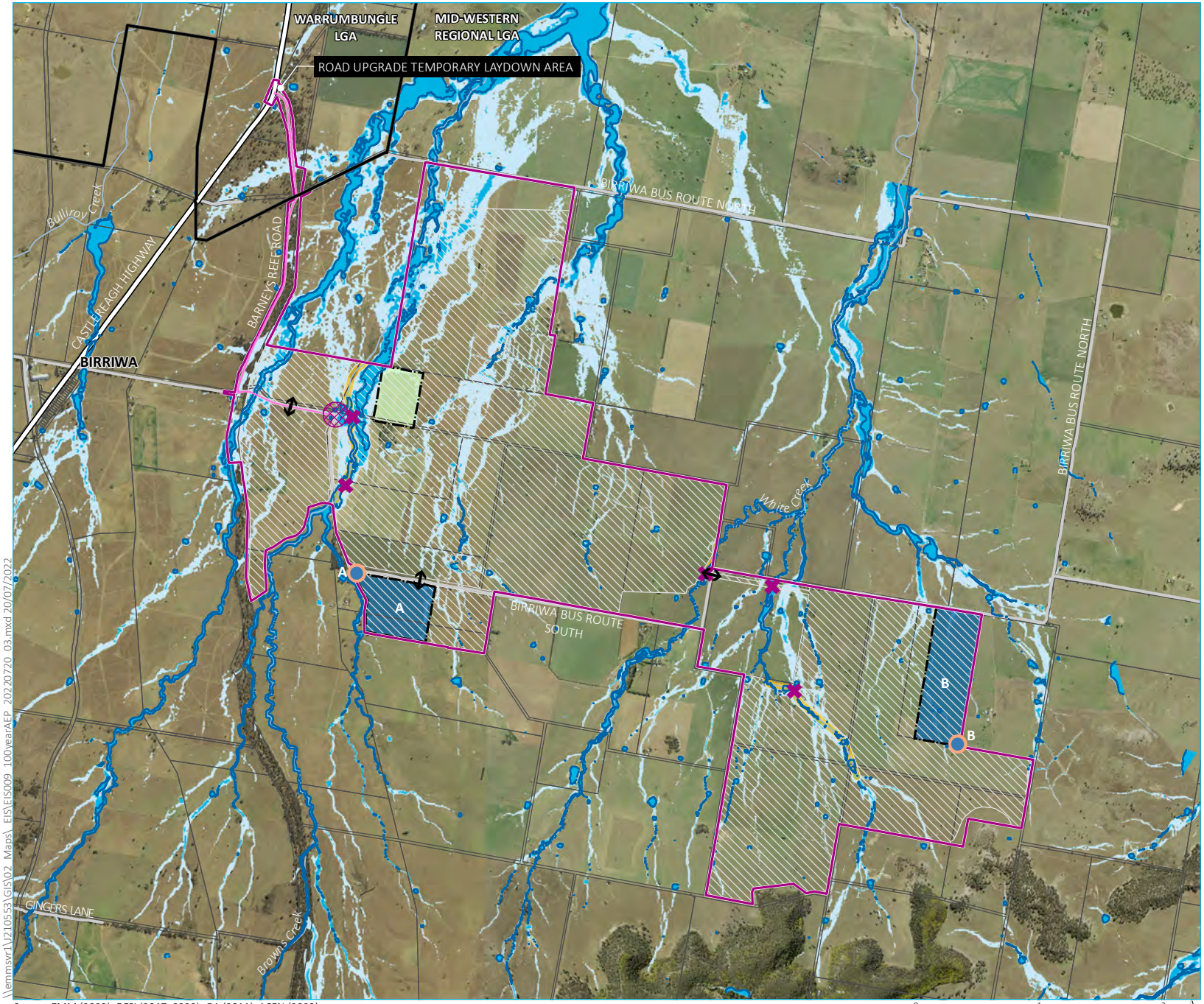
Further, as noted in Section 6.9.2, groundwater in the vicinity of drainage lines is mapped as vulnerable. It is noted that the only infrastructure proposed in these areas are solar panels. The operational infrastructure areas and construction compound are not proposed in these areas, and therefore it is considered there is negligible risk to groundwater resources in these mapped areas.

iii Flooding

Flood prone areas have been mapped across the study area and areas of higher flood risk identified. Due to the small extent of the project at the ground level, the impacts of the project to flood depth, velocities and levels is small. For proposed site infrastructure outside the primary flow paths, flood impacts are considered to be minor in all modelled events.

To provide guidance on the areas that are most appropriate for PV arrays and other site infrastructure (eg the substation, the operational facility and BESS), areas where flood hazards need to be considered have been identified, using the flood depths and velocities from the 1% AEP event as described below:

- **area of higher flood hazard**: flood constraints will be considered in these areas in the project's detailed design. Installation of PV arrays or BESS infrastructure will be avoided in this area unless the hazard can be mitigated. This area includes depths above 0.3 m and velocities above 1.5 m/s;
- **area of low flood hazard**: the project's detailed design will consider any infrastructure with a 300 mm freeboard in these areas. This area includes depths above 0.1 m and velocities above 1.0 m/s; and
- **unconstrained**: all other areas.



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Source: EMM (2022); DFSI (2017, 2022); GA (2011); ACEN (2022)

100 year AEP flood planning zones

Birriwa Solar and Battery Project
Environmental Impact Statement
Figure 6.13

EMM
creating opportunities

6.9.4 Mitigation measures

Table 6.26 details the mitigation measures to be implemented to manage identified flood hazards, and to mitigate potential impacts on water quality.

Table 6.26 Water mitigation measures

ID	Mitigation measures
Water quality	
WQ1	Prior to the commencement of construction, a Soil and Water Management Plan (SWMP) will be prepared, which will outline mitigation measures to be implemented during construction and operation of the project. Mitigation measures may consist of staged construction, construction outside the wet season and erosion and sediment control (ESC) measures such as sediment fences and sediment basins.
WQ2	The SWMP will also outline ESC measures to minimise the risk of erosion from unsealed roads in the study area. Mitigation options may include rumble pads, sediment fencing and sediment basins.
WQ3	The CEMP will include measures to minimise the risk of contamination from chemical spills.
Flooding	
FLO1	The natural state of the draining flow paths will be maintained whenever possible. Internal access roads, where crossing watercourses, will be designed for the 10% AEP design flow and may include compacted rock causeways to provide low maintenance access with limited impact on the drainage line or culvert structures.
FLO2	Foundations for the PV arrays and transmission lines will be located where possible outside of the areas identified as higher food hazard. Solar panels will be designed to provide a minimum of 300 mm freeboard for the lowest edge above the maximum 1% AEP flood level. The panel post and footings will also be designed to withstand the predicted flood velocities (adding scour protection if required).
FLO3	Infrastructure with the potential to cause pollution to waterways in the event of flooding (ie inverters and BESS components) will be located with a minimum 300 mm freeboard above the maximum 1% AEP flood level. Given the shallow depths across the site, raising these small fill pads is highly unlikely to result in any adverse impacts offsite.
FLO4	BESS components are located on pad areas and are aligned with local overland flow paths to prevent flows being redirected.
FLO5	The design and construction of waterway tracks and cable crossings and all internal tracks crossing watercourses within the development footprint will be generally in accordance with the *Guidelines for controlled activities on waterfront land – riparian corridors* (Natural Resources Access Regulator 2018), *Guidelines for watercourse crossings on waterfront land* (Department of Primary Industries, Office of Water 2012) and *Guidelines for laying pipes and cables in watercourses on waterfront land* (NSW Office of Water 2012).
FLO6	The best practice principles for stormwater and sediment control will be incorporated into the design, construction and operation phases of the project as part of the SWMP.
FLO7	Fencing will be designed to consider flood levels across the site through construction of floodways or relocating the fencing to reduce the likelihood of fence blockage due to loss of vegetation in storm events.

6.9.5 Conclusion

The development footprint and study area is traversed by three drainage lines and their associated tributaries, Huxleys Creek (a second order stream within the study area), Browns Creek (third order) and White Creek (third order).

The project is not expected to have a significant impact on water resources in the local area. With the change in primary land use from cropping and grazing to solar panels, a slight decrease in the concentrations of pollutants from the study area is anticipated. The change in land use across the development footprint means that a minor (5%) increase in surface runoff is anticipated.

The moderately sloping nature of the catchment means that flood depths are relatively shallow flood across the study area, and velocities in most of the overland flow paths are generally under 0.5 m/s and pose a low risk.

Areas of higher and low flood hazard have been identified across the study area, using the flood depths and velocities from the 1% AEP event, to guide the detailed design of the project.

6.10 Social

6.10.1 Introduction

A social impact assessment (SIA) has been prepared by EMM (2022d) and is attached as Appendix O. The SIA was prepared in accordance with the *Social Impact Assessment Guideline* (DPIE 2021d). The relevant SEARs and how they are addressed is summarised in Appendix A and Chapter 1.2 of the SIA (Appendix O).

6.10.2 Existing environment

The project is within the Birriwa and Merotherie State Suburb classification (SSC) areas. It is 15 km south-west of the township of Dunedoo and within the Mid-Western Regional LGA, with part of the access route within the Warrumbungle Shire LGA. While the development footprint is localised, direct and indirect impacts may be farther reaching. As such, the project impacts and opportunities have been considered at two spatial scales (or areas of social influence): a local area and a regional area.

The local area consists of the communities anticipated to experience the most direct social impacts of the project (ie impacts related to local social infrastructure and services; workforce; business and industry; housing and accommodation; and community health and wellbeing).

The regional area consists of the geographic areas likely to experience few direct and more indirect social impacts of the project. These indirect impacts are associated with use of infrastructure; supply chains; roads; transportation of goods, materials and equipment; the movement of workers (some of which may have drive in drive out arrangements); and cumulative impacts arising from other projects in the area. The Mid Western Regional LGA and Warrumbungle LGA are identified as the regional area.

The area of reference also includes the Dubbo Regional LGA due to the potential for project workers to be sourced from and accommodated in the LGA.

The communities have been mapped to the Australian Bureau of Statistics (ABS) categories used for data collection (Table 6.27) and the local and regional area of social influence (here-in referred to as the local area, regional area or in some instances the area of reference), as illustrated in Figure 6.14.

Table 6.27 Area of social influence

Study area	Geographic area	2016 ABS data category	Referred to in report as:
Local study area	Birriwa suburb	Birriwa SSC	Local area
	Merotherie suburb	Merotherie SSC	
	Gulgong suburb	Gulgong SSC	
	Dunedoo suburb	Dunedoo SSC	
	Mudgee suburb	Mudgee SSC	
Regional study area	Mid-Western Regional LGA	Mid-Western Regional LGA	Regional area
	Warrumbungle LGA	Warrumbungle LGA	
Area of Reference	Mid-Western Regional LGA	Mid-Western Regional LGA	Area of reference
	Warrumbungle LGA	Warrumbungle LGA	
	Dubbo Regional LGA (formerly known as Western Plains Regional LGA)	Western Plains Regional LGA	
State of New South Wales	State of New South Wales	New South Wales STE	NSW

The local area is a rural area with a strong rural character and residents who highly value their rural way of life. The estimated population of the local area in 2016 was 14,738 people, with the majority of population located in Mudgee and the smaller communities of Gulgong and Dunedoo.

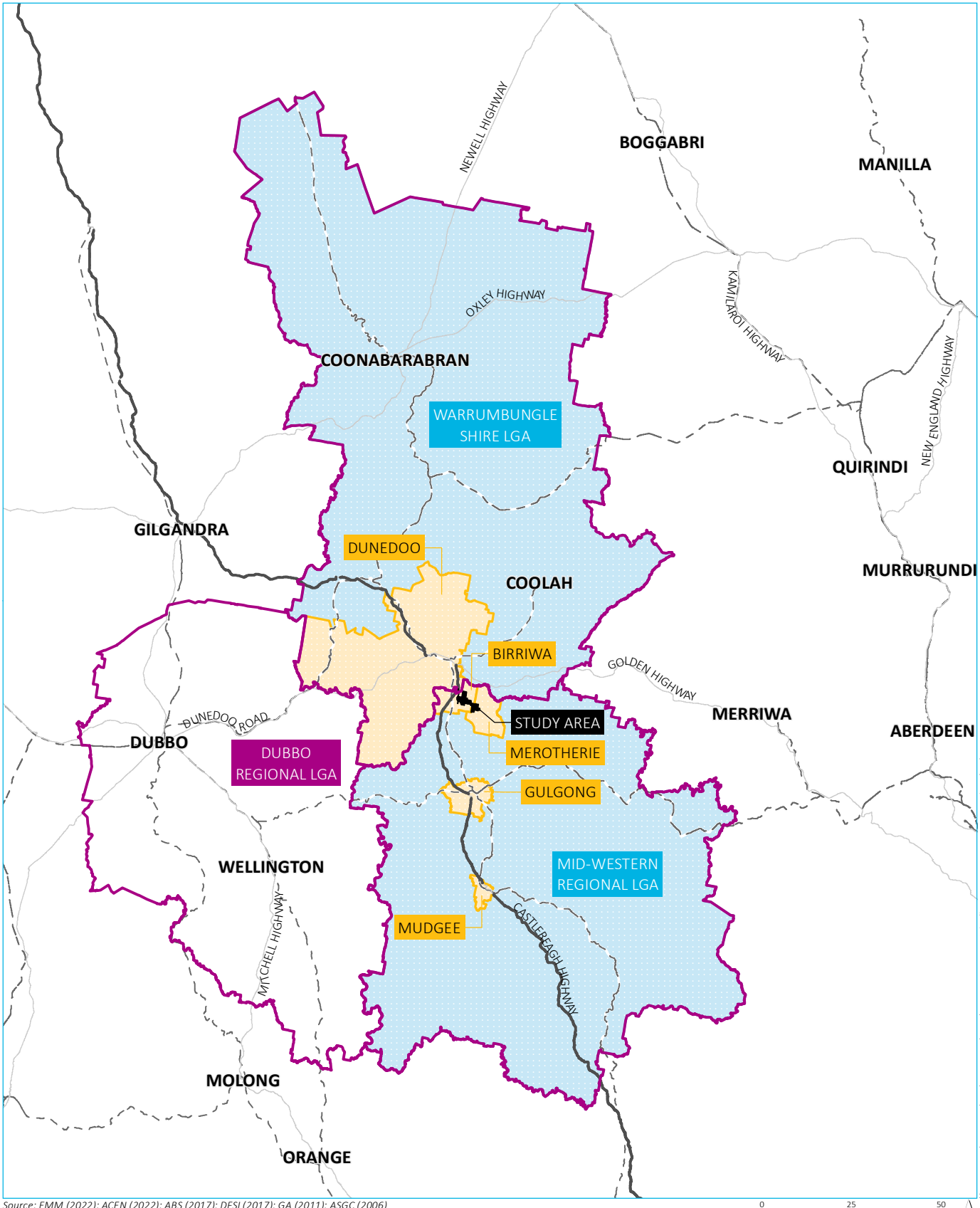
The project will be developed within an area of approximately 1,330 hectares (ha) and is comprised of 18 freehold land parcels. The properties within the study area are currently primarily used for sheep and cattle grazing as well as low intensity dry land cropping. There are scattered rural residential properties within and surrounding the development footprint, including four associated residences within or in close proximity to the study area (A2, A4, A6 and A8). There are 21 non-associated residences within 2 km of the study area, many of them in the township of Birriwa, and another 22 non-associated residences between 2 km and 5 km from the study area.

The local area faces a range of challenges such as decreasing housing affordability and rental accessibility; an ageing population; population decline (particularly in the communities of Dunedoo and Gulgong); outmigration of young people; and skill and labour shortages, which present a barrier to diversifying local economies. The local area (and regional area) has a high number of Indigenous residents. There are high rates of social capital and cohesion amongst communities, with residents expressing a strong connection to place. Communities in the local area value the rural amenity and lifestyle; access to services and employment; and the presence of strong connected communities where people can rely on one another.

Top industry sectors with respect to employment share in the local area include mining, retail trade and health care and social assistance. The agricultural and mining industry sectors are the dominant employment sectors in the regional area. Tourism is also an important and growing industry sector in the Mid-Western Regional LGA. Unemployment levels across the local area and regional area are relatively low but fluctuate in parallel with changes in the mining industry sector. There is currently a low unemployment rate across the local area, however youth unemployment rates in Dunedoo and Gulgong are high.

Chapter 5 of the SIA provides a full summary of the existing social conditions in the area of social influence for the project with reference to the specific and relevant social indicators that align to the following key themes:

- population and demography;
- educational attainment and qualifications;
- labour market and income;
- housing and short term accommodation;
- vulnerabilities and vulnerable groups;
- social infrastructure and services;
- road infrastructure and transport; and
- community strengths and vulnerabilities.



Source: EMM (2022); ACEN (2022); ABS (2017); DFSI (2017); GA (2011); ASGC (2006)

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KEY

- Study area
- Area of reference
- Regional area
- Local area
- Rail line
- Castlereagh Highway
- Major road

INSET KEY

- NPWS reserve
- State forest

SIA social locality

Birriwa Solar and Battery Project
Environmental Impact Statement
Figure 6.14

EMM creating opportunities

6.10.3 Potential impacts and benefits

Assessment of social impacts is complex and as such requires the balancing of a range of factors and often competing interests. The impact assessment is reflective of this and has:

- assessed some aspects of the proposed project as both negative and positive as they relate to different groups of people;
- included negative impacts on local communities while documenting the benefits to the broader region;
- considered the impacts on vulnerable groups and provided management strategies to ensure that any existing disadvantages are not exacerbated; and
- considered each community's access to critical resources, such as housing and health care, and how this affects their resilience.

Potential social impacts have been assessed based on the change to, or the perceived change to, the social and biophysical environment as understood through the project and SIA field study program. These include benefits (ie positive social impacts) and negative social impacts.

The key potential social impacts and benefits are summarised in Table 6.28. The assessment uses the terms unmitigated and mitigated when referring to negative impacts, and un-enhanced or enhanced when referring to positive impacts. Impact ratings are provided for the unenhanced/unmitigated scenarios and also for the enhanced/mitigated scenarios whereby all proposed management strategies and mitigation measures committed by ACEN will be implemented. For those negative impacts for which the impact rating post application of proposed mitigation measures remains medium, high, or very high, a summary of the key issues and considerations is provided.

Detailed discussion of all identified potential impacts and the risk rating framework adopted for assessment of potential social impacts are provided in Chapter 7 and Appendix B of the SIA, respectively.

Table 6.28 Summary of social impacts and benefits

	Matter	Unmitigated	Mitigated	Potential partners	Proposed mitigation and management
	Community benefit related to community investment and involvement.	Medium (positive)	High (positive)	Local businesses including tourism operators. Community organisations and groups. Local councils. Employment and training organisations in the regional area. Secondary education institutions in the local area.	ACEN will adopt a shared value approach in their identification of future community funding opportunities, employment, apprenticeship and training opportunities, and community involvement opportunities. At the time of EIS lodgement, ACEN's contribution to the community involves the following programs: • Stubbo Project SIP; • CW and Orana solar projects CBSP which would see investment in a range of opportunities aligned with the needs of local communities, ACEN and the broader renewable energy sector; and • ACEN's NBSP.
	Community impacts related to reduced social cohesion due to an influx of temporary workers.	High (negative)	Medium (negative)	Local councils. Short-term accommodation providers. Employment and training organisations in the regional area.	ACEN will adopt a number of different measures to reduce the size of the temporary construction workforce including a targeted approach to securing local employees. Construction workforce behaviour will be managed through the implementation of a CWMP. ACEN will appoint a locally based resource to coordinate community and workforce engagement across all ACEN projects in the local area.
	Community impacts related to reduced social cohesion due to the inequitable distribution of project benefits.	Medium (negative)	Low (negative)	Local business operators. Employment and training organisations in the regional area.	ACEN will develop a Local Participation Plan and Aboriginal Participation Plan for the project construction phase.
	Community impacts related to growth and economic development.	Medium (positive)	Medium (positive)	Local business operators. Local councils. Employment and training organisations in the regional area.	ACEN will prioritise local hiring and local procurement where feasible and where practical.

Table 6.28 Summary of social impacts and benefits

	Matter	Unmitigated	Mitigated	Potential partners	Proposed mitigation and management
	Surroundings impacts experienced by near neighbours due to changes in the visual landscape.	High	Medium	Associated and non-associated landholders.	ACEN will: • minimise the use of security lighting to the extent possible to achieve a safe and secure environment; • continue to include project refinement on general measures to minimise the degree of contrast between project infrastructure and the surrounding rural landscape; and • use planting as a visual screen to reduce the visibility of solar project infrastructure from specific vantage points. The ACEN NBSP will also be implemented.
	Surroundings impacts experienced by other stakeholders due to changes in the visual landscape.	Low	Low	Other users of the local road network and people with attachment to the location.	Landscape and visual screening elements will be implemented as part of the project to reduce the visual impact of the project as viewed from the local road network.
	Surroundings impacts due to changes in ecological values and the quality of natural assets.	Medium (negative)	Low (negative)	N/A	A CEMP and OEMP will be prepared for the project.
	Way of life impacts (changes in social amenity) resulting from construction activities.	Medium (negative)	Medium (negative)	N/A	ACEN will implement a Complaints and Grievances Procedure. The procedure will provide an opportunity for stakeholders to raise complaints, grievances, and provide feedback. The procedure will facilitate the timely response to stakeholder complaints and grievances and enable the monitoring and reporting of grievances and ACEN response.

Table 6.28 Summary of social impacts and benefits

	Matter	Unmitigated	Mitigated	Potential partners	Proposed mitigation and management
	Way of life impacts (changes in social amenity) resulting from project operation.	Medium	Medium	N/A	Principal social mitigation measure for way of life impacts include: • landholder agreements; • ACEN's NBSP; • placement of the BESS; and • ACEN 's complaints and grievances procedure. Once the preferred BESS location is identified, additional noise modelling will be completed during detailed design to refine required mitigation and confirm compliance with the NPFI.
	Way of life impacts (personal disadvantage) related to access to affordable housing.	High (negative)	Medium (negative)	Local councils. Real estate-agents and short-term accommodation providers. Employment and training organisations in the regional area. Social housing providers ie Barnardos.	ACEN will prepare a CWAS for the project. The CWAS will seek to mitigate negative impacts and facilitate: • the prioritisation of alternative forms of workforce accommodation during the construction phase of the project; • an increase in the extent of the geographic area for local hires and workforce accommodation; and • enhanced local workforce participation. ACEN will also progress industry engagement (ie with EnergyCo) in relation to the management of cumulative workforce accommodation issues.
	Way of life impacts related to intergenerational equity.	High (positive)	High (positive)	N/A	The approval of the project, as a renewable energy project promotes intergenerational equity. ACEN will also develop a decommissioning and rehabilitation plan for the project that would describe how development footprint would be returner, as far as practicable, to its condition prior to the commencement of construction.
	Accessibility impacts due to capacity of short-term accommodation.	Very high (negative)	Medium (negative)	Short-term accommodation providers. Local councils. Mudgee Regional Tourism.	ACEN will prepare a CWAS for the project. The CWAS will clearly describe how the construction workforce will be accommodated and where they will be accommodated. The CWAS will also described the actions ACEN has taken or plan to take to minimise pressure on the existing capacity of short-term accommodation in the local area. ACEN will continue to advocate with industry bodies such as EnergyCo for a strategic approach to understanding and managing cumulative workforce accommodation impacts from CWO REZ development.

Table 6.28 Summary of social impacts and benefits

	Matter	Unmitigated	Mitigated	Potential partners	Proposed mitigation and management
	Accessibility related to community infrastructure and services.	High (negative)	Medium (negative)	Western NSW LHD including health service providers in the local area. Health Councils in the local area.	The approach to workforce accommodation management will also reduce pressure on health service providers in the local area by reducing the number of temporary workers residing in the local area. ACEN would seek to further reduce pressure by: • engaging in regular communication with health care providers across the regional area; • community benefit sharing with potential investment in initiatives that support health service delivery or health awareness; • prioritising local employment and early investment in partnerships that provide job readiness, training and education outcomes that benefit different sectors of the community and the regional area; • advocating with industry bodies such as EnergyCo for a strategic approach to understanding and managing cumulative impacts from REZ development; and • engaging with other renewable energy proponents in the regional area in relation to a coordinated response to manage potential workforce impacts on services and facilities across the regional area.
	Livelihood benefit related to access to employment and training opportunities (youth).	Medium (positive)	High (positive)	Local employment and training services in the local and regional area, such as TAFE, Mission Australia, and the Goulburn District Education Foundation.	ACEN will prioritise hiring of workers with relevant skills residing within the local area. ACEN will develop a Local Participation Plan that commits to employment and investment in job readiness by ACEN and its contracting partners. ACEN will work with local employment, apprenticeship and training agencies to enhance the potential of hiring local and regional workers.
	Livelihood benefit related to access to employment and training opportunities (Aboriginal and Torres Strait Islander People).	Low (positive)	Medium (positive)	Employment and training agencies supporting Aboriginal and Torres Strait Islander People. Local Aboriginal Land Councils. Local councils.	ACEN will develop an Aboriginal Participation Plan that commits to employment and investment in job readiness by ACEN and its contracting partners. The participation plan will be supported by the Construction Phase SEP.

Table 6.28 Summary of social impacts and benefits

	Matter	Unmitigated	Mitigated	Potential partners	Proposed mitigation and management
	Livelihood impacts related to limited workforce supply and job competition (construction).	Medium (negative)	High (positive)	Business operators in the local area Local councils. Employment and training providers.	ACEN will ensure that project workforce and subcontracting needs are clearly communicated to subcontractors so that they can communicate any delays to their customers or hire additional employees to service their existing business.
	Livelihood impact due to limited workforce supply and job competition (operations).	Low (negative)	Medium (positive)	Business operators in the local area Local councils. Employment and training providers.	With the implementation of the described employment and training measures, more than likely the capacity of the local workforce and local businesses will have increased by the time the project is operational, thereby reducing potential for labour force competition during operations. In particular, the provision of training and apprenticeship opportunities related to servicing renewable energy projects will create legacy benefits as more qualified personnel are trained year on year within the regional area.
	Livelihood impacts due to changes in rural property values.	Medium (negative)	Low (negative)	Near neighbours.	Where significant impacts to neighbouring landholders have been identified, the project has been refined and/or management and mitigation measures have been proposed to further reduce potential impacts. This includes the introduction of setbacks from neighbouring residences to reduce potential views of project infrastructure, paying particular attention to the most valued views from affected residences, or a significant reduction in the development footprint to reduce visual impacts. ACEN will also implement the following measures to reduce impacts to neighbour properties and thus minimise potential risk of property devaluation: • buffer zones during construction works to minimise potential noise impacts at neighbouring residences; • a TMP and Driver Code of Conduct to minimise potential impacts on the safety and serviceability of the local road network; and • a CWMP to manage potential for adverse impacts to occur from the construction workforce.
	Livelihood benefit related to use of local goods and services.	High (positive)	High (positive)	Local business operators.	ACEN will support local business by utilising their established supply networks and providing sufficient opportunities and information for local businesses to secure new supply contracts. Wherever possible and practical, ACEN will work with the local businesses, and the local community to prioritise and use local goods and services.

Table 6.28 Summary of social impacts and benefits

	Matter	Unmitigated	Mitigated	Potential partners	Proposed mitigation and management
	Livelihood benefits related to rural income diversification (associated landholders).	High (positive)	Very high (positive)	Associated and non-associated landholders.	Negotiated agreements will deliver livelihood benefits to associated and non-associated landholders. In addition, ACEN will continue to explore opportunities with landholders to support co-location of livestock grazing with the solar project operation.
	Livelihood benefits related to rural income diversification (non-associated landholders).	Medium (positive)	Medium (positive)	Associated and non-associated landholders.	The NBSP will deliver livelihood benefits to non-associated landholders.
	Livelihood impacts to the agricultural sector.	High	Medium (benefit)	Associated and non-associated landholders. Local farming organisations. Agricultural businesses in the local area.	Agreements with associated landholders and implementation of ACEN's NBSP will delivery supplementary income to associated, and non-associated landholders which in turn may create an opportunity for further investment in agricultural activity. ACEN will engage in frequent communication with landholders and ensure early provision of information regarding the predicted construction impacts to prepare landholders for impacts that cannot be fully mitigated and to provide an opportunity for landholder feedback and engagement. Gate and property access procedures, specific to individual landholder needs and requests will be developed and implemented. ACEN will continue to explore with landholder opportunities to support co-location of livestock grazing with the solar project operation.
	Livelihood impacts to the tourism sector.	High (negative)	Low (negative)	MWRC. Tourism business operators. Short-term accommodation providers.	ACEN will focus on the management of workforce accommodation demands to minimise impacts on the tourism industry sector. The CWAS will clearly describe how the construction workforce will be accommodated and where they will be accommodated. The CWAS will also described the actions ACEN has taken or plan to take to minimise pressure on the existing capacity of short-term accommodation in the local area.

Table 6.28 Summary of social impacts and benefits

	Matter	Unmitigated	Mitigated	Potential partners	Proposed mitigation and management
	Public safety related to increased traffic movements on the local road network.	High (negative)	Medium (negative)	WSC. MWRC. TfNSW.	A detailed CTMP will be developed and implemented for all phases of the project and will involve engagement with school bus operators, CWC Trail Inc. MWRC, WSC and TfNSW. The CTMP will include a Drive Code of Conduct. Road upgrades will be undertaken such as resurfacing and widening along Barneys Reef Road and Birriwa Bus Route South, and new intersection treatment on Castlereagh Highway at the Castlereagh Highway/Barneys Reef Road intersection. Subject to demand ACEN will implement a bus service to and from the project for construction workers residing in Mudgee and Gulgong. ACEN will also encourage carpooling.
	Health and wellbeing impacts related to safe use of the CWC Trail.	Very high (negative)	High	CWC Trail Inc. WSC. MWRC.	ACEN has engaged and will continue to engage in frequent and tailored communication with CWC Trail Inc. The CTMP will include a Driver Code of Conduct and will include direction for drivers on the road to not travel within 100 m of cyclists on Birriwa Bus Route South and not to overtake any cyclists on Birriwa Bus Route South. Speed limits on Birriwa Bus Route South and Barney's Reef Road will be reduced to 80 km/hr for regular traffic.
	Health and wellbeing due to fire risk to public safety.	High (negative)	Medium (negative)	NSW Fire Service. Cudgegong District RFS. Birriwa RFS. Associated and non-associated landholders.	ACEN will prepare a BMP including an ERP for all phases of the project. In preparing and implementing the BMP and ERP, ACEN will consult with the Gulgong and Dunedoo Fire Services, the Birriwa RSF as well as the Cudgegong RFS, MWRC, WSC, and NSW Fire and Rescue. A dedicated water storage facility will be located on the development footprint, to allow for permanent emergency supply and ease of access. Equipment in use will be monitored (ie fire and smoke detectors) and will provide early detection to reduce fire risk. Internal access roads will be maintained at all Health and wellbeing due to stress and times to provide safe, reliable and unobstructed passage for fire vehicles. The proposed CW and Orana solar projects CBSP would provide an opportunity for the local RFS operations to access funding for training and infrastructure investments.
	Health and wellbeing impacts due to project related stress and anxiety (associated and non-associated landholders).	Medium (negative)	Medium (negative)	NA	ACEN has engaged and will continue to engage in frequent and tailored communication with associated and non-associated landholders. This will ensure individuals are kept informed of the project and provided with an opportunity to ask questions or raise issues and concerns.

Table 6.28 Summary of social impacts and benefits

	Matter	Unmitigated	Mitigated	Potential partners	Proposed mitigation and management
	Health and wellbeing impacts due to project related stress and anxiety (broader communities of the local area).	Low (negative)	Low (negative)	NA	ACEN will maintain the project office in Gulgong, during construction and will appoint a locally based resource to manage engagement with the community and other stakeholders. ACEN will development and implement a Construction Phase SEP to guide engagement with the community. And ensure timely release of project information. ACEN proposes to hold a series of community information sessions prior to EIS exhibition to ensure the community is informed of the findings of the technical studies.
	Health impacts arising from sleep disturbance due to operational noise.	Low	Low	NA	ACEN will implement the recommendations of the NVIA.
	Health impacts arising due to proximity to project infrastructure.	Low (negative)	Low (negative)	NA	Elements that reduce EMF exposure have been included in the project design including standard solar PV plant characteristics such as inverters housed in shipping containers or steel cabinets. Potentially ENMF emitting infrastructure ie BESS, underground cabling and arrays have been sited away from occupied residences.
	Cultural impacts related to Aboriginal and Torres Strait Islander Values.	High (negative)	Medium (Negative)	RAPs Other Aboriginal and Torres Strait Islander organisations and residence of the regional area	Long-term management of Aboriginal objects identified within the development footprint will be undertaken in consultation with the RAPS. Identified sites outside the disturbance footprint will be protected during the construction of the project through the use of high-visibility temporary fencing. The location of all sites will be shown on all appropriate plans to ensure that they are not inadvertently harmed. Aboriginal and Torres Strait Islander Organisations in the regional area or with cultural interests in the local area will be encouraged to engage with ACEN regarding shared-value investment opportunities.

6.10.4 Mitigation measures

Table 6.29 details the mitigation measures to be implemented to manage the social impacts from the project.

Table 6.29 Social mitigation measures

ID	Mitigation measures
SOC1	ACEN will adopt a shared value approach in their identification of future community funding opportunities, employment, apprenticeship and training opportunities, and community involvement opportunities.
SOC2	ACEN is exploring the development and implementation of an ACEN Central West Orana solar projects Community Benefit Sharing Program (CBSP) that would see investment in a range of opportunities (including shared value opportunities) aligned with the needs of the community. The CBSP will be informed through a tailored community and stakeholder engagement strategy. In the interim, ACEN will continue to provide community support through the recently established Stubbo Solar and Battery project Social Investment Program.
SOC3	Construction workforce behaviour will be managed through the implementation of a construction workforce management plan (CWMP). The CWMP will seek encourage positive workforce behaviour and participation in community activities.
SOC4	ACEN will appoint a locally based resource to coordinate community and workforce engagement across all ACEN projects in the local area.
SOC5	ACEN will develop a Local Participation Plan and Aboriginal Participation Plan for the project construction phase that commits to procurement, employment and investment in job readiness targets for ACEN and its contracting partners.
SOC6	ACEN will comply with the mandatory contribution obligations for the Birriwa Solar and Battery project, under Section 7.11 and/or Section 7.12 of the EP&A Act in consultation with Mid-Western Regional Council, and/or with any requirements introduced specifically for the CWO REZ in place of such Contributions/Levies. The contributions paid under these requirements will be included in the global amount that constitutes the CBSP.
SOC7	ACEN will work with local employment, apprenticeship and training agencies to enhance the potential of hiring of local and regional workers thereby minimising the need to hire workers from outside of the local and regional areas. Partnership with local employment and training agencies could specifically benefit youth and Aboriginal and Torres Strait Islander People by providing direct employment opportunities.
SOC8	ACEN will implement a Complaints and Grievances Procedure. The procedure will provide an opportunity for stakeholders to raise complaints, grievances, and provide feedback. The procedure will facilitate the timely response to stakeholder complaints and grievances, and enable the monitoring and reporting of grievances and ACEN response.
SOC9	ACEN will prepare a construction workforce and accommodation strategy (CWAS) for the project. The CWAS will document actions that support the following key objectives: • to prioritise other forms of workforce accommodation (ie short-term accommodation and or temporary accommodation village) during the construction phase of the project; • to increase the extent of the geographic area for local hires and workforce accommodation; and • to maximise local workforce participation.
SOC10	ACEN will develop a decommissioning and rehabilitation plan for the project that will describe how the development footprint would be returned, as far as practicable, to its condition prior to the commencement of construction. The decommissioning and rehabilitation plan will also describe the approach to disposal/recycling of infrastructure.
SOC11	ACEN will continue to explore opportunities with landholders to support co-location of livestock grazing within the development footprint.
SOC12	Gate and property access procedures, specific to individual landholder needs and requests, will be developed and implemented.
SOC13	ACEN will develop and implement a construction phase stakeholder engagement plan to guide engagement with the community and ensure timely release of project information.

6.10.5 Conclusion

The outcomes of the SIA indicate that the social impacts to the local and regional areas are confined mainly to the construction phase of the project and relate principally to labour demand, and workforce accommodation arrangements. There are also cumulative dimensions to these issues.

Mitigation and management strategies have been proposed for each of the identified potential social impacts to minimise negative consequences and to maximise social benefits for the local community. Performance indicators will be developed for each management plan in consultation with stakeholders and will be monitored throughout the project life span.

An adaptive approach is proposed allowing ACEN to manage and respond to changing circumstances and new information over time through ongoing monitoring and periodic review of mitigation strategies allowing for modification if required and appropriate. This adaptive approach will ensure that the management of social impacts identified in the SIA will result in minimising negative social consequences and maximising social benefits for the local community.

6.11 Bushfire

6.11.1 Introduction

A bushfire assessment was undertaken by Cool Burn Fire & Ecology for the project in accordance with SEARs and is provided in Appendix P. This section provides a summary of the findings from this assessment.

The project is not on designated bushfire prone land and no fires have been recorded within, or close to, the study area. The project will potentially be exposed to bushfire threat in the form of grassfire and has the potential to cause unplanned ignition of surrounding grassland. Therefore, bushfire risks associated with the project have been assessed in accordance with Chapter 8 and Appendix 2 of *Planning for Bushfire Protection* (PBP) (RFS 2019).

6.11.2 Existing environment

An analysis of the fire weather experienced in the region provides insight into potential bushfire behaviour within the project and surrounds. The Forest Fire Danger Index (FFDI) and Grassland Fire Danger Index (GFDI) values are based upon the LGA and Fire Weather District, as determined by the NSW Rural Fire Service (RFS). The FFDI measures the degree of danger of fire in Australian vegetation and assumes a credible worst case scenario and an absence of any other mitigating factors relating to aspect or prevailing wind. The 1:50 year fire weather scenario for most of NSW is determined as FFDI 80; however, a number of areas including the Greater Sydney, Greater Hunter, Illawarra, Far South Coast and Southern Ranges Fire Areas have higher FFDIs which are set at 100.

The project is in the Mid-Western Regional LGA, and therefore an FFDI of 80 and a GFDI of 110 (Greater Hunter Region Fire Weather District) have been used to inform bushfire behaviour on land within the study area.

The predominant vegetation classification, as per PBP (RFS 2019), is managed, rural grassland vegetation. A large portion of the study area is mapped as non-native and considered cleared, with patches of native pasture vegetation such as derived native grasslands, wind breaks and roadside vegetation strips. The southern perimeter of the study area lays adjacent to Ironbark dominated forests on the Barneys Reef ranges.

Effective slope is considered to be the slope under the vegetation, which will most significantly influence bushfire behaviours for each aspect and is usually the steepest slope. Effective slope surrounding the study area is generally flat (0°) to low undulating (0–5°).

6.11.3 Potential impacts

Fire is capable of damaging the structures associated with the project and consequently impacting upon the safety of staff and contractors. Fire emanating from the project poses a human safety and property threat within the locality, as well as threatening native flora, fauna and ecosystems within the locality of the project.

Woodland fragments are sparse within the development footprint. Throughout the project refinement process ACEN has adopted a preference for avoidance of woodland areas; however, the risk of grassland fire remains. The main potential sources of ignition of unplanned fires during construction and decommissioning of the project are likely to be:

- storage of flammable liquids (eg fuel storage);
- vehicle and machine movement over long grass;
- sparks generated from hot works (eg welders and grinders); and
- human error, such as non-compliance of hot works procedures or incorrect disposal of cigarette butts.

The main potential sources of ignition of unplanned fires from the operation of the project are likely to be the same as those listed above, with the addition of fire risks associated with electrical equipment associated with the operation of the project (eg PCUs, BESS, onsite substation and connection infrastructure). Due to the electrical hazards associated with any power generation facility, including large-scale PV installations, there are additional health and safety considerations for the implementation of effective and appropriate risk control measures when managing an emergency incident that involves an electrical fire.

6.11.4 Mitigation measures

The PBP provides an assessment framework for the identification of potential impacts of bushfire upon proposed new assets and establishes six key bush fire protection measures that are to be addressed and collectively form an effective mitigation strategy to reduce the bushfire impacts. These six key bushfire protection measures are:

- the provision of clear separation of buildings and bushfire hazards, in the form of a fuel-reduced APZ;
- construction standards and design;
- appropriate access standards for residents, fire fighters, emergency service workers and those involved in evacuation;
- adequate water supply and pressure;
- emergency management arrangements for fire protection and/or evacuation; and
- suitable landscaping, to limit fire spreading to a building.

Table 6.30 outlines the mitigation measures to be implemented to manage the risk of bushfire for the project.

Table 6.30 Bushfire mitigation measures

ID	Mitigation measures
BUS1	A minimum 10 m wide APZ will be provided around the perimeter of project assets, including solar array and any operational buildings and storage/laydown areas.
BUS2	The APZ will be installed and maintained for the life of the project to the standard of an Inner Protection Area as outlined within Appendix 4 of PBP and the NSW RFS document *Standards for Asset Protection Zones:* • APZ will be maintained free from fuel (ie comprised of sand, gravel etc; • grass will be kept short and to a height <10 cm; and • where possible, any tree canopy will be excluded from the APZ. Where tree canopy cannot be excluded then the following will be implemented: – ensure canopy cover within the APZ is less than 15% of the total canopy area; – ensure branches do not touch or overhang any infrastructure buildings; – ensure lower limbs are removed up to a height of 2 m above ground; – ensure canopies are separated by at least 2 m; and – preference should be given to smooth barked and evergreen trees.
BUS3	A Bushfire Management Plan will be developed, to guide landscape management, monitor and reduce potential fuel loads surrounding the project and APZ areas via ongoing rural activities (eg slashing, grazing). The Bushfire Management Plan will be developed in consultation with the local NSW RFS District Office.
BUS4	All buildings (BESS, substation buildings, management and operational buildings) will provide for minimum ember protection consistent with BAL12.5 construction standards (AS3959-2018).
BUS5	50–80kL steel tank dedicated water storage will be strategically located in consultation with NSW RFS, to allow for permanent emergency water supply and ease of access.
BUS6	The project site access point and private internal roads will provide for safe, reliable, and unobstructed passage by a Cat 1 firefighting vehicle and maintained for the life of the development.

The preliminary hazard analysis prepared by Sherpa Consulting (refer to Appendix J) also provides recommendations that will be considered during preparation of the Emergency Response Plan for the project.

6.11.5 Conclusion

The study area is not on designated bushfire prone land, in accordance with the Mid-Western Regional Council and Warrumbungle Shire Council bushfire prone land mapping. Notwithstanding, a bushfire assessment in accordance with PBP (RFS 2019) has been undertaken for the project, which demonstrated that the bushfire risk associated with project is low and that the project design and operation can comply in full to the objectives and specific performance criteria of PBP.

6.12 Historic heritage

6.12.1 Introduction

A historic heritage assessment (HHA) was undertaken by OzArk for the project and is provided in Appendix Q (OzArk 2022b). The HAA aimed to investigate any archaeological potential, including built heritage items of historical heritage significance related to European occupation. The HAA included a field investigation of the project to capture potential historical constraints and provided recommendations and management measures for the project. This section of the EIS provides a summary of the findings from this assessment.

6.12.2 Existing environment

There are no items listed on the National Heritage List, Commonwealth Heritage List or State Heritage Register within 5 km of the study area or road upgrade corridor. There are no items listed on the Mid-Western Regional LEP within or adjacent to the study area. The closest listed item is Birriwa Private Cemetery, which is listed on the Warrumbungle LEP, and is approximately 2 km north of the study area.

Early European exploration of the region occurred in the 1820s with the construction of a road across the Blue Mountains facilitating the establishment of cattle runs. There was considerable growth in the area following a gold rush in the early 1870s. Following this, agriculture (predominantly grazing, wheat and wool production) has sustained the region.

6.12.3 Potential impacts

Surveys for the historic heritage assessment took place over eight days at the same time as the Aboriginal heritage assessment field surveys. No historic sites were recorded during the surveys and therefore the project will not impact any historic heritage sites.

Ground disturbing works associated with the project will not harm significant historical archaeological deposits and no further archaeological investigation is required.

6.12.4 Mitigation measures

Table 6.31 list the historic heritage mitigation measures applicable to the project.

Table 6.31 Historic heritage mitigation measures

ID	Mitigation measures
HH1	A historic heritage management plan (HHMP) will be prepared for the project in consultation with DPE, prior to the commencement of construction. The HHMP will include an unanticipated finds protocol that will be implemented if previously unrecorded or unanticipated historic objects are encountered during construction.

6.13 Other impacts

6.13.1 Air quality

i Existing environment

Land use within the study area and surrounds is primarily agricultural, which is likely to influence local and regional air quality. Existing sources of air pollution within a local setting are limited and consist primarily of dust and vehicle and machinery exhaust emissions associated with agricultural production and freight transport along the Golden Highway and Castlereagh Highway. There are a number of mining operations near Ulan, which is approximately 20 km south-east of the study area.

There are four associated residences within or in close proximity to the study area (A2, A4, A6 and A8). There are 21 non-associated residences within 2 km of the study area, many of them in the township of Birriwa, and another 22 between 2 km and 5 km away.

ii Potential impacts

a Construction

Emissions to the atmosphere from the project during construction will be temporary and restricted to dust caused by land disturbance and vehicle, plant and equipment exhaust emissions. Construction of the project will take approximately 28 months from the commencement of site establishment works.

Civil works will be required to prepare the construction laydown area and array areas by installing fencing, internal access tracks, and undertaking minor earth works. In addition, there will be excavation of the trenches for the medium voltage and high voltage cable network that may be buried underground.

The need for heavy civil works such as grading/levelling and compaction will be minimised as much as practicable, as the land within the development footprint is mostly flat or gently undulating. Some heavier earth moving activities will be required for certain project infrastructure where a level pad is necessary (ie substation and BESS). In addition, grading around lower order streams and drainage channels within the development footprint may also be required in order to manage erosion during construction.

During construction, surface disturbance works will include:

- construction of access tracks and boundary fencing;
- preliminary earthworks and installation of environmental controls including erosion and sediment management structures;
- driving or screwing piles to provide support for the mounting frameworks required for the PV modules;
- installation of DC cabling to connect the PV modules to the PCUs;
- installation of the medium voltage cable reticulation network to transport electricity;
- preparation of foundations for the substation and BESS;
- construction of the BESS and relevant infrastructure;

  construction of transmission infrastructure;
- construction activities associated with upgrades to the local road network (namely Barneys Reef Road and Birriwa Bus Route South); and

- installation of permanent fencing and security.

Exhaust emissions will also be generated by the plant and equipment required for the construction of the project. These will include:

- vehicles travelling to and from the development footprint;
- earthmoving machinery and equipment for site preparation;
- cable trenching and laying equipment;
- pile-driving equipment;
- assisted material handling equipment (forklifts and cranes);
- machinery and equipment for connection infrastructure establishment and installation of BESS; and
- water trucks for dust suppression.

During decommissioning, no additional air quality impacts to those described above are anticipated. Total vehicle movements to and from the development footprint during decommissioning will be similar to those experienced during construction. However, it is anticipated that the length of the decommissioning stage will be shorter than the construction stage and therefore emissions to the atmosphere will also be experienced over a shorter period of time.

b Operations

Ongoing maintenance of the development footprint and project infrastructure will be required during operation. The infrastructure maintenance activities listed in Section 3.4.2 will result in minor, localised vehicle emissions and generation of dust from vehicles travelling along the internal, unsealed access roads. Provided the recommended mitigation measures are implemented, predicted impacts will be adequately managed.

iii Mitigation measures

The implementation of the recommended mitigation measures will ensure that the project will not generate significant air quality impacts during construction, operation or decommissioning.

ACEN will apply appropriate mitigation strategies to reduce potential dust generation by project-related construction traffic. This may include measures within the TMP such as speed reduction along unsealed portions of local roads.

The project will not generate significant air quality impacts during construction, operation or decommissioning provided the mitigation measures in Table 6.32 are implemented.

Table 6.32 Air quality mitigation measures

ID	Mitigation measures
AQ1	Water truck(s) will be used during construction for dust suppression along internal, unsealed access roads and disturbed areas.
AQ2	Vehicle movements will be minimised, where possible.
AQ3	All vehicles, plant and equipment will be cleaned and washed regularly.
AQ4	All vehicles, plant and equipment will be regularly inspected and maintained to ensure that they are operating efficiently.
AQ5	Regular maintenance of unsealed access roads will be undertaken to minimise wheel-generated dust.
AQ6	Dust suppression requirements during construction will take into consideration weather and the likelihood of extended dry periods which could exacerbate impacts.

6.13.2 Waste

i Existing environment

Mid-Western Regional Council operates waste management facilities in Gulgong (approximately 20 km south of the project) and Mudgee (approximately 60 km south of the project), as well as a village and rural waste transfer station at Birriwa. Commercial waste removal and bulk recycling services are also available. In addition, Warrumbungle Shire Council operate a waste transfer station in Dunedoo (approximately 15 km north-east of the project).

ii Potential waste streams and management

The waste types likely to be generated during the project have been outlined below in Table 6.33, as well as the waste type, classification, description and management details.

Table 6.33 Potential construction waste types, classification and management details

Waste type	Description	Classification	Management details
Paper and cardboard	Packaging materials, general office wastes and confidential documents.	General Solid Waste (non-putrescible)	Separated for recycling.
Wood	Pallets and cable drums, timber offcuts, wood separators (to prevent damage to photovoltaic modules).	General Solid Waste (non-putrescible)	Separated for reuse or recycling.
Plastic	Packaging materials ties, straps and excess building materials such as safety fencing and barriers.	General Solid Waste (non-putrescible)	Disposed to landfill.
Green waste	Vegetation waste from clearing activities.	General Solid Waste (non-putrescible)	Beneficial onsite or offsite reuse or disposal to a green waste facility or landfill.
Soil	Surplus spoil from excavations and earthworks.	General Solid Waste (non-putrescible)	Onsite reuse or offsite reuse or disposal at a licenced facility. Any contaminated soils (if encountered) would be tested and treated onsite and/or disposed of to a suitably licensed facility.
Electrical	Excess building materials or retired equipment ie solar panels.	General Solid Waste (non-putrescible)	Separated for reuse or recycling or disposal at an approved facility.
Metals	Excess building materials such as safety fencing and barriers or retired equipment.	General Solid Waste (non-putrescible)	Separated for reuse or recycling.
Liquid waste	Oils and fuels, contaminated water from equipment washing.	Liquid waste	Collection in tanks and transported to an offsite licensed facility.
Sewage	Biological waste from onsite septic systems.	Liquid waste and General Solid Waste (non-putrescible)	Collection in tanks and transported to an offsite l licensed facility.
General	Food scraps aluminium cans, glass bottles, plastics and paper containers from the operations maintenance buildings.	General Solid Waste (putrescible and non-putrescible)	Collection by a waste management contractor and disposed of to a suitably licensed facility.
Commercial waste	Oily rags, filters and drums (non-volatile).	General Solid Waste (non-putrescible)	Collection by a contractor and disposed of to a suitably licensed facility.
Waste batteries	Retired batteries used in appliances and construction equipment.	Hazardous waste	Collection by a contractor and disposed of to a suitably licensed facility.

A detailed summary of the waste types, classification, proposed management methods, and estimated annual quantities of wastes produced during the construction and ongoing operation of the project will not be available until the detailed design stage of the project has been completed. These will be included in the project's detailed Waste Management Plan (WMP) prior to construction. The WMP will be prepared in consultation with Mid-Western Regional Council and DPE. In addition, ACEN may also consult with neighbouring councils (eg Warrumbungle Shire Council) should the need for access to additional waste management facilities within the greater Central West region be required.

Notwithstanding, the need to consider specific issues as part of the preparation of the WMP, based on practical experiences with other solar projects the following can be anticipated:

- arrangements will be put in place between the contractor selected for the project, a licensed waste management company and, where available, local sub-contractors (or similar);
- a significant proportion of the waste generated during construction is likely to be the cardboard packaging used for the PV modules and tracker components, which can be recycled (the volume of this waste stream may be in the order of several thousand kilograms per week during peak delivery periods);
- wooden pallets will be another significant waste stream during peak delivery periods and these can be reused if in good condition or sold for wood chip if damaged (the volume of this waste stream may be in the order of 1,000–2,000 units per week during peak delivery periods);
- PCUs will typically be self-contained (containerised) or pre-assembled on a skid or concrete mounted platform and will generate limited waste materials; and
- skip bins will typically be implemented on-site to encourage waste separation (eg separate skip bins for cardboard recycling and timber collection) and general waste bins will be provided for disposal of materials that cannot be cost-effectively recycled.

Potential impacts from poor management of waste include contamination of land and water, and human and animal health impacts.

Both Mudgee and Gulgong waste facilities can accept general waste, recycling, green waste, scrap metal and e-waste, whilst Mudgee Waste Facility also accepts tyres, construction and commercial waste and asbestos. The capacity of these facilities to accept each waste stream will be dependent on the volume provided and how it is provided (ie co-mingled or segregated wastes). It is anticipated that the volumes generated by the project may exceed the capacity of the waste management facilities within the Mid-Western Regional LGA. Discussions with Mid-Western Regional Council and Warrumbungle Shire Council have taken place and concluded that due to the expected volumes it is likely that the waste will need to be managed by a commercial agreement between a contractor(s) appointed by ACEN for the construction of the project, a licensed waste management company and the relevant local councils.

Significant quantities of waste generated during construction, such as cardboard packaging and wooden pallets will be suitable for reuse, recycling or alternative use (eg chipping of pallets for mulch), which will reduce the volume of waste going into landfill. ACEN is currently in discussions with several leading PV module suppliers to understand what they are doing to reduce the volume of plastic used in packaging (ie for shipping/transport of PV modules).

During decommissioning, dismantled and decommissioned infrastructure will be recycled, where possible. There are presently no dedicated recycling facilities for PV modules in Australia; however, these are expected to be established by the time the project is decommissioned as the industry will have had time to develop. Structures and equipment that cannot be recycled will be disposed of at an appropriately licensed waste management facility.

iii Mitigation measures

The project will produce a number of different types of waste during construction, operations and decommissioning. All wastes produced by the project will be classified, stored and handled in accordance with the *Waste Classification Guidelines – Part 1: Classifying Waste* (EPA 2014).

A WMP will prepared and implemented in consultation with Mid-Western Regional Council and DPE. A key objective of the WMP will be to ensure that any use of local waste management facilities does not disadvantage local businesses and, more generally, the local community, by exhausting any available capacity at these facilities.

Table 6.34 details the waste mitigation measure to be implemented as part of the project.

Table 6.34 Waste mitigation measures

ID	Mitigation measures
WAS1	All waste will be managed in accordance with the NSW *Protection of the Environment Operations Act 1997* and the NSW *Waste Avoidance and Resource Recovery Act 2001*.
WAS2	All wastes produced by the project will be classified, stored and handled in accordance with *the Waste Classification Guidelines – Part 1: Classifying Waste* (EPA 2014).
WAS3	Waste will be managed in accordance with the waste hierarchy, which is listed in order of preference: • reduce waste production; • recover resources; and • dispose of waste appropriately.
WAS4	A detailed waste management plan will be prepared prior to construction.
WAS5	As part of decommissioning, ACEN will attempt to recycle all dismantled and decommissioned infrastructure and equipment, where possible (refer to Section 3.4.3).
WAS6	General waste bins will be provided for disposal of materials that cannot be cost-effectively recycled.

6.14 Cumulative impacts

The project will contribute to the overall development of the CWO REZ. Other proposed, approved, under construction and operational renewable energy developments known at the time of finalisation of this EIS and within and in the vicinity of the CWO REZ are shown in Figure 2.4. As shown, there are several renewable energy generation projects (proposed and approved) in the vicinity of the project.

Development in the vicinity of the project has the potential to generate cumulative impacts with the project during both construction and operation. An assessment has been completed with reference to the *Cumulative Impact Assessment Guidelines for State Significant Projects* (DPIE 2021f). The assessment has included consideration of:

- Incremental impacts – impacts of the project to the existing baseline condition of each relevant assessment matter (eg noise, water, biodiversity, heritage, traffic, employment and workforce). The impacts from existing developments have been assumed as part of the baseline conditions, and the incremental impacts of the project have been considered to identify the change in baseline. This is completed in relevant technical assessments and summarised in the relevant sections above in Chapter 6.

- Combined incremental assessment – combined effect of the different impacts of the project, summarised in this section. Existing and approved developments within the local area (known at the time of EIS finalisation) have been considered in the cumulative assessments of each of the technical assessments for visual, noise, traffic and social aspects. Cumulative impacts with other existing development, including those contributing to visual impacts to the landscape, generation of noise that contributes to background noise levels, use of transport routes by local traffic and nearby developments, and social impacts and benefits associated with other development in the local area have all been considered.

- Issue-specific cumulative assessment – impacts of the project together with the impacts of other relevant future projects on specific issues within an identified area, summarised in this section.

- Combined cumulative assessment – considering the combined effect of the different cumulative impacts of the project with other relevant future projects on key matters in an identified area. This is largely qualitative and combined with the issue-specific cumulative assessment in this section. The qualitative nature relates to a range of uncertainties including:
    - the level of detail available for future projects – often future projects are at early stages of the planning process and limited information is available regarding the nature, timing and potential impacts of such projects;
    - the likelihood that those projects will proceed – while many projects will gain approval, some may not, and some projects may never proceed despite gaining approval; and
    - the uncertainty of timing of future projects – while they may proceed at some point in the future, the timing is unknown.

6.14.1 Other state significant projects

There are several state significant development projects (Section 2.4) recently approved or proposed in the local area, as identified through DPE's Major Projects Planning Portal at the time of writing this EIS. A radius of approximately 25 km from the project has been used to identify future projects for consideration of potential cumulative impacts. Of the SSD projects:

- the majority are located in the LGAs of Mid-Western Regional and Warrumbungle;
- two are approved with construction yet to commence (Stubbo Solar and Battery project and Dunedoo Solar Farm);
- six are in various stages of the SSD assessment process; and
- one is approved and operational (Beryl Solar Farm).

A summary of the potential for cumulative impacts with future projects within 25 km of the project is provided in Table 6.35. Cumulative impacts are explained further in Section 6.14.3. As described, potential cumulative impacts have been identified with three nearby projects, the Stubbo Solar and Battery project, which is another ACEN project, and the Tallawang Solar Farm and the Barneys Reef Wind Farm, primarily in relation to potential traffic and visual impacts, if construction stages overlap with the project. Stubbo Solar and Battery project was approved by DPE in June 2021 and is yet to start construction, and SEARs have been issued for both Tallawang Solar Farm and Barneys Reef Wind Farm projects. The remaining projects will either be at a different stage or are sufficiently distant from the project so as not to generate cumulative impacts.

Construction schedules and information pertaining to cumulative impact data for both Tallawang Solar Farm and Barneys Reef Wind Farm were not publicly available at the time of finalising this EIS. However, several ACEN projects, including Birriwa Solar and Battery Project, were shortlisted as a CFG to engage with EnergyCo about issues related to developments in the CWO REZ including connection to the CWO REZ Network Infrastructure, traffic management, workforce and cumulative impacts.

Mitigation measures proposed as part of the project, relating to cumulative impacts include:

- implementation of a traffic management plan (in consultation with TfNSW), which will incorporate adaptive management measures to ensure that potential cumulative impacts can be effectively managed and minimised as far as practical; and
- a construction workforce and accommodation strategy (CWAS) will be developed for the project, which will take into account the workforce demands of nearby projects including Stubbo Solar Farm.

Table 6.35 Cumulative impacts with future projects identified within 25 km of the project

LGA	Project name and development type	Approximate distance to project	Status	Overlap with project and potential for cumulative impacts
Mid-Western Regional LGA	Stubbo Solar and Battery project Electricity generation – solar	14 km south-east	Approved in August 2021. 24 months construction period/ 30 years life of project. Peak construction during the last 12 months.	The project involves the construction and operation of a 400 MW solar farm with energy storage. There is some potential for cumulative impacts related to construction (particularly in relation to construction workforce demand and construction workforce accommodation), as it is anticipated that construction of the Stubbo Solar and Battery project and the project may overlap by approximately 12 months. It is likely that Stubbo Solar may be completed by the time Birriwa Solar is completed. The main traffic route to Stubbo Solar enters from the east along Cope Road. Therefore cumulative traffic impacts are unlikely to interact. Stubbo Solar project is also developed by ACEN. No cumulative impacts are likely for operation.
	Tallawang Solar Farm Electricity generation – solar	16 km south	SEARs issued. 34 month construction period/ 35 years life of project.	The development involves the construction and operation of a solar farm including up to 500 MW of solar electricity generation with a BESS. The construction timeline for Tallawang Solar Farm, if approved, is not known. However, it is understood that the EIS is being developed, and therefore there is the potential, if both projects are approved, for the construction periods for Tallawang Solar Farm and the project to overlap. This may lead to cumulative impacts with respect to traffic movements; workforce demand; and a higher demand for short-term accommodation.

Table 6.35 Cumulative impacts with future projects identified within 25 km of the project

LGA	Project name and development type	Approximate distance to project	Status	Overlap with project and potential for cumulative impacts
	Barneys Reef Wind Farm Electricity generation – wind	6 km south	Amend SEARs. 28 months construction period, with peak construction period expected in months 7–14.	The development involves the construction and operation of a wind farm with approximately 63 wind turbines and battery storage. Development in the vicinity of the Barneys Reef Wind Farm has the potential to generate cumulative traffic and visual impacts with the project during construction, and visual impacts during operations. Like Tallawang Solar Farm, it is understood that the EIS is being developed for Barneys Reef Wind Farm, and therefore there is the potential, if both projects are approved, for the construction periods for Barneys Reef Wind Farm and the project to overlap. Cumulative impacts during construction periods which may overlap would primarily relate to traffic movements, workforce demand; and a higher demand for short-term accommodation and the change in landscape as the turbines are erected.
	Bellambi Heights Solar Farm Electricity generation – solar and batter storage	21 km south	SEARs issued. 12 to 18 months construction period/ 30 years and 20 years for BESS life of project.	The development involves the construction and operation of a solar farm including up to 200 MW of solar electricity generation with energy storage. This future development is spatially distant from the project and no cumulative impacts have been identified in terms of traffic movements, noise, and visual. However, if construction periods overlap with the project, this may lead to cumulative impacts relating to workforce and a higher demand for short-term accommodation for this future development.
	Beryl Solar Farm Electricity generation – solar	24 km south	Operational. 12 months period.	As construction of the Beryl Solar Farm has been completed, there is no potential for cumulative impacts associated with the operation of the project.
Warrumbungle LGA	Valley of the Winds Electricity generation – wind	14 km northeast	Response to Submission stage. 24 to 42 months construction period.	The development involves the construction and operation of a wind farm comprising approximately 175 wind turbines generating approximately 800 MQ of electricity. There is no potential for cumulative impacts related to construction and or operation as the wind farm should be fully operational before construction of the project commences.

Table 6.35 Cumulative impacts with future projects identified within 25 km of the project

LGA	Project name and development type	Approximate distance to project	Status	Overlap with project and potential for cumulative impacts
	Sandy Creek Solar Farm Electricity generation – solar	23 km southwest	SEARS issued. Preparing the EIS 22 to 28 months construction period/ 50 years and 20 years for BESS life of project.	The development involves the construction and operation of a solar farm including up to 750 MW of solar electricity generation with energy storage. This future development is spatially distant from the project and no cumulative impacts have been identified in terms of traffic movements, noise, and visual. However, if construction periods overlap with the project, this may lead to cumulative impacts relating to workforce and a higher demand for short-term accommodation for this future development.
	Dunedoo Solar Farm Electricity generation – solar	13.5 km northwest	Approved. Construction yet to commence. 10–12 months construction period/ 30 years life of project.	The development involves the construction and operation of a solar farm including up to 55 MW of solar electricity generation with energy storage. There is no potential for cumulative impacts related to construction and or operation as the solar farm should be fully operational before construction of the project commences. Although Dunedoo Solar Farm is likely to use a similar traffic route to Birriwa, it will not materially add to the cumulative traffic impacts due to the lower volume of traffic required for a 55 MW project.
	CWO REZ Network Infrastructure		Community Consultation. Easement acquisition. Development Application yet to commence. Expected to commence December 2022.	The Birriwa Solar and Battery project is located within the CWO REZ transmission corridor. This would indicate the possibility of new high voltage transmission lines running west to east near the site. The transmission towers could add to the visual impacts of the surrounding landscape. If construction periods overlap with the project, this may lead to cumulative impacts relating to workforce and a higher demand for short-term accommodation for this future development.

6.14.2 Other related development

As described in Section 1.2 and Section 1.4, the project will require connection works at the project's operational infrastructure area (including the BESS and substation).

From the substation, electricity generated by the project will be injected into the grid at the development footprint boundary via one of two indicative connection points (refer to Figure 3.1). The exact location of the interface point between the project and the Merotherie Energy Hub are being defined in consultation with EnergyCo, as explained in Section 1.4.

The optimal connection option between the project and the Merotherie Energy Hub is anticipated to be a relatively short transmission line, which is not included in the project. This transmission line is expected to be part of the CWO REZ Network Infrastructure and is not included in this proposal.

The potential for cumulative impacts associated with this aspect of the project is considered to be limited, as works will be relatively short term (by virtue of the short connection distance and topography) and concurrent with the construction of the project. Impacts arising from the construction of the transmission line will be managed with standard environmental mitigation and management measures.

6.14.3 Assessment of cumulative impacts

i Employment and workforce

The employment demands for the future projects identified may cause potential impacts on the availability of skilled workforce in the local area, should construction periods overlap substantially. This may require additional workers to be sourced from outside the local and regional areas.

The potential of a non-resident and relocating workforce to service the concurrent developments may contribute to the cumulative impacts in the local area. This may result in impacts on the capacity and availability of local service providers, accommodation providers and increased traffic. However, potential cumulative benefits may also be associated with the high number of SSD projects in the local area, such as increased employment and economic opportunities for local businesses and suppliers.

Local construction and general labour workforce availability may also be impacted by these concurrent developments. This may result in a shortage of workers which would increase the need for drive-in-drive-out workers that would exacerbate pressures on accommodation and housing. However, there is potential for an increase in local job availability supported by a number of SSDs to drive industry growth in the local area and the region.

The construction workforce is estimated to peak at approximately 800 FTE employees during the peak construction phase and will consist of a combination of local hires and non-local hires.

ii Population change

The construction phase of the project will generate approximately 800 new jobs at peak construction. With approximately 70% (560 people) of the construction workforce expected to comprise of workers from outside of the area, a temporary population increase of about 560 people is therefore expected in the local area. The anticipated construction workforce associated with expected concurrent projects ie Stubbo Solar and Battery project, Tallawang Solar Farm and Barneys Reef Wind Farm) is 3,466 full-time employees. While it is unlikely that all of these employees will be sourced from outside the regional area, the total has been used as it is not possible to predict the level of in migration resulting from other projects. The sum of non-local construction workers for the project and the anticipated construction workforce of concurrent projects is [560 + 3,466]. It is also noted that while possible, it is unlikely that the construction periods of all four projects will overlap. This is therefore considered a conservative estimate.

If all four projects were to be constructed at the same time, the maximum temporary cumulative population increase as a result of the project and other concurrent developments could be up to around [4,026] people. This represents a 15.7% increase in the total population of the Mid-Western Regional LGA based on the 2021 population figure of 25,563.

Further discussion on the construction workforce and mitigation measures proposed is provided in Section 6.10 and Appendix E.

iii Amenity

Potential amenity impacts could arise from dust accumulating from an increase of truck movements, especially during construction phase, as well as noise caused by plant and equipment, operating and traffic generation.

Potential cumulative visual impacts can arise from the presence of similar projects that may have a low impact individually, but when viewed together, can have a significant visual impact on the landscape. Barneys Reef Wind Farm, if approved, has the potential for cumulative impacts during construction and operations. The construction impacts would primarily be vehicle movements and the change in landscape as the turbines are erected. If the wind farm is constructed during the construction of the Birriwa Solar Farm, there is potential for cumulative impacts.

Due to the height of the wind turbines and the extent across the landscape, wind farms are visible from a greater distance than solar farms. During the operations stages of the wind farm and the project, there is potential to see both projects from very limited points on the Castlereagh Highway or the Golden Highway. The potential also exists along Merotherie Road.

Additionally, the proposed solar and battery project is located within the CWO REZ transmission corridor. This would indicate the possibility of new high voltage transmission lines running west to east near the site. The transmission towers could add to the visual impacts of the surrounding landscape.

Of the projects listed in Table 6.35, only the Barneys Reef Wind Farm and the transmission lines have the potential to be visible at the same time as the construction of project. The most likely impact would be on people travelling on Castlereagh Highway or the rail line from Gulgong to Dunedoo, who would travel past three or four solar farms and a wind farm.

iv Traffic and public safety

Development in vicinity of the project has the potential to generate cumulative traffic impacts with the project. The greatest potential for cumulative impacts of future projects and the project in relation to traffic are associated with construction of the Tallawang Solar Farm and Barneys Reef Wind, which have the potential to have construction periods that overlap with the project.

These projects are expected to require increased heavy vehicle movements during construction. In particular it is expected that heavy and light vehicle movements would use the Castlereagh Highway, and the intersection between Castlereagh Highway and Barneys Reef Road, therefore there is potential for cumulative traffic impacts at this intersection.

The scoping reports for Tallawang Solar Farm and Barneys Reef Wind Farm do not specify the construction start and end months/year of their respective developments. Currently, there is no publicly available information regarding their construction schedules.

According to the TIA (Appendix H), there will be an increase in the peak hour volume of traffic from 450 at the baseline conditions to 600 at the cumulative traffic conditions, with 12% of this total being heavy vehicles (EMM 2022e). These traffic totals are for a worst-case scenario where it is assumed that traffic from the two nearby developments, Tallawang Solar Farm and Barneys Reef Wind Farm, project construction traffic and road network traffic would all overlap in the same morning and evening peak hours. The TIA considers this highly unlikely, and further, arrival and departure patterns of traffic may not necessarily coincide.

Potential cumulative impacts are likely if the peak construction periods of these projects overlap, and it is proposed that this be further considered in subsequent phases of the project as the construction timeframes for each of the projects becomes more certain. A range of mitigation measures are proposed as part of the project, including the implementation of a construction traffic management plan, which will incorporate adaptive management measures to ensure that potential cumulative impacts can be effectively managed and minimised as far as practical.

The TIA considered the potential cumulative traffic impacts of the project particularly associated with heavy vehicle movements, including a road safety assessment. The impact on road safety for all road users is considered to be negligible, with an assessment concluding no major road safety hazards were identified which may result from the proposed increase in both light and heavy vehicle volumes. Additionally, the recorded crash history along the Castlereagh Highway and road upgrade corridor does not indicate an existing or developing road safety problem that would be made worse by the cumulative contribution of the vehicle traffic to/from the project.

v Services

Local population growth (temporary or permanent) associated with local and regional development can increase the need for funding and presence of local social and health services due to increased pressures and demand from workforces of the concurrent SSDs. Temporary population growth associated with the proposed SSDs workforces may increase demand for more health services, for different health services including specialists, and for more diversity and capacity in employment and training organisations.

A potential cumulative benefit of the large number of local projects is related to significant combined community contribution (eg benefit sharing agreements and opportunities), procurement and local investment.

MWRC operates waste management facilities in Gulgong (approximately 20 km south of the project) and Mudgee (approximately 60 km south of the project), as well as a village and rural waste transfer station at Birriwa. Commercial waste removal and bulk recycling services are also available. In addition, Warrumbungle Shire Council operate a waste transfer station in Dunedoo (approximately 15 km north-east of the project).

Discussions with Mid-Western Regional Council and Warrumbungle Shire Council have taken place and concluded that due to the expected volumes it is likely that the waste will need to be managed by a commercial agreement between a contractor(s) appointed by ACEN for the construction of the project, a licensed waste management company and the relevant local councils.

vi Housing and short-term accommodation

The rental vacancy rate in the local area in May 2022 was consistently below the 3.0 % benchmark, indicating a tight rental market with an undersupply of rental housing during that time. Whilst the data shows considerable fluctuation in rental vacancy rates across the three communities of the local area, overall rental vacancy rates have steadily declined. In May 2022, there were three rental vacancies in Dunedoo, three in Gulgong and 42 in Mudgee. An additional 77 properties were located in Dubbo (SQM Research 2022).

Increased demand for skilled workforce and trades skills more generally, may arise with the construction and operation of concurrent SSD projects. This may cause potential impacts on the availability of skilled workforce in the LGA, requiring additional project workforce to be sourced from outside the local and regional areas, which may increase demand on rental housing within the local and regional areas.

The MWRC estimates there are currently 3,200 rooms of short-stay accommodation in the Mid-Western Regional LGA and a much smaller number of rooms in the Warrumbungle LGA, with an average occupancy rate of over 80% (SIA field study). Assuming the majority of workforces associated with other projects that overlap with the project will be sourced from outside the regional area, then the projected cumulative demand for short-term accommodation and rental accommodation in the regional area will be extreme and supplementary accommodation eg temporary workforce accommodation village would need to be provided.

This has significant potential consequences for persons currently at risk of financial hardship, housing instability and homelessness, particularly in the context of COVID-19, which has further contributed to increased rents and lower rental availability in regional areas of Australia due to migrations from urban centres to more regional and rural areas (Anglicare 2021). Commitments to local hiring, provision of training and apprenticeship opportunities for local workers, and partnership with local employment and training services reduce the need for outsourcing of workers.

The number of projects in the regional area suggests a long-term pipeline (possibly upwards of 10 years) of construction work opportunities located in the regional area. With industry collaboration there is an opportunity to draw a permanent resident construction workforce to the regional area. This would have a positive effect on accommodation demand as workers may seek to buy in the regional area and relocate permanently if there is a clear pathway forward for long-term employment. The Warrumbungle LGA in the regional area and Dunedoo and Gulgong in the local area are all experiencing a trend of population decline. Encouraging a permanent construction workforce on the regional area would benefit long term sustainability of these communities and the services and facilities they provide, as well as supporting long term economic benefits for business operators.

7 Project justification

This chapter provides a justification and evaluation of the project, having regard to the economic, environmental, and social impacts and benefits of the project and the principles of ecologically sustainable development (ESD).

7.1 Summary

The development and operation of the project, in conjunction with other large-scale renewable energy projects, has potential to fill the need for replacement power as ageing coal-fired generators face closure. The project is consistent with relevant Commonwealth, State, regional and local strategic plans and polices, in particular the *NSW Electricity Infrastructure Roadmap*, which sets out the plan to deliver REZs in NSW. The project will contribute to the energy generation and storage targets for the CWO REZ, with an indicative capacity of around 600 MW and storage of up to 600 MW for a 2 hour duration (1,200 MWh).

In addition to its location within the CWO REZ, the study area is favourable for the construction and operation of a solar and battery project due to the available solar resource, physical conditions (flat to gently undulating topography and predominantly cleared, agricultural land), absence of biophysical strategic agricultural land and relatively few residences living within close proximity. In addition, the project's proximity to the proposed CWO REZ T-Link and Merotherie Energy Hub means that there will be infrastructure within the immediate area with the capacity to export the electricity generated by the project to the grid.

Were this project not to proceed, the project's benefits, including contributions to the generation of renewable energy and increased energy security, will not be realised. Due to the need to establish renewable energy generation and storage projects in NSW, not proceeding with the project in its current location may encourage development in a less favourable location, resulting in undesired outcomes, such as greater requirements for grid connection infrastructure and greater environmental and social impacts.

The project will have both impacts and benefits on the surrounding natural and built environments. The impacts have been investigated, are not predicted to be significant and can be adequately managed through appropriate design, mitigation and management during construction and operation. On balance, it is therefore considered that the project is in the public's best interest.

7.2 Design development

During the preparation of the EIS, the development footprint within the study area has been refined based on environmental constraints identification, stakeholder engagement, community consultation and design of project infrastructure with the objective of developing an efficient project that avoids and minimises environmental and social impacts.

Throughout the project refinement process (refer to Section 2.5.4), ACEN has made considerable effort to avoid potential environmental impacts where possible. In those instances where the potential for impacts cannot be avoided, ACEN's design principles have sought to minimise environmental impacts and/or implement mitigation measures to manage the extent and severity of any residual impacts. The proposed mitigation measures that will be implemented for each of the key environmental matters assessed in this EIS are summarised in Appendix E.

The development footprint reflects the most appropriate area for the project infrastructure based on inputs provided during consultation activities with regulatory and community stakeholders (refer to Chapter 5), environmental assessments undertaken to date (refer to Chapter 6) and the functional requirements of project infrastructure. In a number of instances, the irregular shape of the development footprint is a result of avoidance of identified impacts.

During detailed design and prior to the commencement of construction, it is anticipated that the placement of infrastructure and extent of construction activities will be further refined to ensure avoidance and minimisation objectives are met.

7.3 Strategic context

The project is supported by Commonwealth, State, regional and local plans and policies (as described in Table 2.1) and will support the Commonwealth and State governments to achieve their respective renewable energy and greenhouse gas emission reduction targets. Importantly, the project will also contribute to the continued growth of renewable energy generation and storage capacity in the CWO REZ.

7.4 Objects of the EP&A Act

The objects of the EP&A Act are set out in Clause 1.3 of the Act. An assessment of the consistency of the project with the objects of the EP&A Act is provided in Table 7.1.

Table 7.1 Project's consistency with the objects of the EP&A Act

Object	Consistency with the project
To promote the social and economic welfare of the community and better environment by the proper management, development and conservation of the State's natural and other resources.	Resources within the study area and, more specifically, the development footprint, include land that is being used for agricultural production and land which has biodiversity and Aboriginal cultural heritage values. This constitutes the 'natural resources', which must be properly managed, developed or conserved. It is acknowledged that the development of the project will reduce the utilisation of the land within the development footprint for agricultural production; however, this impact will be mitigated by a number of factors including: • the use of single axis tracking PV modules involves a typical row spacing of 8–12 m, which would leave a significant area of land that could still be utilised for sheep grazing during operations; • site selection – the development footprint has been strategically placed so that primary production can continue within the immediate surrounds and to reduce potential impacts on the use of neighbouring farmland for primary production purposes; and • return to agricultural land – the development footprint can be returned to agricultural land use at the completion of the project's operations. Land management practices will avoid or minimise potential impacts to neighbouring agricultural operations that have been identified during engagement with the local community and as part of the LUCRA. Through design, the project will have minimal impact on biodiversity values and Aboriginal cultural heritage resources. The existing agricultural use of the development footprint means that impacts on biodiversity will be minimal, and largely associated with the road upgrade corridor; the footprint of which has been minimised in consultation with Council engineers. The residual biodiversity values that will be impacted by the project will be offset. The impact of the project on Aboriginal cultural heritage will be limited to one site, which will be salvaged prior to construction. The development footprint has been altered to avoid the other Aboriginal cultural heritage sites identified in the study area.
To facilitate ecologically sustainable development by integrating relevant economic, environmental and social considerations in decision-making about environmental planning and assessment.	This EIS describes the economic, environmental and social context of the project and the potential impacts of it to allow informed consideration of these aspects in determining the development application. The project will contribute to the continued growth of renewable energy generation and storage capacity, as well as providing energy security and reliability.

Table 7.1 Project's consistency with the objects of the EP&A Act

Object	Consistency with the project
To promote the orderly and economic use and development of land.	The orderly and economic use of land is best served by development that is permissible under the relevant planning regime and predominately in accordance with the prevailing planning controls. The project is permissible with consent, is consistent with statutory and strategic planning controls and will connect to the Merotherie Energy Hub, the indicative location of which is in the vicinity of the study area. As detailed in this EIS, the project will result in positive economic impacts, with appropriate mitigation measures and management strategies being proposed to reduce any adverse environmental and social impacts.
To promote the delivery and maintenance of affordable housing.	Not directly applicable to the project.
To protect the environment, including the conservation of threatened and other species of native animals and plants, ecological communities and their habitats.	Measures to avoid and minimise impacts to native vegetation and threatened species habitat were considered during the initial design stages of the project, resulting in avoidance of significant biodiversity values and minimisation of impacts on other areas of native vegetation. Further, the road upgrade corridor utilises existing roads, tracks and maintained road shoulders to the extent practicable to minimise the amount of vegetation clearing required. All unavoidable impacts will be offset in accordance with NSW Government policy. Establishing offsets will enhance biodiversity values in the medium to short-term.
To promote the sustainable management of built and cultural heritage (including Aboriginal cultural heritage).	Avoidance of Aboriginal cultural heritage values has been a key aspect of the project refinement process. Subsequently, only one Aboriginal site, Mangarlowe IF-2, will be impacted by the project, and will be collected prior to commencement of construction. The project will not impact any historic heritage sites.
To promote good design and amenity of the built environment.	Potential visual, noise and air quality impacts on sensitive receptors (including residences) have been fully assessed and described in Chapter 6.
To promote the proper construction and maintenance of buildings, including the protection of the health and safety of their occupants.	Over the life of the project, infrastructure will be maintained, or upgraded, to ensure safe and efficient operations. All construction associated with the project will be compliant with the Building Code of Australia and all other relevant statutory requirements.
To promote the sharing of the responsibility for environmental planning and assessment between the different levels of government in the State.	This is a matter for the different levels of government in the State. As summarised in Chapter 1, a wide range of government agencies have been consulted regarding the project, including Mid-Western Regional Council, Warrumbungle Shire Council, and DPE.
To provide increased opportunity for community participation in environmental planning and assessment.	As described in Chapter 1, there have been a range of engagement activities to inform the community about the project and to seek community (and other stakeholder) feedback. This EIS provides further detailed information regarding the project and its potential impacts. It will be placed on public exhibition by DPE, and community members will be able to make formal submissions. ACEN will prepare a report responding to these submissions.

7.5 Consideration of community views

Consultation conducted for the project is described in Chapter 5. Feedback from the community included both positive and negative views on a range of topics.

Some stakeholders recognised the benefits of the project. In particular, stakeholders acknowledged the project as a source of local employment, particularly during construction. Stakeholders were also interested in understanding how the benefits of the project could be shared within the community.

Some concerns were raised by community stakeholders regarding how the project will change the landscape, associated visual amenity impacts and the cumulative effect of multiple projects in the area.

Detail of community views and responses are included in Chapter 5 and were identified as part of targeted engagement and the SIA field study. Stakeholder requests were responded to, and further information was provided to address concerns.

7.6 Summary of project impacts

This EIS has considered the potential impacts associated with the project, as well as the need for the project and alternative development options. This section summarises the potential impacts and provides a justification for the project on environmental, economic and social grounds.

7.6.1 Environmental impacts

This EIS has assessed potential impacts to the biophysical environment which are summarised below:

- Biodiversity – The project has been designed to avoid and minimise impacts to biodiversity, resulting in the avoidance of areas of high biodiversity value as much as possible. The project will result in residual impacts to 76.80 ha of PCT 80, of which only 1.18 ha is of condition to require offsetting under the NSW BOS, and associated habitat for flora and fauna species, and 291.91 ha of PCT 281, of which only 7.45 ha is of condition to require offsetting under the NSW BOS, and associated habitat for flora and fauna species. The project is not expected to result in significant impacts to MNES. To compensate for unavoidable disturbance of native vegetation and threatened species habitat, offsets are proposed.

- Aboriginal cultural heritage – avoidance of Aboriginal cultural heritage values has been a key aspect of the project refinement process. Subsequently, only one Aboriginal site, Mangarlowe IF-2, will be impacted by the project, and will be collected prior to commencement of construction.

- Historic heritage – the project will not impact any historic heritage sites.

- Land resources – the project will result in a temporary change of land use for land within the development footprint. Land management will include consideration of the viability of sheep grazing throughout the life of the project. Land management practices will avoid or minimise potential impacts across the study area and to neighbouring agricultural operations and ensure that the development footprint is not precluded from being returned to a productive agricultural use at the end of operations.

- Visual – the development of the project will result in some changes to the landscape. Visual impacts will occur during the construction and operational stages of the project. Landscape screening is proposed to mitigate visual impacts at two non-associated residences and will reduce the visibility of project infrastructure.

- Water – The project is not expected to have a significant impact on water resources in the local area. The moderately sloping nature of the catchment means that flood depths are relatively shallow flood across the study area, and velocities in most of the overland flow paths are generally under 0.5 m/s and pose a low risk.

- Areas of higher and low flood hazard have been identified across the study area, using the flood depths and velocities from the 1% AEP event, to guide the detailed design of the project. All waterway crossings will comply with the *Policy and Guidelines for Fish Friendly Waterway Crossings* (DPI 2003) and *Guidelines for Watercourse Crossings on Waterfront Land* (DPI 2012).

7.6.2 Economic impacts

The project is justified economically due to the economic benefits and stimulus it will provide to the local region. The project will generate up to 800 jobs during construction and 20 full time equivalent jobs throughout operations and will provide ongoing economic benefits for both the local economy within the Mid-Western Regional LGA and the Warrumbungle Shire LGA and more broadly, the regional economy within the Central West.

ACEN will work in partnership with Mid-Western Regional Council and the local community to ensure that, as far as possible, the benefits of the projected economic growth in the region are maximised and impacts minimised.

7.6.3 Social impacts

The social impacts of the project are assessed in Section 6.10 and Appendix O. The project is justified on social grounds for three principal reasons:

- the main issues raised by the local community have been addressed and mitigated;
- it will contribute to the local and regional economy; and
- it will provide indirect benefits through the use of services and facilities both locally and regionally.

It will also generate energy from a renewable energy source, contributing to filling the need for replacement power as ageing coal-fired power stations progressively close.

While the project has potential negative impacts, it is considered that these can be managed to acceptably low levels and are outweighed by the project's benefits. Mitigation and management strategies have been proposed for each of the identified potential social impacts to minimise negative consequences and to maximise social benefits for the local community.

Public safety risks, including bushfire, hazards and risks associated with project infrastructure, will be mitigated through design of buildings, construction areas and other assets to include appropriate bushfire protection measures (eg, asset protection zones), and emergency access and evacuation protocols, which will be developed as part of the emergency response plan.

7.6.4 Cumulative impacts

The project has potential for cumulative impacts with nearby development and future projects. Cumulative impacts have been addressed in Section 6.14.

7.7 Ecologically sustainable development

The principles of ESD are outlined in Part 8, Division 5, Section 193 of the EP&A Regulation and are addressed in Table 7.2.

Table 7.2 Consideration of principles of ecologically sustainable development

Principle	Ecologically sustainable development principle	Evaluation of project impact against principle
Precautionary principle	The **precautionary principle**, namely, that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. In the application of the precautionary principle, public and private decisions should be guided by— i) careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment, and ii) an assessment of the risk-weighted consequences of various options.	During the project planning phase and preparation of this EIS, experts in their respective fields have carefully considered environmental outcomes through the preparation of quantitative technical assessments, providing a high degree of certainty around the impacts that may arise from the project. The findings of the technical assessments are provided in Chapter 6. The project has been designed with regard to the precautionary principle and in response to legislation, policies, and guidelines to ensure that it does not pose an unacceptable risk to human health or the environment. Management measures have been proposed for all potential environmental impacts. Taking these measures into account, it is considered that there would be no threat of serious or irreversible damage to the environment. Therefore, the project is consistent with the precautionary principle.
Social equity including inter-generational equity	**Inter-generational equity**, namely, that the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations.	A range of mitigation measures are proposed that will minimise the impacts of the project during construction and operation. The project will contribute to the sustainable transition of electricity generation in NSW to a more reliable, more affordable and cleaner energy future and contribute to a net reduction in greenhouse gas emissions. Once decommissioned, the land within the development footprint can be rehabilitated to its current use if required thereby allowing for either continuation of renewable energy generation or a return to agricultural production, both of which would provide benefits for future generations. Further, the project will enable the generation of electricity for a renewable energy source. Given the above, it is considered that the project supports inter-generational equity.
Conservation of biological diversity and maintenance of ecological integrity	**Conservation of biological diversity and ecological integrity**, namely, that conservation of biological diversity and ecological integrity should be a fundamental consideration.	The conservation of biological diversity and ecological integrity was a fundamental consideration in the development of the project. The location of the project on land with a long history of agricultural use means that biodiversity values are minimal in the study area. In addition, the project has been sited within the study area to minimise impacts to biodiversity values where possible. Specifically, the development footprint was refined to avoid areas of high biodiversity value once these areas were identified by the biodiversity assessment carried out for the project, namely the two areas on the north-east side, and the small area of DNG in the south-east corner of the study area. The BDAR was prepared to assess the project's potential impacts on biodiversity (Section 6.2 and Appendix F). Direct impacts to 1.18 ha of PCT 80 and 7.45 ha of PCT 281 (and associated habitat for flora and fauna species) will require offsetting under the NSW BOS. Management and mitigation measure have been prescribed to minimise, manage and offset residual impacts on biodiversity (Appendix F).

Table 7.2 Consideration of principles of ecologically sustainable development

Principle	Ecologically sustainable development principle	Evaluation of project impact against principle
Improved valuation and pricing of environmental resources	**Improved valuation, pricing and incentive mechanisms**, namely, that environmental factors should be included in the valuation of assets and services, such as— i) polluter pays, that is, those who generate pollution and waste should bear the cost of containment, avoidance or abatement, ii) the users of goods and services should pay prices based on the full life cycle of costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste, and iii) established environmental goals should be pursued in the most cost effective way by establishing incentive structures, including market mechanisms, that enable those best placed to maximise benefits or minimise costs to develop their own solutions and responses to environmental problems.	Project benefits are considered to outweigh the costs. The project will generate up to 800 jobs during construction and 20 full time equivalent jobs throughout operations and will provide economic benefits to the local community. The project also supports the transition away from fossil fuel (coal and gas) energy generation, thereby contributing to a net reduction in greenhouse gas emissions. ACEN accepts the financial costs associated with all the measures required for the project to avoid, minimise, mitigate and manage potential environmental and social impacts.

7.8 How compliance will be ensured

A monitoring and management framework will be developed to enable the potential positive and negative impacts to be monitored over time. It is proposed that the monitoring and management framework identifies the following key aspects:

- track progress of mitigation and management strategies;
- assess actual project impacts against predicted impacts;
- identify how information will be captured for reporting to impacted stakeholders including landholders, communities and government on progress and achievements;
- key performance indicators, targets and outcomes;
- responsible parties; and
- mechanisms for ongoing adaption of management measures when required.

To ensure the effectiveness of the management measures for the identified positive and negative impacts, it is recommended that a continuous improvement approach be adopted allowing for the review and adaption of impacts, management measures and outcomes.

7.9 Key uncertainties and proposed measures

ACEN is developing and operating solar and battery projects internationally and has experience in the construction and operation of their facilities to meet relevant standards and best available technologies. A competitive bid process will select an engineering, procurement and construction contractor with a demonstrated ability to build the project in a manner that is consistent with those mitigation and management strategies that have been proposed and summarised in Appendix E.

7.10 Conclusion

The project involves the development and operation of a large-scale solar PV generation facility along with battery storage and associated infrastructure. The project will be within the NSW Government declared CWO REZ and will play an important part in achieving the objectives of the CWO REZ. It will also provide significant economic stimulus to the region through construction jobs and associated flow-on benefits.

The residual environmental and social impacts identified throughout the EIS will be managed through the mitigation and management measures described throughout, such that the project will not result in significant impacts on the environment or the local community.

The project will achieve the following overall benefits:

- contributions to energy security and reliability in NSW by diversifying the State's energy mix and helping to prepare for the retirement of large-scale coal-fired power generation;
- alignment with Commonwealth and NSW Government electricity policies and strategies and regional plans;
- providing ongoing economic benefits for both the local economy within the Mid-Western Regional LGA and the Warrumbungle Shire LGA and more broadly, the regional economy within the Central West; and
- provide significant employment opportunities during the 28 month construction period.

Abbreviations

Item	Definition
ABS	Australian Bureau of Statistics
AC	Alternating current
ACEN	ACEN Australia Pty Ltd
ACHA	Aboriginal cultural heritage assessment
ACHMP	Aboriginal cultural heritage management plan
ADGC	Australian Dangerous Goods Code
AEMO	Australian Energy Market Operator
AEP	annual exceedance probability
AHIMS	Aboriginal Heritage Information Management System
APZ	asset protection zone
AUL	auxiliary left lane turn
BAL	Basic Left Turn
BAR	Basic Right Turn
BDAR	Biodiversity development assessment report
BESS	Battery energy storage system
BSAL	Biophysical Strategic Agricultural Land
BSF	Birriwa Solar Farm
CEEC	Critically endangered ecological community
CFG	Candidate Foundation Generator
CICs	Critical Industry Clusters
CHR	channelised right turn treatment
CWAS	construction workforce and accommodation strategy
CWO	Central-West Orana
CWCT	Central West Cycle Trail
DCCEEW	Commonwealth Department of Climate Change, Energy, Environment and Water
DC	Direct current
DG	Dangerous Goods
DP	Deposited plan
DPI	Department of Primary Industries
DPE	Department of Planning and Environment (formerly the Department of Planning, Industry and Environment, DPIE)
EEC	Endangered ecological community

Item	Definition
EIS	Environmental Impact Statement
EMM	EMM Consulting Pty Limited
EMP	Environmental management plan
EnergyCo	Energy Corporation of NSW
EPA	NSW Environment Protection Authority
EP&A Act	NSW *Environmental Planning and Assessment Act 1979*
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
ES	Earth sands
FCAS	Frequency Control and Ancillary Services
FFDI	Forest Fire Danger Index
GDEs	Groundwater Dependent Ecosystems
GFDI	Grassland Fire Danger Index
ha	hectares
HFRA	Hydrology and flood risk assessment
HHA	Historic heritage assessment
hr	Home Rule
HVACs	Heating ventilation air conditioning
km	kilometres
kV	Kilovolt
LALC	Local Aboriginal Land Council
LEP	Local Environmental Plan
LGA	Local government area
lp	Lees Pinch
LPG	Liquified petroleum gas
LRET	Large Scale Renewable Energy Target
LUSEA	Land use, soils and erosion assessment
NEM	National Electricity Market
MNES	Matters of national environmental significance
MW	Megawatt (1 million watts of power)
MWh	Megawatt hour (a megawatt hour is equivalent to 1 million watts of electricity being used for an hour. A megawatt hour could be 2 megawatts of power being used for half an hour or it could be 0.5 megawatts of power being used continually for 2 hours).
NATA	National Association of Testing Authorities
NMLs	noise management levels

Item	Definition
NSW	New South Wales
NVIA	Noise and vibration impact assessment
OSOM	Oversize and/or overmass
PAD	Potential archaeological deposit
PCT	Plant community type
PCU	Power conversion unit
PHA	Preliminary hazard analysis
PMST	Commonwealth Protected Matters Search Tool
PV	Photovoltaic
RAPs	Registered Aboriginal parties
RBLs	Rating background noise levels
REZ	Renewable Energy Zone
RFS	NSW Rural Fire Service
rs	Rouse
SC	Solodic soils
SEARs	Secretary's Environmental Assessment Requirements
SIA	Social impact assessment
SRD SEPP	*State Environmental Planning Policy (State and Regional Development) 2011*
SSAL	State significant agricultural land
SSD	State significant development
T-Link	Transmission link - NSW Energy Corporation's planned new 500/330kV transmission line, substation(s) and related infrastructure within the CWO REZ
TEC	Threatened ecological communities
T-Link	The proposed CWO REZ transmission link
The project	Birriwa Solar and Battery Project; a large scale solar photovoltaic generation facility along with battery storage and associated infrastructure
ti	Turill
TIA	Traffic impact assessment
TN	Total nitrogen
TSS	Total suspended solids
TP	Total phosphorus
UPC\AC	UPC\AC Renewables Australia - a joint venture between the UPC Renewables Group (UPC) and AC Energy (AC)
VIA	Visual impact assessment
Watt	A watt is the basic unit of power. Watts = voltage x current.

Item	Definition
WMP	Waste management plan
WQIA	Water quality impact assessment
WVWAC	Wiradjuri Aboriginal Corporation

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