Kerarbury Orchard Solar Farm and BESS

Statement of Environmental Effects

30 November 2022

Project No.: 0640174

The business of sustainability

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Kerarbury Orchard Solar Farm and BESS

Statement of Environmental Effects

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1. INTRODUCTION

1.1 Overview

Environmental Resources Management Australia Pty Ltd (ERM) has been engaged by Sustainable Business Energy Solutions T/A AGL Energy Solutions (AGL), to provide planning and environmental support for the preparation and submission of a development application (DA) for the proposed Solar Farm and battery energy storage system (BESS) to power the Kerarbury Orchard property (the Project or the proposed Project) and to export any excess energy through the local grid via the Kerarbury Orchard's existing high voltage Essential Energy connection.

The applicant and proponent, Sustainable Business Energy Solutions Pty Ltd T/A AGL Energy Solutions (ABN 21 131 625 600), proposes the development, design, construction and operation of a photovoltaic solar farm on 16705 Sturt Highway, Darlington Point in New South Wales (NSW).

The Project site is part of the Kerarbury Almond Farm/Orchard property which is owned by Rural Funds Management (RFM) and operated under a long-term lease by OLAM Food Ingredient (OFI) until 2038. OFI is Australia's largest almond producer with 11,500 hectares (ha) of almonds, almond processing and other agricultural businesses. The proposed 'Project site' would comprise an area of approximately 7 ha, with a solar farm footprint of approximately 6.1 ha, located wholly within Lots 68 and 69 of Deposited Plans (DP) 750877.

The Project would include the installation of solar photovoltaic (PV) cells with a capacity of up to 4.95 Megawatts (MW) AC and a BESS with capacity of up to 4.586 MWh including any additional supporting infrastructure. The BESS will have a footprint of up to 0.003 ha (30 m^2). The proposed High Voltage (HV) electrical switchgear would connect to the existing privately owned HV electricity network within the Project site. AGL will consult with Essential Energy and its accredited HV contractor to connect the HV pole within the solar farm to the existing 33 kV line. This will be confirmed during the detailed design. The proposed works would involve ground surface disturbances, and changes to existing land use and the local visual environment.

The design of the Project has been developed in conjunction with environmental assessments and preliminary constraints analysis, to ensure potential impacts were avoided and minimised wherever possible. A pre-development application (pre-DA) meeting has been undertaken with Murrumbidgee Council on 15 June 2022. Any specific requirements advised by Council would need to be included in the DA and have been addressed in this Statement of Environmental Effects (SEE).

The Project will generate up to 11,000 MWh of solar power annually and will power irrigation and other operations in OFI's Kerarbury Almond Orchard. Excess energy will be exported through the local grid. AGL will be engaging with the local electricity distributor, Essential Energy to ensure that that the connection is approved by Essential Energy and any consideration for the local supply are addressed prior to construction.

1.2 Scope

This SEE has been prepared by ERM on behalf of the applicant, AGL. This report has been prepared based on information and mapping completed by external consultants. Please note, Lots 68 and 69 of DP 750877 containing the proposed Project is referred to as the 'subject land' throughout this SEE. The area of land subject to the proposed Project footprint may be referred to as the 'Project site' on mapping and discussions contained in this report.

This SEE has been prepared to:

- Describe the proposed works, the Project site, and the wider locality;
- Describe the planning context and statutory approval requirements;
- Identify and assess the significance of impacts on environmental value; and
- Provide mitigation measures to avoid, minimise or mitigate identified impacts.

This report shall be read in conjunction with the accompanying documentation appended to this report.

1.3 The Applicant

The Applicant for the development is Sustainable Business Energy Solutions T/A AGL Energy Solutions (ABN 21 131 625 600), was founded in 1837 and currently operates Australia’s largest electricity generation portfolio. AGL is the largest private investor in renewable energy and provides 4.2 million energy and telecommunications services to our residential, small and large business, and wholesale customers. AGL has also invested in large-scale solar projects including the Broken Hill Solar Plant in NSW and Nyngan Solar Plant in NSW, thereby playing a vital role in Australia's sustainable energy supply.

AGL have been engaged to design, engineer, construct and operate an onsite (behind the meter) solar and storage generation facility to supply energy to the OFI Kerarbury Almond Orchard under a power purchase agreement. This Project is an example in how AGL is providing more energy certainty for the needs of primary industries, especially for high energy intensive organisations within a difficult to abate sector like agribusiness.

2. SITE DESCRIPTION AND CONTEXT

This section provides a description of the proposed Project site, as well as contextual overview of the site in relation to climate and solar exposure.

2.1 Description

The Project site is identified within Lots 68 and 69 of DP750877, located at 16705 Sturt Hwy, Darlington Point in NSW. The Project site is approximately 17 km south-west of Darlington Point, NSW and, as outlined in **Figure 2-1**. The total area of the development footprint within the proposed Project site is approximately 7 ha, with the solar farm footprint of approximately 6.1 ha, as outlined in **Figure 2-2**. The Project site is located within the 2,500 ha Kerarbury Almond Orchard.

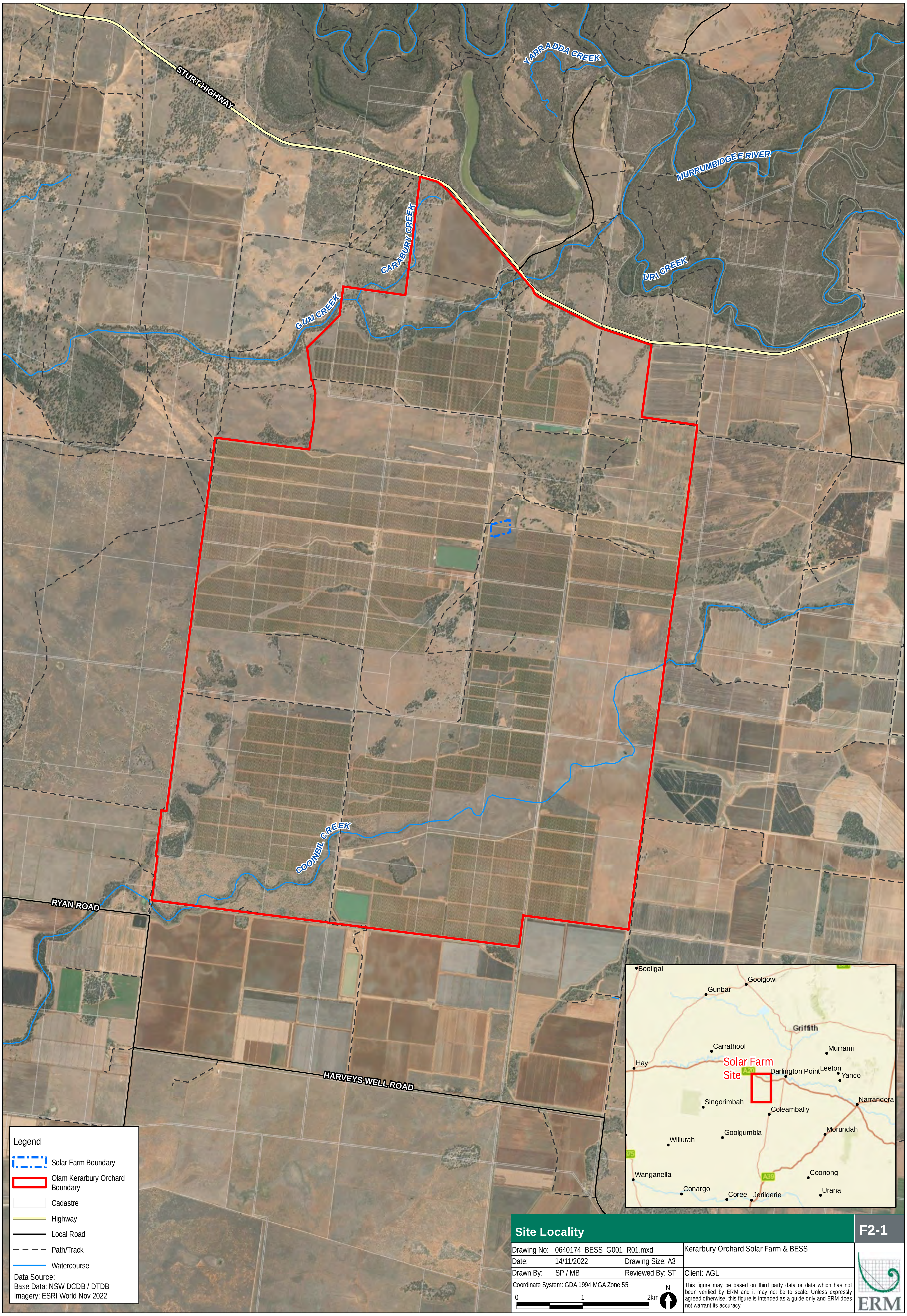
The Project site consists primarily of a rhomboidal plot of land bounded by the existing site access road within the Kerarbury Orchard to the north and agricultural land to the south, west and east. There are some building structures present within the subject land, though no significant structures present within the Project site.

2.2 Context

The Project site is situated within rural land on the outskirts of Darlington Point township within the Murrumbidgee Council Local Government Area (LGA). The Project site is zoned RU1 ‘Primary Production’ pursuant to the provisions of the *Murrumbidgee Local Environmental Plan 2013* (Murrumbidgee LEP) and is bounded by land RU1 ‘Primary Production’ in all directions.

The Project site is largely cleared of native vegetation as a result of long term agricultural land use and ongoing almond farming. The surrounding land use is also predominantly used for agricultural purposes. The existing electrical connection pole will retained at the current location. A new High Voltage (HV) pole will be added at an adjacent location about 50 m (in an easterly direction) from the existing site to create a spur off the existing network.

An existing 33 kV overhead line runs parallel to the new proposed solar farm fence boundary, located approximately 10 m away from the solar panels. Additionally, there is an existing 132 kV overhead transmission line is located 30 m south of the proposed solar farm fence and well within the provided easement running south of the fence.


STURT HIGHWAY
YARRADDA CREEK
MURRUMBIDGEE RIVER
CARABURY CREEK
URI CREEK
GUM CREEK
COOINBIL CREEK
RYAN ROAD
HARVEYS WELL ROAD
Booligal
Goolgowi
Gunbar
Griffith
Carrathool
Murrami
Hay
Solar Farm Site
Darlington Point
Leeton
Yanco
Narrandera
Singorimbah
Coleambally
Morundah
Goolgumbla
Willurah
Wanganella
Coonong
Conargo
Coree
Jerilderie
Urana
A20
A39
Legend
Solar Farm Boundary
Olam Kerarbury Orchard Boundary
Cadastre
Highway
Local Road
Path/Track
Watercourse
Data Source:
Base Data: NSW DCDB / DTDB
Imagery: ESRI World Nov 2022
Site Locality
F2-1
Drawing No: 0640174_BESS_G001_R01.mxd
Date: 14/11/2022
Drawing Size: A3
Drawn By: SP / MB
Reviewed By: ST
Kerarbury Orchard Solar Farm & BESS
Client: AGL
Coordinate System: GDA 1994 MGA Zone 55
0
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2km
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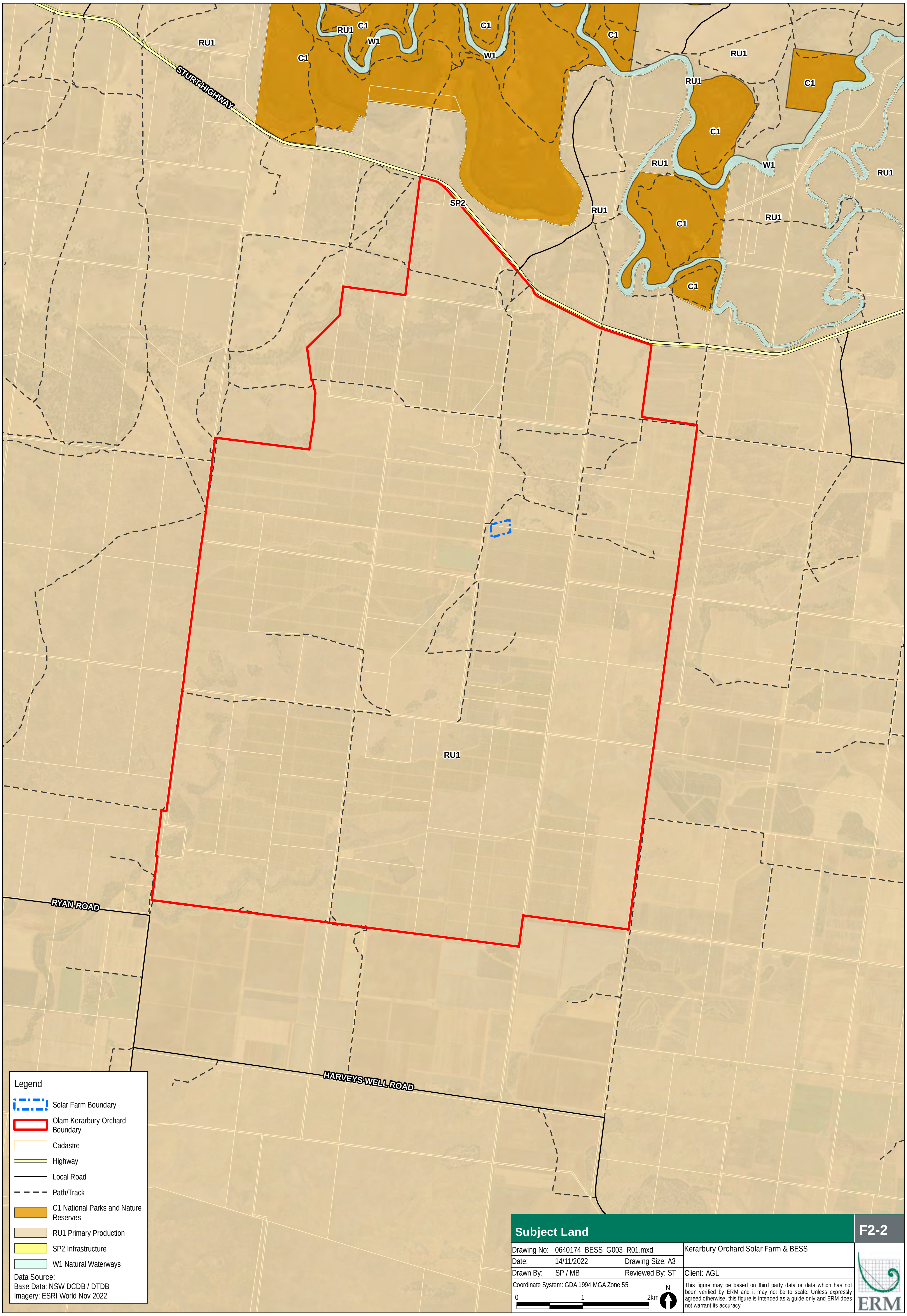

STURT HIGHWAY
RU1
C1
W1
SP2
RYAN ROAD
HARVEYS WELL ROAD
Legend
Solar Farm Boundary
Olam Kerarbury Orchard Boundary
Cadastre
Highway
Local Road
Path/Track
C1 National Parks and Nature Reserves
RU1 Primary Production
SP2 Infrastructure
W1 Natural Waterways
Data Source:
Base Data: NSW DCDB / DTDB
Imagery: ESRI World Nov 2022
Subject Land
F2-2
Drawing No: 0640174_BESS_G003_R01.mxd
Date: 14/11/2022
Drawing Size: A3
Drawn By: SP / MB
Reviewed By: ST
Kerarbury Orchard Solar Farm & BESS
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Coordinate System: GDA 1994 MGA Zone 55
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2.2.1 Climate and Solar Exposure

Global solar exposure is defined as the total amount of solar energy falling on a horizontal surface (BoM, 2020). Typical values for daily global solar exposure range from one to 35 MJ/m^2 (megajoules per square metre). The values are usually highest in clear sun conditions during summer and lowest during winter or very cloudy days.

The proposed Project site has strong irradiation. As a whole Australia experiences levels of solar exposure much greater than global average figures, including in many areas of NSW. While there are other parts of NSW that receive higher levels of solar exposure than the Project site, these tend to be in remote parts of the State, where there is limited capacity on existing electricity transmission and distribution networks. In contrast, the proposed Project site is ideally located to connect into the existing distribution network and contribute to meeting local demand.

Figure 2-3 shows average daily solar exposure across NSW for the 12-month period from 1 November 2021 to 31 October 2022. During this period, Griffith Airport (Station ID 075041) (as indicated by the red circle and is the nearest monitoring station to Darlington Point), received an average of over 16 MJ/m^2 each day, placing it within one of the highest zones receiving solar radiation in NSW.

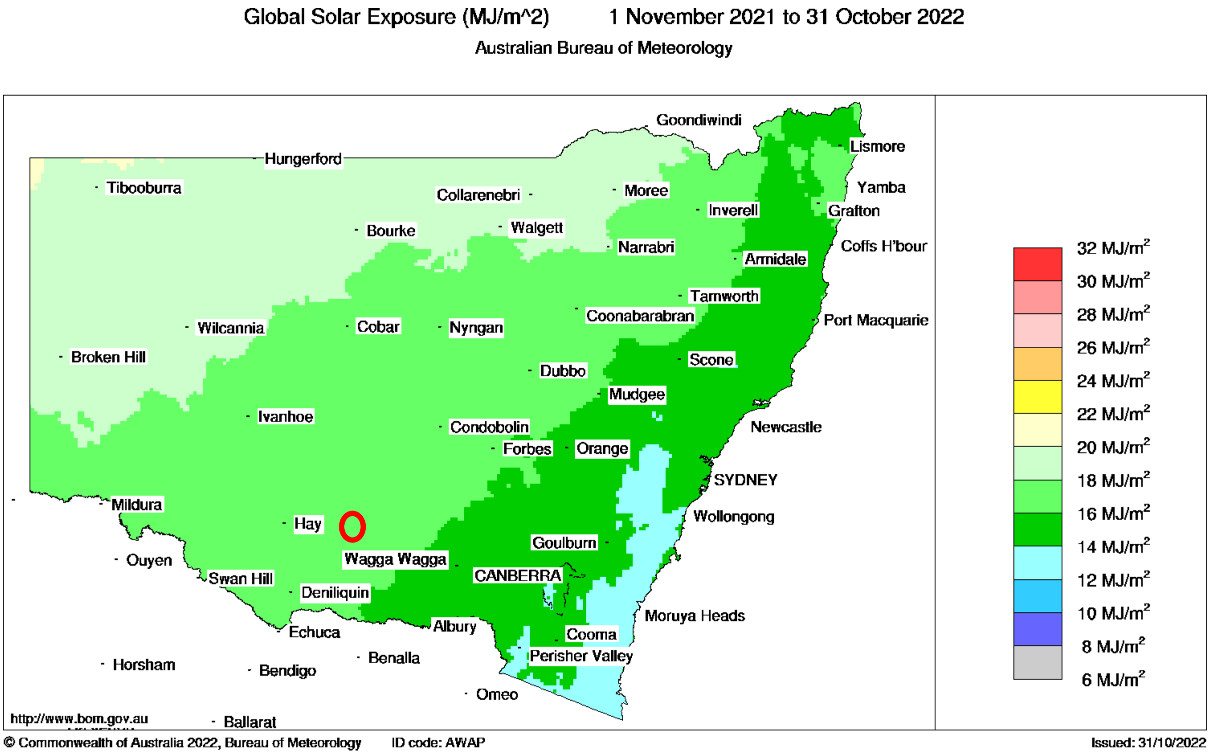


Figure 2-3 Yearly Average Solar Exposure for NSW (BoM, 2022a)

The mean monthly global solar exposure measured at Griffith Airport (Station ID 075041), being approximately 56 km to the north-east of the Project site, is provided in **Table 2-1**. The annual mean daily global exposure for 2022 was 18.4 MJ/m^2.

Table 2-1 Mean daily global solar exposure at Griffith, 2021

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Daily Mean	27.7	24.3	20.3	14.9	10.9	8.6	9.4	12.6	17.1	21.9	24.9	27.7	18.4

Figure 2-4 shows the average daily hours of sunshine across Australia. The Kerarbury Orchard (indicatively outlined in red below), receives an average of seven to eight hours of sunshine each day.

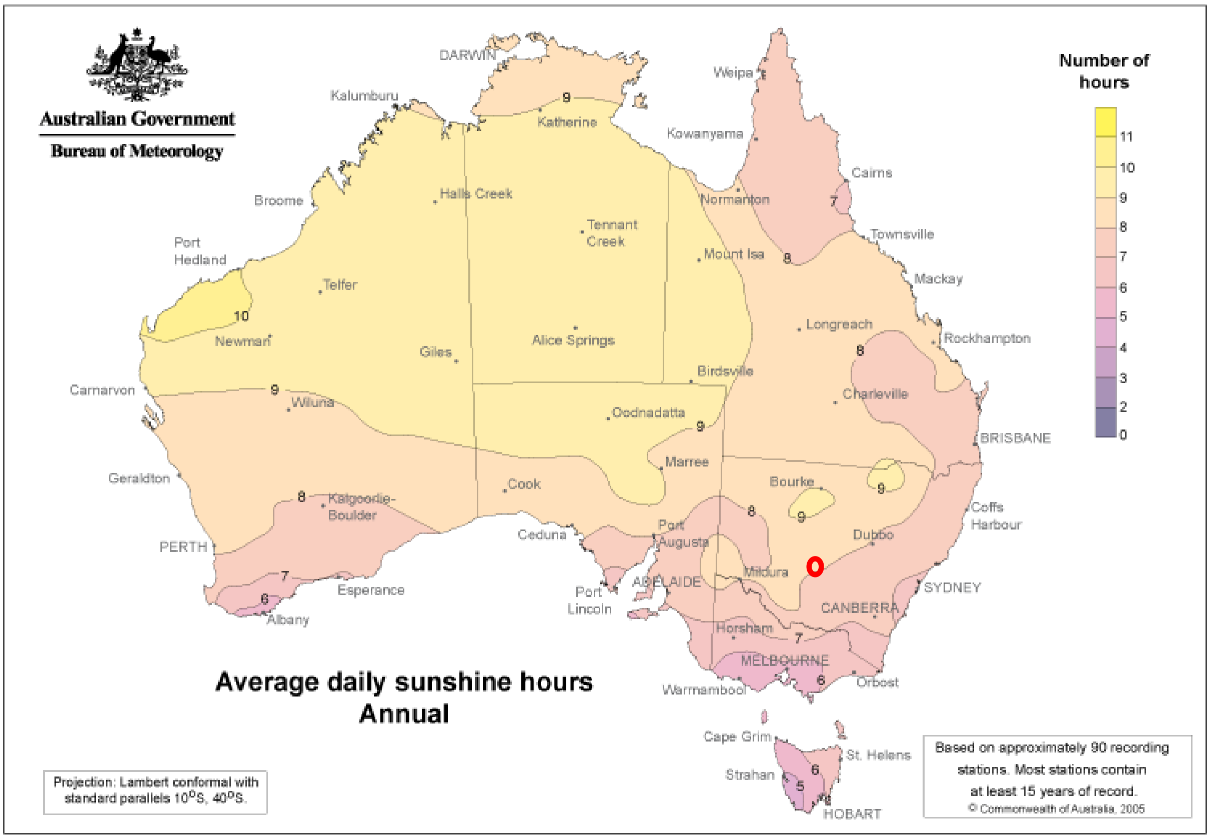


Figure 2-4 Average Daily Sunshine Hours (Annual) - Kerarbury Orchard (BoM, 2022b)

3. PROJECT DESCRIPTION

3.1 Overview

The Project involves the construction and operation of a solar farm with a capacity of up to 4.95 MW and a 4.586 MWh BESS, at OFI's Kerarbury Almond Orchard. Key activities required for development of the solar farm and BESS are:

- Site clearing and minor earth works / levelling, including cut and fill based on recommendations from a Geotechnical report and topography survey;
- Installation of fencing and gates for the proposed compound;
- On-site stormwater management measures, such as basins and sediment control structures;
- Using the internal access road within the Project site via Sturt Highway during construction to accommodate delivery and construction vehicles;
- Delivery of the demountable site office and portable amenities to the Project site (operational building and/or the control room);
- Delivery of panels and frames within shipping containers;
- Delivery of inverter and other electrical equipment;
- Installation of support columns (i.e., pilings);
- Wiring of panels and switchboards via connection to underground cabling;
- Installation of inverter station and BESS;
- Assets for installation of HV pole and a grid connection via the Kerarbury Orchard's existing high voltage Essential Energy connection.;
- Solar farm generation testing and commissioning; and
- Removal of temporary site office and amenities once construction has been completed.

The Project comprises a solar farm, BESS and ancillary facilities with an AC output capacity on approximately 7 ha of the total Project site with a capacity to generate up to 11,000 MWh annually, which will be confirmed upon completion of the further studies.

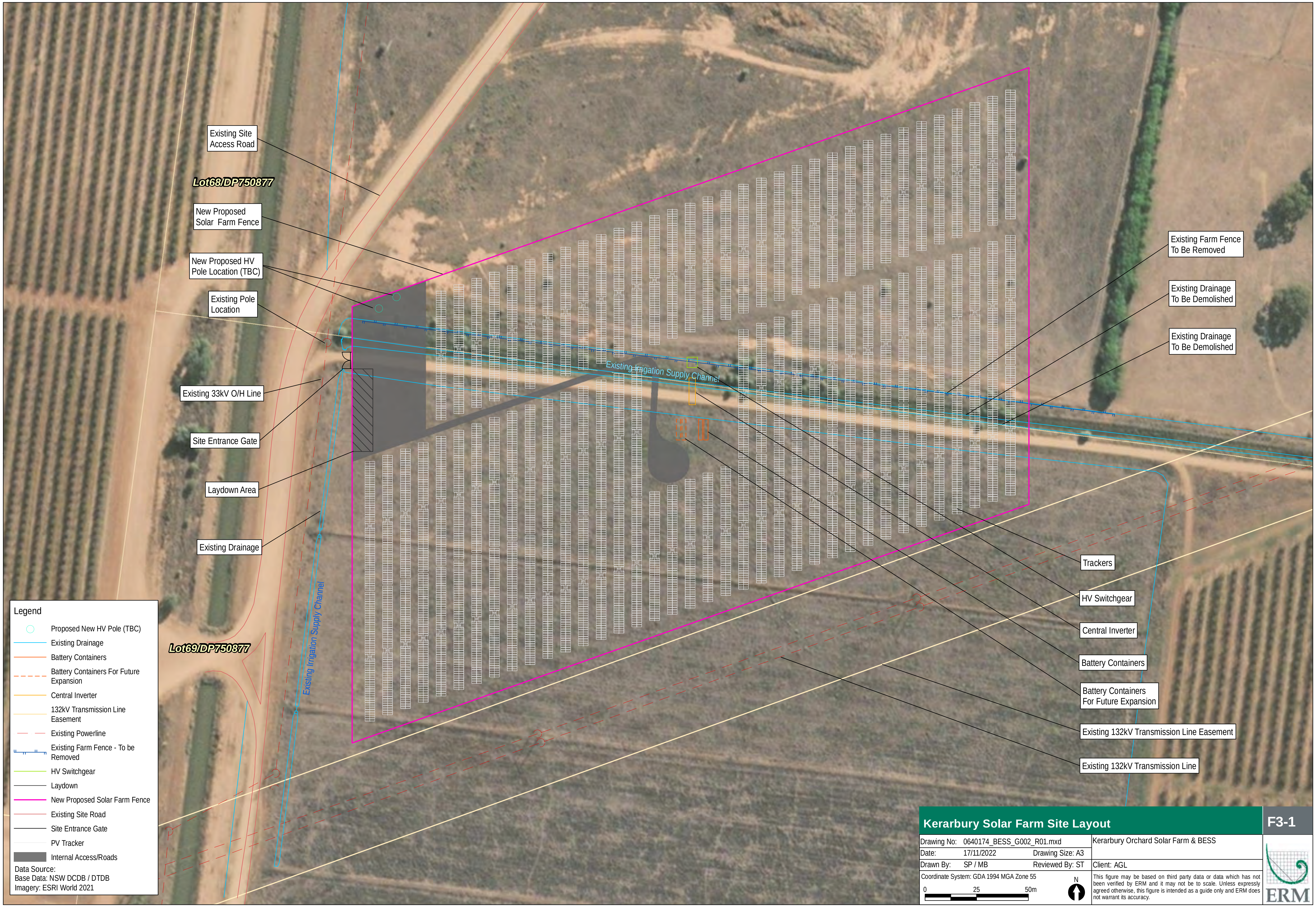
The Project will require construction of a new solar and storage renewable generation facility on the existing property and the existing electrical infrastructure owned by OFI. The Project will construct permanent plant including:

- A ground mounted PV solar panel array;
- A battery energy storage system (BESS) and associated components and features;
- Electrical collection systems including switchroom, control room and an inverter station;
- Fencing boundary to secure the new plant; and
- High Voltage (HV) electrical switchgear to connect to the existing privately owned HV electricity network.

During the construction phase, there will be a requirement for a temporary construction hub including, demountable offices, amenities, equipment laydown areas and vehicle parking facilities. All construction amenities and carparking will be located in the laydown area in the north-eastern corner of Project site (refer **Figure 3-1**).The proposed Project site footprint is centrally situated within the Kerarbury Almond Orchard and positioned away from the existing residences to the north-east of the lot boundary. The proposed Project site layout is outlined on **Figure 3-1** below and design plans for the Project are attached as **Appendix A** to the SEE.

This development application seeks approval only for all the components (solar PV, BESS, trackers, HV (high voltage) switchgear, central inverter, battery containers, new HV pole, site entrance and laydown area) included within the new proposed solar farm fence boundary depicted in **Figure 3-1.**

AGL will engage with Essential Energy to ensure that the connection from the proposed Project is approved by Essential Energy and any consideration for the local supply are addressed prior to construction. AGL is compliant with and will also maintain adherence with the necessary requirements for locating infrastructure adjacent and/or within easements as stated in the *Developments near Essential Energy's Infrastructure Guide* developed to meet the requirements of *ISSC 20 Guideline for the Management of Activities within Electricity Easements and Close to Electricity Infrastructure (NSW Industry Steering Committee, 2012)* and *CEOP8046 - Easement Requirements (Essential Energy, 2013).*


Existing Site Access Road
Lot68/DP750877
New Proposed Solar Farm Fence
New Proposed HV Pole Location (TBC)
Existing Pole Location
Existing 33kV O/H Line
Site Entrance Gate
Laydown Area
Existing Drainage
Lot69/DP750877
Existing Irrigation Supply Channel
Existing Irrigation Supply Channel
Existing Farm Fence To Be Removed
Existing Drainage To Be Demolished
Existing Drainage To Be Demolished
Trackers
HV Switchgear
Central Inverter
Battery Containers
Battery Containers For Future Expansion
Existing 132kV Transmission Line Easement
Existing 132kV Transmission Line
Legend
Proposed New HV Pole (TBC)
Existing Drainage
Battery Containers
Battery Containers For Future Expansion
Central Inverter
132kV Transmission Line Easement
Existing Powerline
Existing Farm Fence - To be Removed
HV Switchgear
Laydown
New Proposed Solar Farm Fence
Existing Site Road
Site Entrance Gate
PV Tracker
Internal Access/Roads
Data Source:
Base Data: NSW DCDB / DTDB
Imagery: ESRI World 2021
Kerarbury Solar Farm Site Layout
F3-1
Drawing No: 0640174_BESS_G002_R01.mxd
Date: 17/11/2022
Drawing Size: A3
Drawn By: SP / MB
Reviewed By: ST
Coordinate System: GDA 1994 MGA Zone 55
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Kerarbury Orchard Solar Farm & BESS
Client: AGL
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3.2 Project Components

3.2.1 Photovoltaic Panels

At this stage of design, 11,016 solar modules are proposed for installation on a ground mount racking system with single axis trackers. The proposed system consists of several arrays which have a total monocrystalline photovoltaic (PV) module front surface area of 28,783 m^2. The panel front surface consists of the 3.2 mm high transmission, anti-reflection coated tempered glass and silver anodized aluminium alloy frame. The panels can rotate from 50° pitch East, through to 50° West.

3.2.2 Inverters

The Sungrow Turnkey Station for 1500 Vdc System (SG4950HV-MV) is an integrated MV (medium voltage) transformer system that provides advanced three-level technology, maximum inverter efficiency 99%, effective cooling, full power operation at 50°C and an option for BESS DC coupling.

The advantages of the system include:

- Integrated MV transformer, switchgear, and LV (low voltage) auxiliary power supply;
- Integrated zone monitoring and MV parameters monitoring function for online analysis and troubleshooting
- Modular design, easy for maintenance; and
- Convenient external touch screen.

It is expected that the inverters will connect to the overhead 33 kV line via the HV (high voltage) switchgear and new electrical pole located at the north-west of the Project site, as depicted in **Figure 3-1.**

3.2.3 Battery Energy Storage System

The Project includes the installation and operation of a two small Battery Energy Storage Systems (BESS) with a total combined capacity of 4.586 MWh within the Project site, to support the Project with dispatchable firming energy supply (i.e. a guaranteed energy source in the event of low solar radiation), whilst enhancing grid and service capabilities.

The BESS units will be positioned in the central portion of the Project site and will be located adjacent to the trackers, HV (high voltage) switchgear, central inverter, battery containers and battery containers for future expansion. The supporting foundations of the BESS will have reserved space for capacity extension to meet increased grid demand, though does not form part of this approval. However, should the BESS expansion option be sought in the future, this proposed works will be subject to further approvals as required.

The BESS is a liquid cooled energy storage system (ST2293UX) featuring compact and optimized design, enabling more profitability, flexibility, and safety. In respect of the modular DC/DC converter, the system enables parallel connection and flexible system expansion. Meanwhile, each battery rack can be fully charged and discharged through the DC/DC converter. DC electric circuit safety management includes fast breaking and anti-arc protection making the system safe and reliable.

3.3 Services

Reticulated water and sewer services are not required to be provided to the solar farm as there are no permanent offices or amenities proposed onsite. Water supply during construction will be maintained through storage tanks onsite and water deliveries as needed. Maintenance workers would not be required to remain onsite. Cleaning of the PV panels would be carried out on an annual basis to maximise the performance of the system. This is done using water brought into the Project site and a sponge mop.

An existing overhead 33 kV transmission lines run parallel to the western boundary of the Project site. An 132 kV transmission line located 30 m south of the proposed solar farm fence and well within the provided easement running south of the fence.

3.4 Construction

The total construction and installation of the proposed solar farm facility will take approximately six (6) months from commencement of works to the commissioning of the facility. Construction activities will be undertaken on Monday to Friday (7 am to 6 pm), and Saturday (8 am to 1 pm). No works are proposed on Sundays or public holidays, and any out of hours works will be subject to further consultation with Council.

There will be approximately up to 12 staff onsite daily, and approximately up to 40 staff during peak construction periods. The equipment and machinery proposed to undertake the construction and installation of the Project are provided below. The equipment and vehicles listed below, is indicative at this stage and may vary in size and quantity, depending on availability and final requirements, once the detailed design is complete:

- Telehandler;
- Rug Terrain Crane;
- Dozer;
- Grader;
- Smooth Drum Roller;
- Skid Steer;
- Water Truck;
- Excavator; and
- Solar Piling Rig.

Other fixed and mobile plant, equipment and/or machinery include:

- 5 axle semi-trailer;
- Rigid body truck with dog trailer (3 axle truck) + 3 axle dog;
- 25T Franna Crane;
- Water Carts (10,000L);
- 18T Tilt tray / Sideloader / 6 axle semi-trailer;
- 10T Tilt tray / flat bed; and
- Light vehicles.

3.4.1 Access

Access to the Project site is via the internal road within the Kerarbury Almond Orchard which can be accessed via the driveway off Sturt Highway as shown below in **Figure 3-2**, which has been extracted from **Appendix G**.

The Project site (including the solar farm and BESS) will be separated from the orchard by new fencing. The solar farm will be located centrally within the orchard, approximately 3 km south of Sturt Highway. The solar farm would be accessed via an internal road within the site as shown above in **Figure 3-2**. Upon completion of the solar farm construction, the solar farm and the orchard will operate simultaneously using the same site access driveway off Sturt Highway.

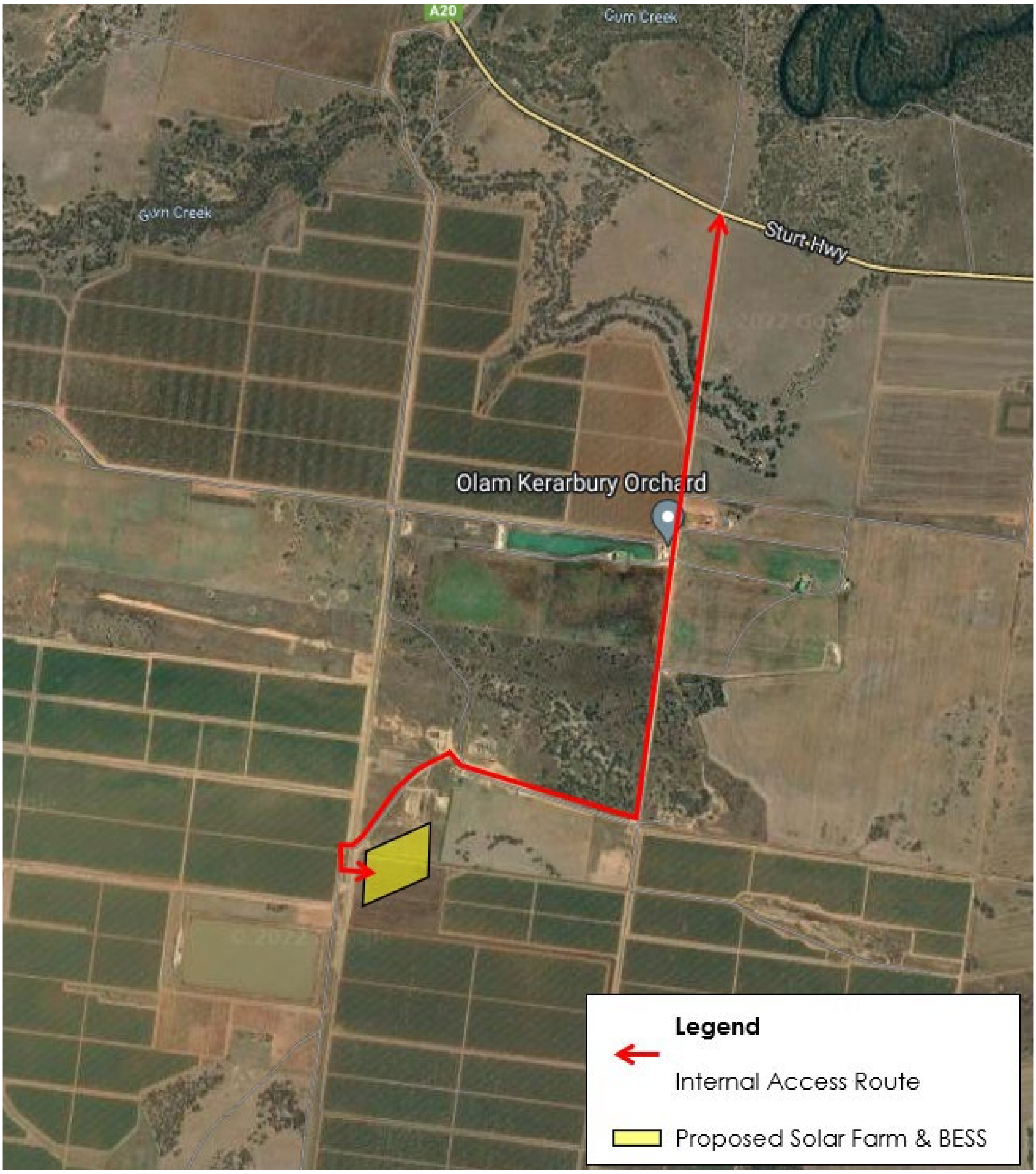

Figure 3-2 Access Road

A temporary materials laydown area is to be sited at the north-western corner of the development footprint, near the site access point, to accommodate any additional car parking facilities as required.

3.4.2 Security

The Project site is to be enclosed within the wider boundary and fence of the Kerarbury Almond Orchard, which provides natural vegetative screening buffer.

Additional installation of a closed-circuit television (CCTV) system and surveillance cameras is not proposed as part of the development. Security lighting is not proposed at this stage.

3.5 Operations

Once construction of the Project has been completed, the Project will move to the operations and maintenance phase, with the operation of the solar farm conducted remotely along with the majority of maintenance and monitoring. The operation of the solar farm will occur simultaneously with the Kerarbury Orchard operation. However, access to the Project site will be required periodically to physically maintain and repair the solar farm equipment. Physical maintenance is proposed to be undertaken approximately two (2) times a year, each spanning approximately a week in duration. Onsite parking to allow for physical maintenance works is proposed wholly within the Project site, for up to two (2) vehicles.

No additional plant/equipment will be procured for operational phase of the Project.

3.6 Decommissioning

The Project is expected to remain fully operational indefinitely, in order to contribute to the sustainable electricity power supply to the state of NSW. The standard operational timeframe for a solar farm is around 15 years. If decommissioning is required after this time, then all infrastructure, panels, mounting frames (including footings), inverters, cabling and other sub-surface materials would be disassembled and removed from the Project site. The Project site would then be returned to 'pre-solar farm' purposes (i.e., to accommodate previous agricultural purposes), in accordance with a Decommissioning and Rehabilitation Plan, to be prepared as a condition of consent following project approval.

It is recommended that the detailed decommissioning and rehabilitation plan should be prepared within 5 years of the planned closure of the Project. This plan will detail all aspects of decommissioning and removal of all infrastructure unwanted for post Project land use (some infrastructure may remain for post Project land use purposes i.e., constructed internal roads may be kept as part of the agricultural infrastructure), which may require temporary erosion and sediment control measures.

3.7 Alternatives Considered

3.7.1 Alternative Location

During the site selection process for the Project, given that it includes a 'behind the meter' solar farm, it was imperative to ensure that the solar and BESS system was connected to the privately owned 33kV electrical infrastructure already installed onsite. The Project site as proposed was selected based on (but not limited to) the following:

- Proximity to privately owned 33 kV site powerline in order to minimise distance to PV/BESS;
- Flood inundation levels, and contours of land to mitigate cut and fill requirements;
- To ensure that the land on which the solar farm and BESS is sited is within the OLAM site envelope that is leased from RFM. For context, as described in **Section 1.3**, the Almond Farm property is owned by RFM and operated under a long-term lease by OFI. Leased land was targeted for this development given that RFM as the landowner was already engaged and agreeable to the establishment/construction of a solar farm and BESS system on their portion of the lease.
- Ease of access to site, in consideration of:
  - Main road proximity and wet weather road conditions during rainy season;
  - Minimal crossover between delivery trucks, site trucks and normal operational equipment; and
  - Laydown areas for construction works.

Based on the above requirements, three (3) sites were under consideration as shown include:

- South of the Citrus pump house: given its proximity to the front gate and services. The location was not on lease which meant that it would require lease renegotiation. In addition, the land was undulated (depicted in blue)
- North of K1 dam: previously the land was an airstrip. It is too narrow and would require crossing the main agricultural channel to connect to the 33 kV privately owned electrical infrastructure (depicted in orange)
- West of K1 dam: It met all the requirements stated above and the land was to be prepped by OLAM (depicted in green). This site has been selected for the development of the solar farm and BESS at the Kerarbury Almond Orchard.

Figure 3-3 Alternative sites considered for the Project

3.7.2 *Alternative Technologies*

Solar renewable energy technologies were considered as part of the Project design, however solar PV technology has been selected for the Project due to the following benefits:

- Commercially proven, robust and low technical risk;
- Low environmental impact in comparison to other power generation technologies;
- Fast deployment in comparison with other renewable and non-renewable power generation technologies; and
- Solar projects are highly reversible at the end of their life, which allows for the return of the land to its former use (i.e., agricultural).

3.8 Project Justification

Solar energy is energy created by the heat and light of the sun. Solar power is produced when this energy is converted into electricity or used to heat air, water, or other substances. Australia has the highest average solar radiation per square metre of any continent in the world. Despite uncertainty regarding energy policy, the Commonwealth and NSW Governments have recognised the need to supplement energy derived from fossil fuels with energy generated from renewable sources, including solar photovoltaic (PV), geo-thermal, solar thermal, wave and tidal action, and wind.

The development of solar photovoltaic power is well underway in NSW and across Australia. Growth in the local solar PV sector continues to provide a significant boost for Australia's economy, specifically in regional areas. According to the Clean Energy Council (CEC) as of September 2022, there are currently 117 projects that are in construction (or due to start construction soon) in Australia. This is based on projects that have reached financial close and are not yet commissioned. These projects would deliver over $24.9 billion in capital investment, 16,295 MW of new renewable energy capacity and create 14,914 direct jobs (CEC, 2022).

The Project would support long-term and stable energy policies, such as the Renewable Energy Target (RET) scheme. Additionally, large-scale solar farm developments (under the RET) provide an alternative power generation source resulting in the potential to benefit the Australian community by reducing average household electricity bills and power disruptions. Specific to Australia's commitments, the Project would provide the following benefits:

- Reduced greenhouse gas emissions, contributing to meeting our international climate commitments;
- Aid the transition towards cleaner electricity generation; and
- Direct contribution to help in meeting the RET.

The Project is in accordance with relevant objects of the *Environmental Planning and Assessment Act 1979* (EP&A Act) in that it will assist to generate power to be distributed to the residents of NSW, thereby promoting the social and economic welfare of the community in a manner that manages and conserves natural resources. The Project will further the goals of sustainability, and the orderly and economic use of land.

3.8.1 Socio-economic Benefits

3.8.1.1 Broad benefits

Broad benefits that would be associated with the Project include:

- Reduced GHG emissions, assisting the transition towards cleaner electricity generation;
- Provision of a renewable energy supply that would assist the Australian and NSW Governments to reach Australia's energy and carbon mitigation goals;
- Embed electricity generation supply into the Australian grid, closer to identified consumption centres;
- Diversification of land use and economic activity in regional NSW. Specifically, the proposed Project would:
  - Generate approximately 11,000 MWh of renewable electricity per year (using a solar capacity factor of 25%);
  - Lower energy prices as renewable energy promotes the diversification and competition in the wholesale energy market – as in any market, more competition means lower prices.

3.8.1.2 Local benefits

The Project would provide energy supply to power irrigation and other requirements of the local supply of renewable energy direct to the grid. It would support 40 direct jobs over the six (6) month construction period.

The employment benefits also extend through the local supply chains to fuel supply, vehicle servicing, uniform suppliers, hotels/motels, Bed & Breakfasts, cafés, pubs, catering and cleaning companies, tradespersons, tool/s and equipment suppliers and many other businesses.

4. STATUTORY FRAMEWORK

This section provides an overview of the federal, state, regional and local legislation and policies relevant to the proposed Project.

4.1 Commonwealth Legislation

4.1.1 Environment Protection and Biodiversity Conservation Act 1999

The *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) provides protection of the environment from actions proposed to 'have the potential to significantly impact on matters of national environmental significance (MNES) or the environment of Commonwealth land'. Approval is required by the Commonwealth Minister for the Environment for actions that may have a significant impact on MNES. MNES under the Act include the following:

- World Heritage Properties;
- National Heritage Places;
- Ramsar Wetlands;
- Threatened species or ecological communities listed in the EPBC Act;
- Migratory species listed in the EPBC Act;
- Commonwealth marine environment;
- Nuclear actions;
- Great Barrier Reef Marine Park; and
- A water resource, in relation to coal seam gas development and large coal mining development.

An EPBC protected matters search tool (PMST) was undertaken on 26 October 2022. The search included a 10 km buffer around the Project site. The search results are provided in **Appendix B** and are summarised below in **Table 4-1**.

Table 4-1 Assessment of potential impacts to MNES

Matter/s of National Environmental Significance	Impact
World Heritage Properties There are no World Heritage Properties located at the Project site or within the surrounding 10 km buffer.	Nil
National Heritage Places There are no National Heritage Places located at the Project site or within the surrounding 10km buffer.	Nil
Wetlands of International Significance (Ramsar) There are no Ramsar wetlands located within the Project boundary. The Project site is located more than 200 km upstream from the closest wetlands of international importance and will not be impacted by the Project: The Ramsar sites identified in the PMST include ■ The Coorong, and Lakes Alexandrina and Albert Wetland (500 – 600 km upstream from Ramsar site), ■ Banrock Station Wetland Complex (400 – 500 km upstream from Ramsar site), ■ Riverland (400 – 500 km upstream from Ramsar site) and, ■ Hattah-Kulkyne Lakes (200 - 300km upstream from Ramsar site).	Nil

Matter/s of National Environmental Significance	Impact
Threatened Species or Ecological Communities listed in the EPBC Act The results of the Biodiversity Values Assessment Report (BAR, refer to **Appendix C**) indicate that no listed TECs or any vegetation under the EPBC Act or the BC Act are contained within the Project site. The PMST results indicated that there are four (4) TECs and 23 threatened species recorded in the locality of the wider site, however, due to the agricultural history of the area none were found on the Project site	No impact anticipated
Migratory Species listed in the EPBC Act There are nine (9) migratory species which may occur, or related to, the area searched. No migratory species were identified within the locality of the Project site during ecological surveys. None of these species would be dependent on limited resources available within the cleared Project site.	No impact anticipated
Commonwealth Marine Environment There are no Commonwealth marine areas located at the Project site or within the surrounding 10 km buffer.	Nil
Nuclear Actions The development does not involve nuclear actions and there are no nuclear actions located within the surrounding 10 km buffer.	Nil
Great Barrier Reef Marine Park The development is not located within the Great Barrier Reef Marine Park, nor is it located within the surrounding 10 km buffer.	Nil
A water resource, in relation to coal seam gas development and large coal mining development The development is not associated with coal seam gas developments or a coal mining activity.	Nil

The results of the PMST identified that threatened species, TEC's and migratory species (or species habitat) may occur, or relate to, the area searched. However, the subject land has been subject to extensive disturbance as part of historic agricultural activities, with the Project components being confined to previously disturbed areas. The findings of the BAR (refer to **Appendix C**) indicate that no threatened species or TECs listed under the EPBC Act occur within in the Project site. As a result, the Project will not have a significant impact on relevant MNES and it does not require referral under the EPBC Act.

4.1.2 *Biosecurity Act 2015*

The Commonwealth *Biosecurity Act 2015* came into effect on 1 July 2017, effectively replacing the *Noxious Weeds Act 1993*, and 13 other Acts, with a single Act. Under the *Noxious Weeds Act 1993* all landowners have a responsibility to control noxious weeds on their property. Similarly, under the *Biosecurity Act 2015* the same responsibility will apply and will be known as a **General Biosecurity Duty**. The General Biosecurity Duty states:

"*Any person who deals with biosecurity matter or a carrier and who knows, or ought reasonably to know, the biosecurity risk posed or likely to be posed by the biosecurity matter, carrier or dealing has a biosecurity duty to ensure that, so far as is reasonably practicable, the biosecurity risk is prevented, eliminated or minimised.*"

The general biosecurity duty applies to all weeds listed in Schedule 3 of the *Biosecurity Act 2015* (also included as Weeds of National Significance (WoNS). No Primary Weeds or Weeds of National Significance (WoNS) have been recorded within the Project site. Of the 11 invasive flora species recorded within the Project site, *Echium plantagineum* is not restricted in accordance with State Legislation, however, it is considered a Noxious Weed in NSW.

Weed management measures have been developed for implementation as part of the Project, as outlined in Section 6 of the BAR contained in **Appendix C** of this SEE.

4.1.3 Renewable Energy (Electricity) Act 2000

The *Renewable Energy (Electricity) Act 2000* (RE Act) aims to:

- Encourage the additional generation of electricity from renewable sources;
- Reduce emissions of greenhouse gases in the electricity sector; and
- Ensure that renewable energy sources are ecologically sustainable.

Section 17 of the RE Act defines renewable energy sources eligible under the Commonwealth Government's RET; this includes solar energy. Certificates for the generation of electricity are issued using eligible renewable energy sources. The Project would need to be accredited as a Renewable Energy Generator to create Renewable Energy Certificates.

4.2 NSW Legislation

4.2.1 Environmental Planning and Assessment Act 1979

The *Environmental Planning and Assessment Act 1979* (EP&A Act) is the principal planning legislation in NSW. The EP&A Act, in conjunction with the *Environmental Planning and Assessment Regulation 2000* (EP&A Regulation) provide the statutory framework for the assessment of an activity. The EP&A Act aims to support ecologically sustainable development by integrating relevant economic, environmental and social considerations into environmental planning and assessment. The EP&A Act institutes a system of decision-making for environmental planning and assessment, to promote the sharing of responsibility between different levels of government in the State.

There are a range of assessment pathways for renewable energy proposals, which are tailored to the size, location and level of environmental impact of the proposal. Small-scale renewable energy systems are primarily covered by the *State Environmental Planning Policy (Transport and Infrastructure) 2021* (Transport and Infrastructure SEPP), which includes solar energy systems. This is described further in **Section 4.3.1** below.

The Project would be assessed under Part 4, Clause 4.2 of the EP&A Act, and will require development consent to be granted prior to development. Clause 4.15 of the EP&A Act identifies matters to be considered in determining a DA, including:

a) The provisions of any relevant environmental planning instrument, development control plan, planning agreement, regulation, coastal zone management plan;

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;

c) The suitability of the site for the development;

d) Any submissions made in accordance with this Act or the regulations; and

e) The public interest.

Section 5.6 of the Act requires a determining authority, when considering an activity, to examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment.

The local council, being Murrumbidgee Shire Council, is expected to be the consent authority, however the Project will be referred to a Regional Planning Panel (RPP) for determination, as the capital investment value (CIV) of the Project is over $5M but below $30M. This is discussed further in **Section 4.3.2** below. In order to satisfy the matters above, this SEE has been prepared to accompany the DA for the Project, which will be provided for Council's consideration.

4.2.2 Heritage Act 1977

The *Heritage Act 1977* is administered by Heritage NSW and aims to protect the natural and cultural heritage of NSW. The *Heritage Act 1977* provides blanket protection for surface and sub-surface relics and for heritage items of state significance listed on the State Heritage Register (SHR). The Act defers to local planning instruments under the EP&A Act for the protection of items of local significance (‘items of the environmental heritage”).

4.2.3 Other Relevant NSW Legislation

Other relevant NSW legislation and its applicability to the proposed modification is outlined in **Table 4-2** below.

Table 4-2 Application of other NSW Legislation

Legislation	Description	Relevance to the Project
Biodiversity Conservation Act 2016 (BC Act)	The BC Act establishes mechanisms for: ■ The management and protection of listed threatened species of native flora and fauna (excluding fish and marine vegetation) and threatened ecological communities (TECs); ■ The listing of threatened species, TECs and key threatening processes; ■ The development and implementation of recovery and threat abatement plans; ■ The declaration of critical habitat; ■ The consideration and assessment of threatened species impacts in development assessment process; and ■ Biodiversity Offsets Scheme, including the Biodiversity Values Map and method to identify serious and irreversible impacts (SAII).	The proposed Project must be assessed in accordance with the provisions outlined in clause 7.2 of the BC Act, to determine whether the development is likely to significantly affect threatened species. According to clause 7.7(2) of the BC Act, if the proposed Project is likely to significantly affect threatened species, the development application is to be accompanied by a biodiversity development assessment report (BDAR). The accompanying BAR (**Appendix C**) considers the biodiversity impacts of the proposed Project, summarised in **Section 5.1** below. The proposed Project would not significantly affect threatened species or ecological communities, or their habitats. As such, further detailed assessment is not required under the BC Act. A review of the Biodiversity Offsets Scheme Entry Threshold (BOSET) confirmed that no areas of high biodiversity values are currently mapped within the Project site and provided that less than 1 ha of native vegetation is to be cleared, the Project will not exceed the BOS threshold and does not trigger entry into the BOS.
Heritage Act 1977	The *Heritage Act 1977* is administered by the Heritage NSW and aims to protect the natural and cultural heritage of NSW. It provides blanket protection for surface and sub-surface relics and for heritage items of state significance listed on the State Heritage Register. The Act defers to local planning instruments under the EP&A Act for the protection of items of local significant. The proposed Project must assess and take into account historic heritage values of the site.	Historic heritage values of the Project site have been assessed within the accompanying the Cultural Heritage Due Diligence Assessment Report (CHDD) (**Appendix D**), which has been summarised in **Section 5.2** of this SEE.
National Parks and Wildlife Act 1974	The objective of the *National Parks and Wildlife Act 1974* (NPW Act) is to consolidate and amend the law relating to the establishment, preservation and management of national parks, historic sites, certain other area, and the protection of certain fauna, native plants and	Aboriginal culture values of the Project site have been assessed within the accompanying CHDD (**Appendix D**), which has been summarised in **Section 5.2** of this SEE.

Legislation	Description	Relevance to the Project
	Aboriginal objects. Any proposed Project would have to assess and take into account Aboriginal cultural heritage values of the site location.	
Roads Act 1993	The *Roads Act 1993* addresses authorities, function and regulation of activities relating to the use and type of roads. Approval under section 138 of the Roads Act is required to impact or carry out work on or over a public road.	A section 138 permit would be sought from Council prior to the release of the construction certificate for any proposed road and access upgrades, if required. The development is not Integrated Development under the Roads Act, according to clause 4.48(3) of the EP&A Act.
Water Management Act 2000	The *Water Management Act 2000* (WM Act) regulates the use and interference with surface and groundwater where a water sharing plan has been implemented. For areas outside the limits of water sharing plans, licensing provisions of the *Water Act 1912* (Water Act) are still in force. Any proposed develop would need to consider water use approvals (Section 89), water management work approvals (Section 90) and controlled activity approvals near waterfront land (Section 91) as part of the WM Act.	The design of the proposed Project has incorporated adequate setbacks from Gum Creek, to reduce the risk of potential impacts to waterways. It is expected that a controlled activity approval would not be required.
Protection of the Environment Operations Act 1997 (POEO Act)	The POEO Act is the primary piece of legislation regulating pollution control and waste disposal in NSW. Schedule 1 of the POEO Act defines scheduled activities for which an Environmental Protection Licence is required.	Solar energy generation does not fall within the definition of electricity generation under Schedule 1 of the POEO Act and therefore does not require an Environment Protection Licence (EPL).
Rural Fires Act 1997 (RF Act)	The RF Act aims to prevent, mitigate and suppress bush and other fires in local government areas of the NSW. Section 63(2) of the RF Act requires the owners of land to prevent the ignition and spread of bushfires on their land.	The RF Act places a duty of care on all land managers/owners to prevent a fire spreading on or from their land. This duty of care for the Project will be addressed through solar farm design, construction and operation, and will be managed in accordance with a Bushfire Emergency Management Plan, which will be prepared following Project approval.

4.3 Environmental Planning Policies

4.3.1 State Environmental Planning Policy (Transport and Infrastructure) 2021

The *State Environmental Planning Policy (Transport and Infrastructure) 2021* (Transport and Infrastructure SEPP) consolidates and repeals the provisions of the former *State Environmental Planning Policy (Infrastructure) 2007* (ISEPP).

For definition, it is required to note that in the Transport and Infrastructure SEPP 2021, large utility-scale solar farms are identified as *electricity generating works* where the primary purpose is exporting electricity to the grid and are not suitable in residential or environmental zones. Smaller scale solar farms are identified as *solar energy systems* designed for in situ, where the primary purpose is to generate electricity for their own use and can be carried out in any zone, in accordance with the relevant requirements in the Transport and Infrastructure SEPP.

Given that the primary intent of the proposed Solar Farm with a capacity up to 4.95 MW and 4.586 MWh BESS facility at Kerarbury Almond Orchard is to power irrigation and other requirements for the operation of the orchard, the proposed Project will be defined as ***solar energy system***.

Permissibility of the proposed Project for the purposes of solar energy system is provided by virtue of Part 2.3, Division 4, Clause 2.36 (9) of the Transport and Infrastructure SEPP, which states:

Solar Energy Systems

Development for the purpose of a solar energy system may be carried out by any person with consent on any land.

The solar farm and BESS facility at Kerarbury Orchard is proposed to be developed on land which is zoned as *RU1 – Primary Production* in the Murrumbidgee LEP. The Project is therefore permissible 'with' development consent given that the prescribed rural zone (i.e RU1) defined in Sections 2.35 and 2.36 (9) of Division 4 in Part 2.3 of Chapter 2 of the Transport and Infrastructure SEPP 2021.

According to Section 2.7(1) under Part 2.1 of the Transport and Infrastructure SEPP 2021, the above provisions prevail over any inconsistency in any other planning instruments, including the *Murrumbidgee Local Environmental Plan 2013* (Murrumbidgee LEP).

As such, the proposed Project is permitted with consent under the provisions of the Transport and Infrastructure SEPP 2021.

Additionally, Division 5, Subdivision 2 of the Transport and Infrastructure SEPP relates to developments likely to affect an electricity transmission and distribution network. Section 2.48 (2) states that the consent authority must:

(a) give written notice to the electricity supply authority for the area in which the development is to be carried out, inviting comments about potential safety risks, and

(b) take into consideration any response to the notice that is received within 21 days after the notice is given.

The Project is considered to be development that would affect an electricity transmission or distribution network. As such, the application must be referred by Murrumbidgee Shire Council to the relevant electricity supply authority, before determining a development application.

4.3.2 State Environmental Planning Policy (Planning Systems) 2021

The *State Environmental Planning Policy (Planning Systems) 2021* (Planning Systems SEPP) consolidates and repeals the provisions of the former *State Environmental Planning Policy (State and Regional Development) 2011* (SRD SEPP). It is noted that as of 1 March 2022, the provisions of the former SRD SEPP were transferred to Chapter 2 of the Planning Systems SEPP.

Part 2.4, Section 2.19 of the Planning Systems SEPP 2021 declares a development as 'regionally significant' if it is contained within Schedule 6 of the Act. Schedule 6 includes a list of developments that are considered regionally significant if they meet the relevant criteria, predominantly relating to a specific CIV.

Condition 5, Schedule 6 relates to private infrastructure over $5Mil, and sets out the following criteria:

Private infrastructure and community facilities over $5 million

Development that has a capital investment value of more than $5 million for any of the following purposes—

*(a) air transport facilities, **electricity generating works**, port facilities, rail infrastructure facilities, road infrastructure facilities, sewerage systems, telecommunications facilities, waste or resource management facilities, water supply systems, or wharf or boating facilities,*

AGL has prepared a CIV report for the Project, which indicates that the proposed CIV of the Project is $11,794,295.14 (Refer **Appendix E**). Consequently, as the Project exceeds $5M, but is below $30M, it is considered *Regionally Significant Development* for the purposes of the electricity generating works. As described in **Section 4.2.1** above, the proposed Project is expected to have a CIV that exceeds $5 million but is below $30 million. As such, the project would be considered Regionally Significant Development for the purposes of the electricity generating works.

Therefore, for the purposes of this Project, the development application would be assessed by Murrumbidgee Shire Council, with the role of determining authority falling to a Regional Planning Panel. for Regionally Significant Projects within the Murrumbidgee Shire Council LGA, the Western Regional Planning Panel (WRPP) is the nominated Planning Panel.

4.3.3 State Environmental Planning Policy (Resilience and Hazards) 2021

The *State Environmental Planning Policy (Resilience and Hazards) 2021* (Resilience and Hazards SEPP) consolidates and repeals the provisions of the former *State Environmental Planning Policy No. 33 – Hazardous and Offensive Development* (SEPP 33) and the former *State Environmental Planning Policy No. 55 – Remediation of Land* (SEPP 55).

Chapter 3 of the Resilience and Hazards SEPP assesses the potential hazards associated with the proposed Project by providing definitions and guidelines for hazardous industry, offensive industry, hazardous storage establishments, and offensive storage establishments. Clause 3.2, under Chapter 3 provides definitions for potentially hazardous industry and potentially offensive industry. The potential hazard and offensiveness of the proposed solar farm (including the BESS) is discussed in **Section 5.9.4**.

Chapter 4 of the Resilience and Hazards SEPP provides a state wide planning approach to the remediation of contaminated land. Under Clause 4.6 (1) of the Resilience and Hazards SEPP, a consent authority is required to consider whether a proposed Project site is affected by soil or other contaminants before granting consent. Potential land contamination within the proposed Project site has been discussed in in **Section 5.9.4**.

4.3.4 State Environmental Planning Policy (Biodiversity and Conservation) 2021

The *State Environmental Planning Policy (Biodiversity and Conservation) 2021* (Biodiversity and Conservation SEPP) consolidates and repeals the provisions of the former *State Environmental Planning Policy (Koala Habitat Protection) 2021* (Koala Habitat Protection SEPP 2021) and the former *State Environmental Planning Policy (Koala Habitat Protection) 2020* (Koala Habitat Protection SEPP 2020).

The Project site has been completely cleared of native vegetation and does not invoke any areas of concern highlighted *within SEPP (Biodiversity and Conservation) 2021*. No trees will be impacted by the proposed works and the provisions of the Biodiversity and Conservation SEPP 2021 do not apply.

4.4 Regional Planning Provisions

4.4.1 Riverina Murray Regional Plan 2036

The goals and directions detailed within the Riverina Murray Regional Plan 2036 (RMRP) (DPE,2017) identify the regions having significant potential for renewable energy industries. The RMRP discusses the need for adopting a strategic approach to new renewable energy projects and incorporating small-scale cogeneration measures into the design of new developments. The draft Riverina Murray Regional Plan 2041 (DPE, 2022) is presently under consideration following exhibition in September 2022 and supports a transition to net zero emissions region by 2050 by enabling the establishment of the South West Renewable Energy Zone. The final plan is expected to be released later in 2022.Development for the purposes of renewable energy generation align with the objectives and actions outlined in the RMRP. Specifically, Direction 11 – Promote the diversification of energy supplies through renewable energy generation and Action 11.3 presented below:

'Promote appropriate smaller-scale renewable energy projects using bioenergy, solar, wind, small-scale hydro, geothermal or other innovative storage technologies.

The development of the Project would align with the direction and outcomes of the Riverina Murray Regional Plan. Specific to the Project, the region receives approximately 18-19 megajoules of solar exposure daily, making it a region with high solar penetration in NSW.

4.5 Local Planning Provisions

4.5.1 Murrumbidgee Local Environmental Plan 2013

The Project site is zoned RU1 - Primary Production in the Murrumbidgee LEP. The objectives of the zone are as follows:

RU1 - Primary Production

- To encourage sustainable primary industry production by maintaining and enhancing the natural resource base;
- To encourage diversity in primary industry enterprises and systems appropriate for the area;
- To minimise the fragmentation and alienation of resource lands; and
- To minimise conflict between land uses within this zone and land uses within adjoining zones.

Development for the purpose of electricity generation is not specified in item 2 or 3 or 4 of the Murrumbidgee LEP for land zoned as R1 and is therefore permitted with consent.

Regardless, as stated in **Section 4.3.1** above, permissibility of the solar energy development is provided by way of Section 2.36 (9) under Division 4 of Part 2.3 of the Transport and Infrastructure SEPP 2021, which prevails over any inconsistency with any other planning instruments, including the Murrumbidgee LEP, in accordance with Section 2.7(1) of Transport and Infrastructure SEPP 2021.

4.5.2 Darlington Point & Coleambally Development Control Plan

The *Darlington Point & Coleambally Development Control Plan1994* facilitates development within the LGA, providing detailed planning guidelines. DCPs do not have statutory standing, but rather are guideline documents. The general intent of the DCP is to facilitate good development outcomes for the Murrumbidgee Shire.

Currently there is no updated Development Control Plan adopted by the Murrumbidgee Shire Council, which is pertinent to the Project Site. In consideration of this, a Pre-DA meeting with the Murrumbidgee Shire Council was convened on 15 June 2022 to further discuss the proposed Project and the outcomes from this meeting (as per correspondence from Council dated 16 June 2022), informs this SEE.

5. ENVIRONMENTAL ASSESSMENT

The following sections provide a description of the existing environment followed by an assessment of the environmental impacts of the Project, along with recommended safeguards and management measures to minimise impacts to the environment.

5.1 Biodiversity

A Biodiversity Assessment Report (BAR) has been prepared on behalf of AGL Energy Solutions (AGL) for the proposed Project site, which has been summarised in this section of the SEE. The full BAR can be found in **Appendix C**.

The purpose of the BAR is to characterise the biodiversity values of the Project site, and to identify the known or potential occurrence of (or habitat for) any species, populations or ecological communities that are listed as threatened under the NSW BC Act or the Commonwealth EPBC Act. The BAR provides an assessment of whether the proposed activity is likely to result in a significant impact to flora, fauna and ecological communities and recommends mitigation measures to minimise impacts where required. The assessment was informed by a combination of desktop reviews, database searches and observations from the site visit completed by ERM on 5 October 2022.

5.1.1 Existing Environment

The Project site is situated within the NSW Riverina Bioregion which covers areas of south-west NSW and contains parts of the Murray, Murrumbidgee, Lachlan and Goulburn River catchments. The Project site is located south of the Murrumbidgee River and the nearest water source being Gum Creek located approximately 2.5 km to the north of the Project site. The Riverina Bioregion is characterised by a broad range of native flora and fauna, supported by a persistently dry semi-arid climate characterised by hot summers and cool winters.

Native vegetation in the Project site has been completely cleared for agricultural use, as an orchard, and is predominantly non-native grassland.

5.1.2 Methodology

5.1.2.1 Desktop Review

The Desktop Review included analysis of the following online resources:

- NSW Threatened Biodiversity Data Collection, including the Wildlife Atlas (BioNET), Vegetation Information System (VIS) database and threatened species profiles. Accessed on 26 October 2022;
- Results of the Commonwealth EPBC Act Protected Matters Search Tool (PMST) identifying threatened species and communities with potential to occur within the locality (10 km buffer around the Project boundary). Accessed on 26 October 2022;
- NSW SEED mapping to identify Plant Community Types (PCT), listed threatened species or communities or known or likely to occur at the Project site; Mitchell Landscapes, map of interim Biographic Regionalisation of Australia (IBRA) version 7. Accessed on 26 October 2022;
- Biodiversity Offset Scheme Entry Threshold (BOSET) mapping, version 8. Accessed on 26 October 2022 via https://www.lmbc.nsw.gov.au/Maps/index.html?viewer=BOSETMap;
- Atlas of Living Australia (ALA) database. Accessed on 26 October 2022; and
- Local Government databases.

5.1.2.2 Field Surveys

A one day survey of the Project site was undertaken by Elspeth Mackenzie, ERM Principal Consultant on Wednesday the 5 October 2022, representing a total of 8 person hours.

The purpose of the field survey was to identify the presence of important biodiversity values within the Project site. Important biodiversity values included:

- The presence of threatened fauna and flora species, or supporting habitat;
- Threatened ecological communities (TEC); and
- Habitat and resources considered important for threatened species or ecological communities.

Assessments targeted potential threatened flora species, koala habitat, hollow bearing trees and native grasslands. Fauna observations were undertaken opportunistically across the duration of the field survey. Survey methodologies were designed to rapidly assess biodiversity values and were not undertaken in accordance within the Biodiversity Assessment Method (BAM).

5.1.2.3 Likelihood of Occurrence

Consistent with the accepted approach for biodiversity assessment, a likelihood of occurrence assessment was undertaken, informed by desktop sources and the results of the field survey.

Desktop sources identified a number of fauna species listed under the EPBC Act and BC Act that have been recorded previously or are predicted to occur within a 10 km buffer of the Project site. The likelihood of occurrence approach refines the desktop generated list using site-specific and specific-species habitat information. Desktop sources are indicative only and likelihood rankings, particularly in regard to the presence of preferred habitat, are conservative. The assessment ranks the likelihood of the species occurring within the Project site through analysis of species distribution information and the presence of specific habitat attributes as identified through the desktop analysis and field survey.

5.1.2.4 Assessment of Significance

As the Project does not exceed the biodiversity offsets scheme threshold (refer to Section 2 of the BAR, **Appendix C**), the test of significance applies. Section 7.2 of the BC Act provides that development under the EP&A Act is likely to significantly affect threatened species if:

a) It is likely to significantly affect threatened species or ecological communities, or their habitats, according to the test in Section 7.3, or

b) The development exceeds the biodiversity offsets scheme threshold if the biodiversity offsets scheme applies to the impacts of the development on biodiversity values, or

c) It is carried out in a declared area of outstanding biodiversity value.

The test has been applied to those threatened species and ecological communities that have been recorded or are considered likely to occur and which may be affected either directly or indirectly by the proposed Project or activity (refer to **Appendix C**).

A species does not have to be considered as part of the test of significance if recent and reliable data, relating to the site and derived from field surveys consistent with DPIE guidelines, clearly show that the species:

1) Does not occur in the study area,

2) Will not use on-site habitats on occasion, and

3) Will not be influenced by off-site impacts of the proposed Project.

An Assessment of Significance (AOS), also referred to as a test of significance, was not undertaken for the Project, as no threatened species or communities have been identified as having the potential to be impacted by the proposed Project.

5.1.2.5 Assumptions and Limitations

The field and desktop assessment undertaken provides an overview of the biodiversity values that exist within the Project site. The one-day survey was undertaken across the Project site to gain a general understanding of the types of species and habitat features that occur.

The absence of a species from a database list or observational studies does not confirm its absence from the Project site.

The lack of existing records from databases may indicate a low historic sampling effort in the region, as opposed to an absence of species. Similarly, the timing of the October 2022 field survey precludes the detection of a number of migratory and wader species that are typically absent from the area at that time of the year.

To overcome these limitations, the likelihood of occurrence is based on the precautionary approach and identify species that have the potential to occur rather than relying on species sightings alone.

5.1.3 Impact Assessment

5.1.3.1 Threatened Species

Based on the results of the desktop surveys and one day site survey, no listed threatened species or ecological communities have been recorded within the Project site.

There are six (6) bird species under the BC Act that have been recorded adjacent to the Project site, within the nearby Murrumbidgee National Park and surrounds (approximately 3.8 km to the northeast): Based on the results of the desktop assessment and site survey, there is potential for the White-bellied Sea-Eagle, Black Falcon and the Diamond Firetail to visit the wider site. However, due to there being no impact by the proposed Project, an Assessment of Significance was not necessary.

Additional mitigation measures have been considered within **Section 6** of the BAR to ensure that the Project will not result in a significant impact on any BC Act listed ecological community, population or threatened species.

5.1.3.2 Threatened Ecological Communities

During field survey, it was confirmed that there are no TECs identified within the Project site given that majority of the Project site has been historically cleared and subject to a range of disturbances including intensive agricultural practices and livestock grazing.

Though the PMST results identified six (6) BC listed TECs that are likely to occur within the broader locality, the Project site itself does not consist of vegetation considered a TEC under the EPBC Act or the BC Act.

5.1.3.3 Habitat Values

During the field and desktop surveys, no habitat features or high biodiversity values were identified within the Project site.

There were no large trees, dense vegetation, fallen timber, surface rocks or burrows observed within the Project site.

5.1.3.4 Matters of National Environmental Significance

The findings of the BAR (**Appendix C**) carried out to date have not confirmed the presence of threatened species or TECs listed under the EPBC Act in the Project site. Therefore, the proposed Project does not need to be referred to the Australian Government Minister for the Environment and Energy through the preparation of a separate referral. The proposed Project is not considered likely to affect MNES or environment on Commonwealth land.

5.1.4 Mitigation Measures

Based on the results of the desktop and one (1) day field survey, no Matters of National Environmental Significance under the EPBC Act or threatened species or communities under the BC Act were identified within the Project site. The Project site does not contain any areas of high biodiversity value and is characterised by completed cleared and heavily grazed pastures. There were no large trees, dense vegetation, fallen timber, surface rocks, animal burrows or other habitat features observed during the field survey.

While adverse impacts from the Project to biodiversity values are unlikely, the Project can further reduce and/ or avoid potential impacts during the design and construction phase by employing the following recommended measures and controls:

- Ensure sediment and erosion control measures are established during the construction phase of the Project;
- The long-term management of weeds should be considered as part of the planning proposal and future development of this site; and
- Vehicle hygiene protocols should be established and will assist to control the movement of both pathogens and weeds.

5.2 Heritage

5.2.1 Introduction

A Cultural Heritage Due Diligence Assessment Report (CHDD) was undertaken by ERM behalf of AGL as part of the DA process for the Project, attached as **Appendix D** to this SEE.

5.2.1.1 Methodology

The CHDD has been prepared to investigate the presence of Aboriginal and non-Aboriginal (Historic) heritage items and values within the Project site. The report will provide preliminary assessment of impacts to heritage values (if identified), along with the management and mitigation measures to avoid or mitigate impacts to known heritage values, where appropriate and feasible.

Preparation of this report required the following tasks to be undertaken:

- Background historical research and review of previous reports;
- Heritage register and database searches;
- Mapping of heritage items;
- Site inspection;
- Assessment of potential impacts from the proposal; and
- Preparation of recommendations for management of heritage values at the site.

5.2.2 Background Context

5.2.2.1 Environmental Context

The Project site is situated within rural land and there are some agricultural structures in the vicinity or the Project site, in addition to a fence line, track, irrigation ditch and transmission line that runs through. Initial background research has indicated that the Project site has remained cleared farming land for much of its colonial and modern history. The land has been ploughed for orchard planting and subject to construction of drainage channels and associated infrastructure. These activities have resulted in significance disturbance to the ground surface.

- **Bioregion:** The Project site is within the Riverina Bioregion, which is situated in southwest NSW extending into central-north Victoria. The bioregion is characterised by a dry semi-arid climate, with hot summers and cool winters.
- **Topography and Hydrology**: The Project site is situated on a flat plain with minimal variance in elevation. The Project site contains no water courses, with the nearest permanent water source identified as Gum Creek, approximately 2.5 km to the north of the Project site.
- **Geology and Soils**: The underlying geology of the Project site consists of Shepparton Formation which formed in a fluvio-lacustrine environment between the Pleistocene and Holocene. The soils within the Project site are vertosols characterised by a high clay content that has the potential for cracking (NSW eSpade 2022). Archaeologically, vertosols are prone to frequent subsurface movement due to cracking and it is unlikely that intact archaeological deposits would occur within these soils.

5.2.2.2 Historical Context

- **Aboriginal Culture in the Riverina:** The Project site is located within the lands of the Wiradjuri language group. Wiradjuri was one of the largest tribal groupings in Australia, with many smaller subgroupings. The Wiradjuri who lived in the region of the Project site are likely to have lived in small and highly mobile family groups who came together regularly to participate in trade, marriage and ceremonial gatherings. The Darlington Point area has been suggested as a traditional ceremonial region where “a good deal of food may have been available at certain times of the year” (Read 1983:24).
- **Early European Exploration and Settlers**: of the areas surrounding Darlington Point, was directly related to over-land cattle routes between NSW and Victoria. Settlement extended along the banks of the Murrumbidgee from Wagga Wagga and reached the ford in the river at the location of the current township of Darlington Point by the early 1830s.

5.2.2.3 Archaeological Context

- **Heritage Register Searches**: A basic search of the Aboriginal Heritage Information Management System (AHIMS) database was undertaken on 17 October 2022 within a 1 km buffer around the Project site identified that there were no registered sites within the search area (**Appendix D**).
- **Historic Heritage Searches**: A search of the statutory and non-statutory heritage registers including the Commonwealth Heritage Register, Australian National Heritage, State Heritage Inventory, Section 170 Registers, Murrumbidgbee LEP 2011, Schedule 5, Register of the National Estate and National Trust – all indicated that there are no known heritage sites within or immediately adjacent to the Project site. The closest known heritage item is “The Homestead (formerly Kerarbury Station)” (Item I3), which is 1.7 km west of the Project site. This site is an historic site of local significance listed on Schedule 5 of the Murrumbidgee LEP 2013.
- **Previous Archaeological Investigations**: Few archaeological investigations have been conducted in the region around Darlington Point or the Project site. It identified culturally modified trees, artefact scatters and hearths; a variety of site types which demonstrate that the region was utilised for a diverse range of activities (Refer **Appendix D**). Based on the results of the background research and register searches, there is low potential for Aboriginal and historical archaeological sites within the Project site.

5.2.3 Site Inspection

Pedestrian survey of the Project site was undertaken by Elspeth Mackenzie, ERM archaeologist on Wednesday 5 October 2022. The southern portion of the Project site consists of a ploughed paddock, with tall grass and weeds currently growing consistently across the whole area. The northern portion of the Project site consists of a highly disturbed paddock with evidence of significant earthworks. It has less tall grass and weeds, which are also currently growing consistently across the whole area. A track runs east-west across the north and a transmission line runs east-west across the south of the area.

No Aboriginal or historic heritage sites were identified within the Project site during inspection. Ground surface visibility was generally low, owing to thick vegetation coverage. The boundary of "The Homestead (former Kerarbury Station)" is not visible from the Project site.

5.2.4 Mitigation Measures

Based on the results of this due diligence investigation, it is considered unlikely that Aboriginal cultural heritage objects or historic heritage items or will occur within the Project site. Although unlikely, there remains a possibility that Aboriginal and historic cultural heritage objects of value may be identified during the course of works. The following management measures provided in **Table 5-1** below are proposed in the unlikely event that cultural heritage items or Aboriginal objects are identified.

Table 5-1 Summary of Management Measures

Measure	Description
Cultural Awareness Induction	All personnel involved with ground breaking activities within the Project site should undertake a cultural awareness induction, which includes identification of potential Aboriginal and non-Aboriginal heritage objects, identification of historic heritage finds, and an understanding of the chance finds procedure.
Chance Finds Procedure	If suspected Aboriginal heritage objects or heritage items are found during works, the following Chance Find Procedure should be followed and applies to the entire Project site: ■ All activity in the immediate area should cease and the location should be cordoned off and an appropriately qualified heritage professional should be consulted; ■ Heritage NSW (DPC) should be immediately contacted; ■ Griffith Local Aboriginal Land Council should be notified (potential Aboriginal objects only); ■ An appropriately qualified heritage professional should record the location and attributes of the site and determine the significance of the find; and ■ Works will only recommence once the area has been cleared by further assessment.
	In the event of the discovery of human skeletal material (or suspected human skeletal material) during project activities in the Project site the following steps should be followed: ■ All activities and/or works in the immediate area must cease; ■ The State Police must be contacted along with Heritage NSW; and ■ Any sand/soils removed from the near vicinity of the find must be identified and set aside for assessment by the investigating authorities.

5.2.5 Summary

5.2.5.1 Aboriginal Heritage

The key findings of the Aboriginal heritage assessment are summarised below:

- No previously recorded Aboriginal heritage sites were identified within or in close proximity to the Project site;
- No Aboriginal heritage sites were identified within the Project site during this investigation;
- Based on the underlying clay-based soil and high level of historic disturbance the Project site has low potential to contain subsurface Aboriginal cultural material; and
- The Project site is not known to contain Aboriginal cultural heritage values.

5.2.5.2 Historic Heritage

The key findings of the historic heritage assessment are summarised below:

- No previously recorded historic heritage sites are registered within or in close proximity to the Project site;
- Background review indicated low potential for historic heritage to be identified within the Project site;
- No new historic heritage sites were identified during the site inspection; and
- The Project site retains low potential for historical archaeological finds.

5.3 Visual

A Glare Assessment Report has been prepared and is contained in **Appendix F**. The purpose of this report is to provide an assessment of the potential impacts of glare of the Project. A summary of the methodology, key findings, potential impacts and proposed mitigation measures is provided below.

5.3.1 Study Methodology

For the purposes of glare assessment for this Project, the solar glare hazard analysis tool (SGHAT) developed by Sandia National Laboratories was used. SGHAT calculates the potential for glare resulted from solar panels by considering the sun path, observation point locations, panel reflectance and panel orientation (Refer **Appendix F**).

Magnitude of glare will be dependent on the incident angle and the solar radiation intensity. Both these factors are location specific and for the purposes of this report, Darlington Point in NSW is the location under study.

5.3.2 Glare Impact Assessment

Hazards result from glint and glare are categorised into three categories:

- Potential for permanent eye damage (retina lburn);
- Potential for temporary after-image (flash blindness); and
- Low potential for temporary after image.

Glare hazard for the Project was calculated by using ForgeSolar Glare Gauge web application, the simulation is powered by SGHAT V 3.0. Due to the lack of direct irradiance data available for Darling point, the standard direct normal irradiation (DNI) is utilized for this simulation. DNI is the amount of solar radiation received per unit area by a surface that is perpendicular to the rays of light. It is adopted to quantify the magnitude of solar radiation at a given location/time.

The routes studied for glare impact consisted of the section of the Sturt Highway with a 5 km radius of the Kerarbury Orchard Solar Farm, running north-west to south-east of the Project site. Elevations of the road are taken from Forge Solar, and traffic is considered in both directions.

As a result of the assessment, for the proposed Project, a Green glare (low potential for after image) has the potential to be present for short durations, predicted only during the months of January and December. It is understood that short durations of green glare over a limited number of months will have negligible impact on road users of the Sturt Highway.

Given that all glares resulting from the solar panels installation at the Kerarbury Orchard belong to the category low potential for afterimage, the proposed PV array for the Project is deemed suitable for operation in the current location.

5.3.3 Summary

For the purposes of glare analysis for the Project, Solar Glare Hazard Analysis Tool was utilised to determine the potential for glare occurrence and the resulting glare intensity. The glare analysis conducted for the site concluded that glare impact from the proposed Project would be minimal and not considered to be distracting or harmful to Sturt Highway users.

5.4 Traffic and Transport

A Traffic and Transport Impact Assessment (TTIA) has been undertaken by Transport Planning Partnership (TTPP) to support this SEE and is contained in **Appendix G**. A summary of the methodology, key findings, potential impacts and proposed mitigation measures has been provided below.

5.4.1 Existing Environment

5.4.1.1 Local Road Network

The Kerarbury Orchard Solar Farm and BESS site will be located within the existing Kerarbury Almond Orchard. In the vicinity of the Project site, the Sturt Highway has two travel lanes in both directions and forms the northern boundary of the broader site (Kerarbury Almond Orchard). Sturt Highway is a major highway which provides connectivity between Sydney and Adelaide.

5.4.1.2 Existing Traffic Volumes

The Average Annual Daily Traffic (AADT) online data provided by Transport for NSW (TfNSW) was used to indicate a representative of weekday traffic volumes in 2022 and has been recorded at a traffic counter located on Sturt Highway 50 km east from the Project site. Traffic volumes (two-way) on Sturt Highway are in the order of 101 vehicles per hour (vph) in the AM peak and 316 vph in the PM peak period, as summarised in **Table 5-2** below.

Table 5-2 Traffic Volumes (AADT, 2022)

Direction	AM Peak (10:00 – 11:00)			PM Peak (15:00 – 16:00)		
	Light Vehicles	Heavy Vehicles	Combined	Light Vehicles	Heavy Vehicles	Combined
Eastbound	33	18	**51**	42	21	**165**
Westbound	31	17	**50**	35	16	**151**
Two-way Flow	**64**	**37**	**101**	**77**	**37**	**316**

5.4.1.3 Existing Site Traffic Generation

During the off-peak season, the site's traffic generation is significantly less typically requiring less than one (1) vehicle per week on average for ad-hoc and unplanned maintenance.

During the seasonal peak, the orchard will have up to 50 site personnel for the harvesting operation. The seasonal peak of the orchard operation is during the harvest period which occurs annually between February and April. Workers will travel to the site prior to the shift (before 6 am) and leave the site following the shift (after 6 pm). It is anticipated that during peak season, there could be in the order of 40-50 cars generated by the existing operation on a daily basis.

5.4.1.4 Public Transport

The closest bus stop is located in Darlington Point town centre on Sturt Highway, approximately 15 km from the Project site. Bus route 945 services this bus stop, which runs between Darlington Point and Griffith.

Leeton Station is the nearest train station to the site, located 65 km from the Project site. The Southern NSW train line services this train station, which provides connectivity between Griffith and Goulburn.

There are no designated pedestrian footpath or cycleway facilities in the vicinity of the site given the remote nature of the Project site.

5.4.1.5 Crash History

Historic crash data was obtained by from Transport for NSW (TfNSW) is available online for the most recent five-year period between 2017 and 2021. The data indicated that during this period there have been no crashes within 500 m of the site access location. Therefore, there are no existing safety concerns surrounding the site access.

5.4.1.6 Site Entry and Egress

The existing site access driveway is located off Sturt Highway and is currently used to access the Kerarbury Almond Orchard as shown above in **Figure 3-2**. Upon completion of the solar farm construction, the solar farm and the orchard will operate simultaneously using the same site access driveway off Sturt Highway.

An assessment of the turn treatments required for the site access to be used for the solar farm development has been undertaken in accordance with *Austroads Guide to Road Design (AGRD) Part 4 (2017 and 2021)* and *Austroads Guide to Traffic Management (AGTM) Part 6 (2020).* Presently it is anticipated that all construction deliveries and construction staff will arrive from the east direction, turning left-in and right-out of to the site via Sturt Highway.

Turn treatment warrant assessment which considers the design speed of a road identified that the design speed for Sturt Highway is 120 km/h. Currently, a basic left-turn (BAL). treatment in accordance with Austroads Guides is not provided at the site access off Sturt Highway and is not recommended unless the traffic generation associated with the Project and the Kerarbury Orchard exceed the estimates in this TIA.

5.4.2 Traffic and Transport Impact Assessment

5.4.2.1 Construction

The proposed construction activities would be undertaken in five key stages, namely:

- Design and procurement (no site activity);
- Civil and mechanical works and electrical works;
- Logistical and delivery;
- Testing and commissioning works; and
- Post-commissioning tune-up and performance testing.

Construction activities on a typical day are anticipated to generate up to six (6) vehicles per day while during the peak of the construction works, there would be up to 20 heavy vehicles per day. This would be equivalent to up to two (2) vehicles every hour (i.e., 2 inbound trips and 2 outbound trips) on average. This is considered minimal and would not result in any noticeable traffic impact on the surrounding road network.

On a typical day in the construction period, there would be approximately 12 site personnel on-site while the peak construction workforce is expected to be up to 50 site personnel. Adopting a vehicle occupancy rate of 1.5 workers per vehicle (assuming carpooling), there would be in the order of eight (8) vehicles on a typical day or 33 vehicles during the peak construction period (i.e., 33 inbound trips and 33 outbound trips).

Typically, the hours of construction will be 7am-6pm Monday to Friday, and 8am-1pm Saturday which is in-line with the Construction Management Plan for the development. The construction worker trips would occur outside of the surrounding road network peak periods (which occur at 10am and 3pm) and therefore would have a minor impact on the road network.

5.4.2.2 Construction Transport Routes

The majority of construction deliveries are expected to come from the east direction from surrounding regional areas such as Darlington Point, Narrandera, Wagga Wagga and Griffith.

5.4.2.3 Operational Traffic Generation

All operations for the solar farm and BESS would be performed remotely and there would be no permanent staffing on-site except for urgent issues to do with maintenance, repairs, troubleshooting etc. Routine inspections and maintenance would be required twice per year, which would require around two (2) operation staff which would generate up to 2 inbound and 2 outbound trips in a day and would have no impact on the surrounding road network.

5.4.3 Parking Assessment

5.4.3.1 Construction

A construction staff car parking and vehicle laydown area is proposed at the north-western corner of the site, adjacent to the proposed solar farm entrance.

On-site car parking would be provided in-line with Class 1A parking in AS2890.1 which stipulates employee parking spaces to be provide as 2.4 m wide, 5.4 m long and with a 5.8 m aisle width (as a minimum). On this basis, the proposed car parking facility would be able to accommodate the construction workforce parking demand which is expected to be in the order of eight (8) car spaces on a typical day and construction vehicle laydown (one (1) vehicle every two (2) hours).

During peak construction, it is estimated that there would be around 33 staff vehicles per day and two (2) construction vehicles every hour. Additional space immediately north of the solar farm site would be established to accommodate the further construction staff parking demand and construction vehicles in the laydown area.

5.4.3.2 Operation

For the solar farm, all operations would be performed remotely and there would be no permanent staffing on-site. Routine inspections and maintenance of the solar panels and associated infrastructure would occur two times per year. This would also require around two (2) operation and maintenance staff, which would be accessing the site via private light vehicles. The parking demand associated with such tasks would be accommodated within the on-site parking facility.

5.4.4 Site Distance Assessment

A desktop review of driver sight distance has been undertaken in accordance with *Australian Standards AS2890.1:2004* and *Austroads Guide to Road Design Part 4A: Unsignalised and Signalised Intersection*. Access driveways need to be located and constructed so that there is adequate entering sight distance to traffic along the frontage road.

Sturt Highway has a posted speed limit of 110 km/h which requires a minimum sight distance of 190 m and desirable sight distance (based on a five second gap) of 153 m. Based on Google Street View and Nearmap aerial imagery, the available sight distance appears to exceed 500 m in each direction. This is a result of the flat terrain and reasonably straight alignment of the highway, as well as there being no vegetation surrounding the Project site access. This is well above the sight distance requirements at the site access location

5.4.5 Traffic Mitigation Measures

In order to mitigate any potential traffic and access impacts, the following measures should be considered:

- While presently no turn treatment is recommended, if the traffic generation associated with the Project or with the operations of the Kerarbury Orchard traffic exceed the estimates in this TIA, the turn treatment warrant assessment must be reassessed for intersection operation and safety;
- A Construction Traffic Management Plan (CTMP) be prepared and approved by Murrumbidgee Council. The CTMP would outline details pertaining to construction activities proposed at the site and the associated traffic control measures to be implemented to manage the impacts. The CTMP also provide details on any oversize/overmass vehicles required for the construction works; and
- A road dilapidation condition assessment of Sturt Highway to be undertaken prior to and following the completion of construction activities.

5.4.6 Summary

The TIA concluded that with the above mitigation measures in place, the proposed Project would not cause any adverse impacts to the traffic and transport networks surrounding the subject site in the Darlington Point vicinity.

5.5 Flooding

A Flood Impact Assessment (FIA) has been undertaken to support this SEE and is contained in **Appendix H**.

The purpose of the FIA was to understand the potential; flooding mechanisms within the Project site and includes the flood modelling assumptions and results of the potential flood risks at the Project site. The specific tasks of the FIA included:

- Development of a 2D (Two-Dimensional) hydraulic flood model (using TUFLOW) Rain-on-Grid (RoG) methodology to assess flood risk from stormwater runoff;
- Assess the risk of inundation from the Murrumbidgee River; and
- Provide high-level recommendations for any mitigation or design alterations which may be required to reduce the risk associated with flooding and drainage.

5.5.1 Existing Environment

The solar panels for the Project are proposed to be installed on generally flat terrain with an existing irrigation channel running in an east-west direction in the northern portion of the solar array. There is a limited catchment upstream of the site with significant irrigation and drainage network surrounding the site, impacting overland flows from both entering and leaving the site. Runoff from the site appear to be captured by these drains and diverted away from the site while upstream flows may pool against the embankment.

The terrain levels across the site are very flat, varying from 118.9 m AHD to 119.0 m AHD. An existing irrigation channel runs through the site, which is the largest topographic feature. It is understood that this will be removed during the solar farm development.

5.5.2 Methodology

A two-dimensional Rain on Grid (RoG) hydraulic modelling approach was developed and undertaken utilising the latest flood modelling TUFLOW hydraulic flood modelling software; industry standards (i.e., BoM IFD and Australian Rainfall and Runoff (ARR) 2019 guidelines) and latest available 1 metres resolution LiDAR dataset (2015, NSW Spatial Services) under the 1% AEP design storm event.

Flows from the Murrumbidgee River were also modelled as a separate scenario to confirm potential riverine inundation.

5.5.3 Impact Assessment

Detailed TUFLOW modelling was completed for the site for existing conditions and the results are discussed in the following section. The existing conditions 1% AEP depth, velocity and flood hazard results are shown from Figures 3-1 to Figure 3-3 in **Appendix H**. It is noted that the flood depth map has been filtered for small depths below 0.02 m; however, this has not been performed for the other results.

The following observations can be made for the 1% AEP flood event:

- The maximum flood depth within the solar farm site is approximately 200 mm. Flood depths south of an irrigation channel splitting the site is relatively consistent at 150-200 mm. This channel holds water to the south causing the water to pool (noting no details of the channel infrastructure were available or included in the hydraulic model). If this channel is removed (it is assumed it will be given there are panels located on top of the channel), these depths will decrease.
- North of the channel depths are generally below 100mm, with higher depths to the north east reaching up to 180 mm.

- Modelled peak velocities within the proposed solar panel extent are very low, largely below 0.1 m/s with some isolated areas up to 0.15 m/s. This is due to the flat nature of the site.
- A flood hazard map was created from the product of both flood depth and velocity as described in the previous section. The entire site and surrounds are classified as H1: ‘Generally safe for vehicles, people, and buildings’. This is to be expected of shallow still water, ponding across the site rather than traversing it.
- The site was assessed for flooding from the Murrumbidgee River located 6km north of the site. The edge of the Murrumbidgee River floodplain is located 4km north of the site. Flood modelling from the Darlington Point flood study undertaken by BMT WBM in 20182 shows the 1% AEP flood extent typically remained within the broader Murrumbidgee River floodplain. Design flows were extracted downstream of Darlington Point (upstream of the site) and simulated as a steady state flow in a broader flood model. The results showed the subject site is situated well above the 1% AEP design level within the Murrumbidgee River.

5.5.4 Summary

The following is a summary of the flood impact assessment undertaken for the proposed Project site:

- The flood modelling and mapping confirmed that there are no significant overland flow paths across the site with peak flood depths below 200 mm across the area of interest (panel array location);
- Depths were consistently between 100 and 200 mm due to an irrigation channel passing through the site;
- Maximum flood velocities are all very low, below 0.1 m/s, resulting in a minimum flood hazard (H1 – generally safe for people, vehicles and buildings);

Based on the findings of the flood modelling, it is recommended to set any solar panel and critical electrical infrastructure to about 300 mm above the ground level.

5.6 Noise and Vibration

Nuisance, or an unacceptable level of noise / vibration amenity, may arise from construction or operational activities associated with new or existing development. This section addresses these potential issues and provides recommendations for noise / vibration mitigation and management measures. These measures are based on the magnitude and extent of potential impacts and are designed to reduce noise / vibration levels as far as practicable to maintain an appropriate level of acoustic amenity in the community.

The key noise / vibration issues potentially associated with the Project, located at 16705 Sturt Highway, Darlington Point NSW 2706, relate to general construction plant, equipment and activities undertaken within and near to the Project site. Potential noise / vibration issues associated with operation of the Project and project-related road traffic noise emissions on public roads are also addressed here. It is, however, expected that due to the nature of the operations, the impact from operational noise / vibration will be insignificant with the implementation of appropriate mitigation and management measures.

5.6.1 Policy Setting

This noise and vibration assessment has been conducted with due regard to and in accordance with the following key policy and guidelines. Other local and international acoustics standards have been adopted where relevant to the assessment:

- NSW Environment Protection Authority – NSW Noise Policy for Industry (NPI), October 2017;
- NSW Department of Environment and Climate Change – NSW Interim Construction Noise Guideline (ICNG), July 2009;

- NSW Department of Environment and Conservation – Assessing Vibration: A Technical Guideline, February 2006; and
- NSW Department of Environment, Climate Change and Water – NSW Road Noise Policy (RNP), March 2011.

Relevant policy and how this applies to investigation and assessment of the potential impact of the Project are further discussed in **Section 5.6.3**.

5.6.2 Existing Noise Environment

A key element in assessing noise impacts is an understanding of the existing ambient and background noise levels in the vicinity of the closest and/or potentially most affected noise sensitive receptors situated near the Project site. The noise environment in the vicinity of the Project is best described as ‘rural’ defined by the NPI, 2017 as an area with an acoustical environment that is dominated by natural sounds, having little or no road traffic noise and generally characterised by low background noise levels.

A “rural” area may be located in either a rural landscape, large lot residential, primary production, primary production small lots or environmental living zone, as defined on a council zoning map, i.e., Local Environmental Plan (LEP) or other planning instruments.

The Project site is zoned RU1 ‘Primary Production’ pursuant to the provisions of the Murrumbidgee LEP and is bounded by land RU1 ‘Primary Production’ in all directions. The subject land is largely cleared of native vegetation as a result of historic agricultural land use and ongoing almond farming. The surrounding land use is also predominantly for agricultural purposes.

An existing 33 kV overhead line runs parallel to the new proposed solar farm fence boundary, located approximately 10 metres away from the solar panels. Additionally, there is an existing 132 kV transmission line located 6 m away within an easement running south of the proposed solar farm fence.

This Project will include construction of essential associated infrastructure such as track mounted photo voltaic (PV) array structures, operation and maintenance building and site office, inverter station containing electrical switch gear and assets for a grid connection via the Kerarbury Orchard’s existing high voltage Essential Energy connection. The potential main contributors to noise within the Project emanates from inverters.

5.6.2.1 Sensitive Receptors

For the purpose of this assessment, sensitive receptors have been considered based on the distance of receptors to the Project boundary. No residential receptors have been identified within the potential radius of influence of 500 m from the Project. Residential receptors located more than 500 m away are not expected to experience significant noise impact.

5.6.2.2 Estimated Background Noise Levels

In the absence of measured ambient and background noise level data for the Project site and surrounding area, representative values have been estimated for the purpose and completeness of this assessment.

The Rating Background Noise Level (RBL) can be accurately established based on the review of aerial photography and knowledge of existing background noise levels of similar acoustical environments. Due to the rural setting of the Project, the existing noise environment of the surrounding area can be accurately described as having low background noise levels.

For the assessment of operational noise in accordance with the NPI, a conservation approach is adopted where the minimum assumed Rating Background Noise Levels (RBLs, also denoted as L_{90}) are considered (Table 2.1 of NPI). The minimum RBLs are also recommended to be used to assess construction noise in accordance with the ICNG. The adopted RBL for the daytime, evening and night-time assessment periods are presented in **Table 5-3** below.

Table 5-3 Rating Background Noise Levels (RBL)

	Day	Evening	Night
Rating Background Noise Level (L_{90})	35	30	30

Time of day is defined as follows:
Day – the period from 7 am to 6 pm Monday to Saturday or 8 am to 6 pm on Sundays and public holidays
Evening – the period from 6 pm to 10 pm
Night – the remaining periods.

5.6.3 Assessment Criteria

All Project-specific noise management levels (NML) and criteria have been established based on the adopted background noise level presented in **Table** 5-3 in accordance with the NPI, ICNG, and RNP as applicable to the factor being addressed.

For the purposes of the construction and operational assessment, the $L_{Aeq, 15\text{-minute}}$ parameter has been adopted for all receptors assuming that emissions will generally occur throughout the total duration of any given assessment period. L_{Aeq} is an A-weighted noise level representing the equivalent or average noise energy during a measurement period. A-weighting is an adjustment made to sound-level measurement to approximate the response of the human ear. The $L_{Aeq, 15\text{-minute}}$ noise descriptor simply refers to the L_{Aeq} noise level calculated over a 15-minute period. For road traffic noise, the L_{Aeq} parameter also applies with assessment periods of one hour, nine hours or 15 hours depending on the type of road and time of day.

5.6.3.1 Construction Noise

The ICNG suggests the following standard hours for construction activities where noise is audible at residential premises:

- Monday to Friday, 7 am to 6 pm;
- Saturday, 8 am to 1 pm, and
- No construction work is to take place on Sundays or public holidays.

Time restrictions on construction works are the primary management tool of the ICNG. The construction working hours of the Project are expected to be in line with the above standard hours. The guideline also provides noise management levels (NMLs) for residential premises for both standard and outside of standard hours of construction. The NMLs recommended for residential premises are based on the RBLs established above.

During construction the Highly Noise-affected Management Level (HNML) also applies to residential receptors during standard daytime hours and is a fixed value of 75 dB $L_{Aeq, 15\text{-minute}}$. Construction NMLs are summarised in **Table 5-4** below.

Table 5-4 Construction Noise Management Levels (NMLs), in $L_{Aeq, 15\text{-minute}}$

NML Level at Residential Receptor	Daytime (Standard Hours)	Out-of-Hours		
		Day	Evening	Night
Noise Affected	45 dB(A)	40 dB(A)	35 dB(A)	35 dB(A)
Highly Noise Affected	75 dB(A)	-	-	-

5.6.3.2 Operational Noise

All Project-specific operational noise criteria are presented in **Table 5-5**. These values have been determined with due regard to the NPI utilising the RBLs described above.

Table 5-5 Operational Noise Criteria, in $L_{Aeq,\ 15\ minute}$

Receptor Type	Day	Evening	Night
Residential Receptor	40 dB(A)	35 dB(A)	35 dB(A)

5.6.3.3 Road Traffic Noise

For road traffic noise the criteria values have been determined with due regard to the RNP. In accordance with the RNP, criteria values for residential receptors are fixed levels to maintain an appropriate level of acoustic amenity. They are not derived from measured ambient and background noise levels. Road traffic noise criteria are presented in **Table 5-6**.

Table 5-6 Road Traffic Noise Criteria

Road Category	Assessment Criteria, in dB(A)	
	Day (7 am - 10 pm)	**Night (10 pm - 7 am)**
Freeway / Arterial / sub-arterial roads[1]	60 $L_{Aeq,\ 15\ hour}$ (external)	55 $L_{Aeq,\ 9\ hour}$ (external)
Local roads[2]	55 $L_{Aeq,\ 1\ hour}$ (external)	50 $L_{Aeq,\ 1\ hour}$ (external)

1. *Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use developments*
2. *Existing residences affected by additional traffic on existing local roads generated by land use developments*

Where existing traffic noise levels are above the noise assessment criteria, the primary objective is to reduce these through feasible and reasonable measures to meet the assessment criteria. A secondary objective is to protect against excessive decreases in amenity as the result of a Project by applying the relative increase criteria.

In assessing feasible and reasonable mitigation measures, an increase of up to 2 dB represents a minor impact that is considered barely perceptible to the average person.

5.6.3.4 Vibration

The effects of vibration in buildings can be divided into three main categories: human comfort (annoyance), cosmetic damage and structural damage. The guidance has been adopted from international standard DIN4150-3:2016 *Vibration in Buildings effects on structures*, and Assessing vibration: *A technical guideline* (2006, Part 2: Vibration) prepared by NSW Department of Environment and Conservation.

An overview of the applicable standards and guidelines is provided below:

- **Human Comfort (annoyance)**: The NSW Vibration Guideline provides guidance for assessing human exposure (comfort or annoyance issues) to vibration. The publication is based on British Standard (BS 6472–1992) – *Evaluation of Human Exposure to Vibration in Buildings (1 Hz to 80 Hz)*.
- **Cosmetic and Structural Damage**: There is currently no Australian policy or guideline for assessing the potential for building damage (cosmetic and structural**)** from vibration. It is common practice to derive safe limit values for assessment purposes from international standards, such as German Standard DIN4150 Part 3-1999 (DIN4150-3) – *Structural Vibration - Effects of Vibration*

on Structures. DIN4150-3 presents a set of safe limit values that below which cosmetic or structural damage is unlikely to occur.

The NSW Vibration Guideline and DIN 4150-3 criteria vary based on vibration type and receptor type and are dependent on the component frequency of the vibration event. The criteria values from the NSW Vibration Guideline and DIN 4150-3 were considered in the assessment of potential impacts but are not reproduced here.

5.6.4 Potential Impacts

5.6.4.1 Construction Noise

Construction stage of solar farm will involve construction of site access driveway and internal road, cut and fill (i.e., site levelling), foundation construction, delivery and install of demountable site office and portable amenities, installation of solar equipment, etc. It is anticipated that equipment and machinery, including all fixed and mobile plant, as summarised in **Table 5-7** will be used during construction stage.

Table 5-7 Summary of Construction Equipment and Machinery

Type	Purpose	Max. Weight	Quantity	Timing
5 axle semi-trailer	Delivery of framing materials and modules	39T	40	Across duration of project. Peak of 2 per day for during construction
Rigid body truck with dog trailer (3 axle truck) + 3 axle dog	Delivery of imported materials for pad construction	42.5T	40	Peak of up to 5 per day during civil works period
25T Franna Crane	Lifting of HV Kiosk into place	23.9T	1	For single lift, carry and place operation for inverters
Water Carts (10,000L)	Dust suppression; Construction water; Potable water	22.5T	TBC	2-3 per day during civil works
18T Tilt tray/Sideloader/6 axle semi-trailer	Delivery of plant, HV Kiosk and site facilities	42.5T	6	Peaks during site establishment and disestablishment
10T Tilt tray/flat bed	Delivery of general materials and fencing	15T	10	Peak during site establishment and disestablishment
Light vehicles	Personal and site work vehicles	4T	10-15	Daily for duration of project

Location of works will move on a daily basis as the works progresses over the construction period of six (6) months. Construction noise impact will be highest at a particular sensitive receptor when the works are occurring in close proximity. As the works progresses and move further away from that sensitive receptor, the noise impact is expected to reduce accordingly. At the same time, as the works move away from one particular receptor, they may impact a different sensitive receptor.

Based on the type of construction works, activities and equipment, it is anticipated that noise levels will remain below the daytime NML of 45 dBA beyond 500 m of the works. No receptors were identified within 500 m of the works, and therefore construction NML are predicted to be achieved. Construction noise levels are also predicted to comply with the HNML of 75 dBA at the closest receptor. Although construction noise impact is predicted to be insignificant, it may at times be audible even at levels below the NML of 45 dBA. This would however only occur for a short period of time when the construction activities are closest to this receptor.

Generally, where works are situated at a greater distance from the receptors, noise levels and associated impact will be reduced by comparison to works and activities conducted in close proximity. General and suitable management measures, safeguards and/or provisions for monitoring are provided in the following section. Good-practice construction noise mitigation and management measures should also be adhered to reduce noise levels as far as practicable to ensure the acoustic amenity of the local community is maintained for the majority of works.

5.6.4.2 Operational Noise

Operational noise emissions associated with the project mainly include inverters. Other noise sources, such as the transformers, are understood to be existing and will not contribute to additional noise in the area. It is also understood that noise associated with maintenance works would be limited to the daytime hours only and maintenance noise related impacts are expected to be minor and of short duration.

The preliminary layout of the solar farm indicates potential operational noise sources from inverters located in between the array of solar panels. Based on previous experiences with similar sized solar farms, the noise emissions from each inverter are expected to have a Sound Pressure Level (SPL) of approximately 45 dBA at 1 metre. No sensitive receptors were identified within 500 metres of the Project, resulting into insignificant noise impact levels well below the most stringent night-time operational noise criteria identified in this assessment of 35 dBA.

It is concluded that operational noise from the solar farm will be insignificant and as such, no recommendations for operational noise mitigation and management measures are warranted or provided in this assessment.

5.6.4.3 Road Traffic Noise

The Project is expected to generate in the order of 10-15 light vehicles per day and up to 10 heavy vehicles per day during peak construction.

It is noted that the peak construction period will occur for a small portion of the total construction period. Hours of construction are anticipated to occur during the standard hours as per the ICNG being Monday to Friday between 7 am – 6 pm, and Saturday between 8 am – 1 pm or as approved by Council.

Once the Project is operational, there would be operations and maintenance staff who would attend site day-to-day. Operations and maintenance staff would generate up to 30 light vehicle trips across the workday. Remote staffing of the Project is anticipated to occur Monday to Friday between 7 am – 6 pm and, it is anticipated that the solar farm would also be staffed on Saturday between 8 am – 1 pm.

During construction, it is anticipated that a maximum of 20 vehicle trips will be generated on the local road network during peak construction. With the local road network being used by local residents only, the additional traffic caused by the construction of the solar farm may be noticeable, as expected with any new activity. However, vehicle pass-bys are of very short duration and any additional noise levels generated will be of very short duration. The impact on the local residents will be negligible and will not adversely the acoustic amenity of the area.

When the solar farm is operational, the additional 30 daily vehicle trips on the local network are anticipated to remain unnoticeable to the local residents.

It is concluded that insignificant impacts are anticipated during construction and operation. The introduction of the additional construction and operational traffic is unlikely to be perceptible. As such, no recommendations for road traffic noise mitigation and management measures are warranted or provided in this assessment.

5.6.4.4 Vibration

Based on the equipment and activities proposed for the construction and operation of the Project, it is anticipated that vibration will be limited to construction activities. Construction vibration for the Project was assessed based on the applicable safe work distances published in the *Transport for NSW (TfNSW) – Construction Noise and Vibration Strategy (CNVS, or ST-157/4.1)*, April 2019. These safe working distances are outlined in **Table 5-8** below.

Table 5-8 Recommended safe working distances for vibration intensive plant

Item	Rating/Description	Safe Working Distance	
		Cosmetic Damage (BS 7385)	Human Response (OH&E Vibration Guideline)
Vibratory Roller	< 50 kN (Typically 1-2 tonnes)	5 m	15 m to 20 m
	< 100 kN (Typically 2-4 tonnes)	6 m	20 m
	< 200 kN (Typically 4-6 tonnes)	12 m	40 m
	< 300 kN (Typically 7-13 tonnes)	15 m	100 m
	> 300 kN (Typically 13-18 tonnes)	20 m	100 m
	> 300 kN (> 18 tonnes)	25 m	100 m
Small Hydraulic Hammer	(300 kg - 5 to 12t excavator)	2 m	7 m
Medium Hydraulic Hammer	(900 kg – 12 to 18t excavator)	7 m	23 m
Large Hydraulic Hammer	(1600 kg – 18 to 34t excavator)	22 m	73 m
Vibratory Pile Driver	Sheet piles	2 m to 20 m	20 m
Jackhammer	Hand held	1 m (nominal)	Avoid contact with structure

No sensitive receptors were identified within 500 m from the potential construction boundary, therefore cosmetic and structural damage is not anticipated. Human comfort criteria are also expected to be achieved. General good-practice construction management are recommended for the Project. Suitable management measures, safeguards and/or provisions for monitoring were established for the proposed construction and are outlined in **Section 5.6.5** below.

5.6.5 Safeguards and Management Measures

Operational and road traffic noise impacts are expected to be minimal (if any at all) and therefore this section focuses on construction noise and vibration only. To ensure noise and vibration emissions are kept to acceptable limits, the following general and good practice mitigation and management measures are recommended:

- Works to be carried out during standard construction work hours (i.e., 7 am to 6 pm Monday to Friday and 8 am to 1 pm Saturdays). Any work that is performed outside normal work hours or on Sundays or public holidays must be inaudible or undertaken with agreement from neighbours;
- Choose appropriate machines for each task and adopt efficient work practices to minimise the total construction period and the number of noise/vibration sources on the Project site:
  - Where vibration generating works are required with the recommended safe working distances, consultation should be undertaken with the closest receptors to minimise disturbance and vibration monitoring should be undertaken;
  - Avoid unnecessary noise due to idling diesel engines and fast engine speeds when lower speeds are sufficient;

- Ensure all machines used on the Project site are in good condition, with particular emphasis on exhaust silencers, covers on engines and transmissions and squeaking or rattling components. Excessively noisy machines should be repaired or removed from the Project site;
- All plant, equipment and vehicles movements should be optimised in a forward direction to avoid triggering motion alarms that are typically required when these items are used in reverse;
- If any formal noise complaints are received, operator attended noise measurements should be undertaken to measure and compare the Project site noise level contributions ($L_{Aeq,\ 15\ minute}$) to the NMLs presented in this report. All Project site noise levels should be measured to exclude any influential source not associated with the Project:
  - If the measured Project noise levels comply with the NMLs presented in this report, no further mitigation or management measures are required; and
  - If the measured Project noise levels are above those presented in this report, further mitigation and/or management measures should be considered.

5.7 Agricultural Impact Assessment

An Agricultural Impact Assessment (AIA) has been undertaken by Minesoils Land and Rehabilitation Specialists (Minesoils) to support this SEE and is contained in **Appendix I**. A summary of the methodology, potential impacts and proposed mitigation measures has been provided below.

The Project site within the Kerarbury Almond Orchard consists of land cleared for agricultural use, with native pastures established for grazing purposes. The land is not currently subject to agriculture. Farm improvements consist of access tracks and fencing which transect the Project site between Lot 68 and Lot 69 of DP 750877. There is no evidence of soil erosion or surficial degradation.

5.7.1 Existing Environment

Soil And Land Capability: The Project site contains soils with Moderate fertility (3) based on the NSW Land and Soil Capability (LSC) dataset. The surrounding Project locality contains areas of Low fertility (1) and Moderately High fertility (4) which is mapped in close association with the Murrumbidgee River. Regional mapping indicates the Project site is dominated by LSC class 4 land (Moderate capability land), with a very small portion of LSC class 6 (Low capability land) covering less than 0.5 ha. These LSC classes are consistent for the project locality, except for the Murrumbidgee River landscape Dermosol mapping unit, which is mapped as LSC class 5 (Moderate–low capability land).

Potential Agricultural Productivity: Agricultural productivity of land is the value of an agriculture enterprise over a specific area for a specific duration. Given the Project site is not current subject to agricultural activity, the current agricultural productivity is $0/ha/year. The potential production value of the Project site has been estimated based on current practice, site knowledge, average sales prices and the latest gross margin information by the *NSW Department of Primary Industries* (DPI, 2019). The estimated productivity of the study area ranges from approximately $947.39 per annum based on cattle grazing enterprise to $207,860.00 per annum based on an established almond horticulture enterprise, as outlined in Table 4 in **Appendix I**.

The assessment considers the estimated potential productivity of a cattle grazing enterprise to be most representative for the purpose of this assessment given the Project site’s present status, location and characteristics, and initial capital inputs and establishment time required to achieve the almond horticulture production level. That is, cattle grazing is the most practical and readily implemented agriculture alternative to the solar farm.

5.7.2 Methodology

An agricultural impact assessment must be to a level of assessment which is proportionate to the agricultural capability of the land and the anticipated affected by the Project. The approach for the Project includes provisions for an agriculture impact assessment containing the level of detail as described in **Appendix I** on the scale of the Project and the minimal landform disturbance anticipated. This framework for assessment is based on a 'Level 1 basic assessment' with elements of a 'Level 2 reduced assessment' as per the *Large-Scale Solar Energy Guideline* (NSW Department of Planning and Environment, 2022).

5.7.3 Impact Assessment

This section outlines the potential and anticipated temporary and permanent impacts to agriculture as a result of the Project.

The temporary impacts of the Project will include:

- **Agricultural Land Use**: Temporary impacts of the Project will consist of the removal of 7.3 ha from agricultural service for the duration of the Project. Current agricultural land use immediate to the Project site and in the broader Project locality will not be affected;
- **Agricultural Productivity**: The Project will result in an estimated loss in agricultural productivity of $947.39 per annum based on cattle grazing enterprise. The Project will not compromise the capacity for immediate neighbours to continue primary production land uses at this locality. This means temporary impacts to agriculture are limited to the Project site;
- **Fragmentation or Displacement of Agricultural Industries**: Agricultural industries within the Project locality and wider region will not be impacted by the Project as the associated agricultural resources, infrastructure, critical mass thresholds, and staff availability will not be affected;
- **Soil Resources**: The Project will utilise the existing landform and not endeavour to undertake broad-scale re-contouring of the existing ground levels. As a result, the existing vegetative cover and soil structure will be maintained intact across much of the Project site. Given the limited surface disturbance and lack of a soil bank for the site, it is anticipated that all soil stripping and re-use will be localised; that is, soil will be respread from where it was stripped, reinstating the soil profile to its original condition. The risk of erosion is considered to be low due to the topography of the Project site and as long as the project adopts measures as recommended in the *Managing Urban Stormwater: Soils and Construction*, volume 1, 4th edition (Landcom, 2014);
- **Land and Soil Classification**: Due to the nature of the Project which will require only localised and sporadic landform modification including soil stripping (for excavation works and levelling), impacts on LSC are expected to be minor. However, for the purposes of assessing the impact to LSC, during the construction and operation phases of the Project, the LSC class within the Project site subject to surface disturbance will temporarily be reclassified to LSC class 8: not suitable for agriculture. Following the end of life for the Project, disturbance areas will be re-graded where required and stockpiled soil will be placed over disturbed areas and rehabilitated according to the intended final land use. Therefore, any impacts on LSC classes within the Project site will be temporary, as land will be returned to original status following the life of the Project;
- **Water Resources**: Sediment laden run-off from the site is expected to be minimal, given the Project site is relatively flat and is expected to be manageable through the adoption of erosion and sediment control measures during construction. The risk of groundwater impacts during construction is also expected to be low as site levelling for the solar farm and substation foundations is expected to require excavation of no more than 0.40 – 0.60 m, and trenches for underground cables are expected to be 1.0 to 1.2 m deep. There will be no changes to availability of surface or irrigation used by local landholders;

- **Agriculture Support Services**: Changes to the supply and viability of agricultural support services in Darlington Point and the wider region are generally driven by social and market trends far exceeding the scale of the Project site. There are no local industry support services or specialised agri-businesses that will be affected by the change in land use**;**
- **Pest Species and Biosecurity**: Pest species could be inadvertently brought into the Project site with imported materials, machinery, or allowed to invade naturally through removal or damage of current vegetation. Ongoing management of the site and monitoring inspections will determine the requirement for weed or pest elimination as per a Pest Management Plan. Standard procurement safeguards and quarantine procedures as per Australian requirements will control the potential impact on the biosecurity of agricultural resources and enterprises within the region;
- **Air Quality and Dust**: Dust and air quality impacts expected to be negligible given the scale of the Project site and the immediate surrounding land use as orchards. Standard dust suppression measures during construction can be readily implemented as required; and
- **Noise**: The predicted noise levels associated with construction are considered a negligible impact on agricultural activities given the immediate surrounding land use as orchards.

It is anticipated that by adopting the principles of impact avoidance and minimisation during Project construction and operation and implementing effective decommissioning and rehabilitation at the end of Project life, the Project will have no permanent negative impacts on agricultural resources or enterprises.

It is anticipated that the pre-existing land use will be re-established at the time of decommissioning, unless otherwise agreed with the landowner and/or regulatory authorities.

5.7.4 Mitigation Measures

In order to mitigate any potential impacts on agricultural resources, the following measures should be considered:

- **Soil Impact Mitigation** - The following measures may be taken to limit the impacts on soil resources.

  - During solar panel installation, disturbed surfaces in construction areas should be sewn with grass and pasture species with starter fertiliser to provide stabilising ground cover and a healthy topsoil to provide long term protection against erosion;

  - At locations where earthworks are necessary, such as for construction of BESS pad, or site facilities, localised erosion and sediment controls will be placed in accordance with the Landcom (2014) guidelines;

  - Proposed long term stockpiles in areas associated with the higher impact activities where large amounts of soil will be displaced should be stripped of topsoil. Then the excavated subsoil (if requiring disturbance) should be placed on the exposed subsoil of the stockpile area to create a low-profile landform of subsoil. A thin layer of topsoil material from the stripped areas should be placed as a ‘cap’ over the subsoil stockpiles to promote vegetation growth. Topsoil materials should otherwise be stockpiled separately to subsoils;

  - Strip soil material to maximum excavation depths only;

  - Soil should ideally be stripped in a slightly moist condition. Material should not be stripped in either an excessively dry or wet condition;

  - Preservation and stabilisation of drainageways and minimisation of the extent and duration of any surface disturbance will be prioritised during construction;

  - Soil disturbance during operation of the Project should be minimal and limited to maintenance activities, involving very small, localised disturbance areas on an infrequent basis;

- Standard erosion and sediment control measures should be implemented to minimise the potential for sediment export within areas to be disturbed during operations. These measures would be developed on a case-by-case basis and are likely to include measures such as sediment fencing, localised sediment traps, and progressive stabilisation with vegetation;

- During operation, mounted solar panels should change orientation during the day, with any rainfall runoff being distributed in the area around each panel, and not drained permanently to a single point on the ground;

- **Monitoring Programs** - Erosion and Sediment Control Plan, Weed and Pest Management Plan; and Rehabilitation Plan will be prepared to manage impacts on agricultural land as a result of the Project. These management plans will be reviewed and revised where necessary to incorporate the requirements associated with the Project prior to commencement. A key component of this revision will be the development of trigger levels and Trigger Response Action Plans as detailed in **Appendix I.**

5.8 Air Quality

The Project Site is located within a rural zone, approximately 17 km southwest of the township of Darlington Point. The proposed Project site for installation of the solar arrays is a rhomboidal plot of land bounded by almond tree orchards and the surrounding lands are primarily used for agricultural production or grazing.

Air quality in the study area is typical of the surrounding rural region. In general, air quality is generally high; however, raised dust during the drier months contributes to sporadic reductions in air quality, with increases in the level of particulate matter in the air due to the burning of agricultural residues and soil cultivation for cropping.

Air quality would be affected during the construction phase by vehicle and machinery exhaust emissions, although the emissions would be readily dispersed and any impacts to residents or workers at the Project site are expected to be transient and minor.

It is expected that air quality at the site during the harvesting months (February till April) would be slightly impacted due to the movement of vehicles transporting the harvested almonds from the site.

Additionally, vehicle use of temporary and permanent internal site tracks may generate dust. Dust has the potential to cause nuisance for neighbouring residents and affect water supplies and pasture and can also adversely affect the limited natural terrestrial and aquatic ecosystems that occur at or adjacent to the Project site. Internal access tracks would be surfaced with compacted basecourse to reduce the potential for dust generation. The condition of internal tracks and movement areas would be monitored regularly, and a water cart used as required for dust suppression.

During the operation phase, soils at the Project site would be stable and vegetated with perennial grass cover. Dust generation would be closely managed as it would be harmful to the effectiveness of the solar array to generate electricity and cause nuisance to surrounding receptors and ecosystems. Unlike fossil fuel power generation, solar farms have very low air emissions of air pollutants during the operation phase.

5.8.1 Mitigation Measures

Implementation of the following mitigation measures during construction will minimise potential impacts to air quality:

- Limit the area of soil disturbance at any one time where possible;
- Maintain all disturbed areas, stockpiles and handling areas in a manner that minimises dust emissions (including windblown, traffic-generated or equipment generated emissions);
- Where required, undertake strategic watering suppress dust;
- Minimise vehicle movement and speed where required;

- Avoid dust generating activities during windy and dry conditions;
- Ensure all construction plant and equipment are operated and maintained to manufacturer's specifications in order to minimise exhaust emissions;
- Restricting vehicle movements and ground disturbance to the minimum area that is safely practicable; and
- If necessary, temporary cessation of some works during excessively dry and windy conditions.

Subject to mitigation measures, any dust or other air quality impacts are likely to be minor, temporary, and highly localised.

5.9 Hazards

5.9.1 Bushfire

The Project site is not mapped as bushfire prone land on the NSW Rural Fire Service (RFS) Bushfire Prone Land Mapping Tool (RFS, 2022). Infrastructure comprising electricity generating works is not a habitable building and is not listed as a special fire protection purpose under section 100B of the *Rural Fires Act 1997*. However, despite not being mapped as bushfire prone, all land in Australia can be subject to bushfire risk.

In addition, there are specific bushfire mitigation measures relating to solar farm development outlined in the NSW RFS *Planning for Bushfire Protection* (RFS, 2019), summarised below.

5.9.1.1 Mitigation Measures

Standard construction bushfire risk reduction and management measures including availability of fire-suppression equipment, access and water and appropriate bush fire emergency management planning should be in place, in addition to the solar farm-specific measures presented below.

Solar farms require certain consideration to allow for adequate clearances to combustible vegetation as well as firefighting access and water. The following bushfire mitigation measures will be provided for the Project:

- A minimum 10 m asset protection zone (APZ) for the structures and associated; and buildings/infrastructure; and
- The APZ must be maintained to the standard of an inner protection area (IPA) for the life of the development.

Infrastructure for the purposes of requiring APZ excludes road access to the Project site and power or other services to the site and associated fencing. A Bush Fire Emergency Management and Operations Plan will need to be prepared following project approval, to outline appropriate management and maintenance of bushfire protection measures, for the life of the development. This plan would need to be developed in consultation with local NSW RFS or Fire & Rescue NSW and will include specific measures outlined in the Project's conditions of approval.

5.9.2 Contamination

A search of the NSW EPA contaminated land public record of notices (NSW EPA, 2021a) identified no records within or near the Project site in Murrumbidgee Council LGA.

A search of the list of NSW contaminated sites notified to the EPA (NSW EPA, 2022b) returned one sites near the Project site in Griffith, NSW which was a Former Murrumbidgee Irrigation Depot located 50 km north-east of the Project site.

The identified site is well separated from the Project site and would therefore pose minimal contamination risk to the proposed Project. A search of the POEO Act register (NSW EPA, 2022c) identified twelve (12) issued POEO licenced facilities in Darlington Point within the Murrumbidgee Shire Council, including the below:

- Sewage treatment processing by small plants; and
- Extractive activities at Waddi Sand Pit.

Given the nature of the proposed Project, the Project is unlikely to impact any of the licensed facilities in the premises, nor is it expected to be impacted by operations of these facilities.

5.9.3 Electromagnetic Fields

Electromagnetic fields (EMF) are produced naturally as well as by human activity. The earth has both a magnetic field, produced in the earth’s core, and an electric field produced by electrical activity like storms in the atmosphere. Electrical equipment of all sizes and voltages produces EMF. Both fields drop away rapidly with distance from the source or due to shielding by insulation or earth (in the case of buried installations).

The International Commission on Non-Ionizing Radiation Protection (ICNIRP) has issued *Guidelines for Limiting Exposure to Time-Varying Electric and Magnetic Fields*. The relevant authority in Australia is the Australian Radiation Protection and Nuclear Safety Agency (ARPNSA) and it refers to the ICNIRP guidelines. These supersede earlier guidelines published by National Health and Medical Research Council.

The ICNIRP EMF guidelines provide relevant limits for the general public for 50 Hz sources as follows:

- Electrical Field Strength: 5 kilo Volts per metre (kV/m); and
- Magnetic Flux Density: 100 micro Teslas (μT).

EMF increases with voltage and proximity to the apparatus producing, transmitting or consuming electricity. EMF varies according to specific design and construction parameters such as conductor height, electrical load and phasing, and whether the conductors are overhead or buried, as burying cables close together has a cancelling effect.

On the Project site, the various EMF generating components would include connection cables (which will be underground), inverters, step up transformers and switching station. In relative terms the existing 33 kV overhead transmission lines that run parallel to the western boundary of the site and the existing 132 kV transmission line that run parallel to the south of the solar farm and BESS location, already emit higher EMF than will infrastructure associated with the Project.

As such, the Project is unlikely to generate substantial EMF within the Project site and wider Project site. AGL, in consultation with the construction contractor (TBA) will ensure that in detailed design and equipment procurement is in compliance with that the ICNIRP EMF guidelines.

5.9.4 Hazardous Materials

The State Environmental Planning Policy (Resilience and Hazards SEPP) 2021 incorporates provisions from the SEPPs being consolidated as follows:

- Chapter 2 - Coastal management’ contains planning provisions from the Coastal Management SEPP for land use planning within the coastal zone consistent with the Coastal Management Act 2016;
- Chapter 3 – Hazardous and offensive development’ contains planning provisions from SEPP 33 to manage hazardous and offensive development; and
- Chapter 4 – Remediation of land’ contains planning provisions from SEPP 55, which provides a state-wide planning framework for the remediation of contaminated land and to minimise the risk of harm.

With reference to Chapter 3 - Hazardous and Offensive Development of the *Resilience and Hazards SEPP 2021*, the proposed solar farm is not potentially hazardous or a potentially offensive development. It poses little to no threat to people or property. This battery system is used widely across the world and has an extremely low occurrence of incidents. The Sungrow ST2293UXV11 Battery is Classified as Dangerous Goods Class 9 and therefore doesn't fall within the SEPP screening threshold guidelines. There are two battery units on the site and each battery unit contains approximately 4.2T of LiFePO4 (8.4T total). This site contains <10T of a Dangerous Goods component and therefore also does not require WorkCover NSW notification. Each battery module weighs approx. 343kg. Each enclosure contains approx. 13.7T of batteries. Only part of this is Li-ion (approximately concentration 30% w/w) - which equates to approx. 4.2T of Li-ion within each battery enclosure.

Lithium-ion batteries are the proposed battery type as the major component of the BESS, which are identified as 'Class 9' dangerous goods under the Guidelines. Class 9 dangerous goods are excluded from the risk screening process, as they pose little threat to people or property, but should be considered in terms of their potential for environmental harm. As lithium-ion batteries are excluded from the screening process, there is no threshold quantity for their storage within the Guidelines, and as such, a PHA is not required for the Project.

With reference to Chapter 4 – Remediation of Land of the *Resilience and Hazards SEPP 2021*, the site has been historically cleared and used for cropping and as such, is not expected to be at high risk from contamination. In addition, the proposed Project is not a sensitive use and the land is suitable for the intended use it its' current form. As such, the site is considered suitable for the proposed use and meets the requirements of 4.6(1) of the SEPP.

5.9.4.1 Implications for the Project

The proposed Project is not considered to meet the definition of potentially offensive development according to the Resilience and Hazards SEPP 2021 provisions. The proposed works for the Project would result in vehicle and machinery exhaust emissions during the construction phase, as in any construction project. The emissions would occur outside, in a rural locality, and would be readily dispersed. Noise impacts would also largely be confined to standard working hours during the construction phase and would not be hazardous to employees or neighbouring residents (refer to **Section 5.6**). Water pollution risks are assessed as low, subject to identified mitigation measures, including the re-establishment and maintenance of groundcover across the site (refer to **Section 5.5**). These factors indicate that the Project would not be considered potentially offensive development.

5.10 Waste

Waste will be generated during the construction phase of the Project and be predominantly classified as general solid waste (non-putrescible). Construction wastes would include:

- Packaging materials;
- Excess building materials, scrap metal and cabling materials;
- Masonry products, including concrete wash; and
- Excavation of topsoils and vegetation clearing and bio wastes facilities, hired from portable WC providers (putrescible).

All waste generated on site during all phases of the Project will be managed in accordance with the POEO Act and adhere to the objectives of the *Waste Avoidance and Resource Recovery Act 2001.* Waste will be classified in accordance with the NSW EPA Waste Classification Guidelines (EPA, 2014).

Waste produced during construction would be disposed of at an appropriately licensed waste facility. While it is anticipated that no trees will be removed during construction, any green waste (i.e., from vegetation clearing) would be mulched for use in rehabilitation at the Project site, or appropriately removed from the Project site. Ancillary facilities in the site compound would produce sanitary wastes classified as general solid waste (putrescibles) in accordance with the POEO Act. Toilet hire and maintenance services would be employed to remove sanitary wastes on a regular basis.

It is expected that the Project will be operational for at least 15 years. Upon decommissioning all infrastructure, including cabling and panels and mounting frames including footings and inverters would be disassembled and removed from the Project site. There are currently limited opportunities to recycle the components of solar panels, however, it is anticipated that the waste recycling industry will expand and develop new technologies and uses for those components by the time decommissioning occurs.

5.10.1 Implications for Project

A Waste Management Plan (WMP) will be prepared as part of a Construction Environmental Management Plan (CEMP) following project approval and prior to the commencement of construction. The WMP will be prepared to specify precise volumes of each waste material, classify the waste material and identify appropriate management procedures including means of transport and the destination. The management of waste during the construction phase will be addressed in the CEMP.

Waste management should be predicated on the international hierarchy of waste management to avoid/reduce, reuse, recycle, recover, treat and dispose of waste products, with the intent of avoiding or reducing waste materials where possible, and reusing, recycling and recovering the majority of waste materials generated during the construction, operational and decommissioning phases.

5.10.2 Mitigation Measures

Implementation of the following mitigation measures during construction will minimise potential impacts to waste:

- The work site will be kept free of rubbish and cleaned up at the end of each working day;
- All waste that cannot be recycled will be disposed at a legally operating waste facility;
- No waste will be burnt or buried on-site;
- All opportunities for recycling will be implemented;
- All waste would be classified in accordance with the EPA's Waste Classification Guidelines and stored and handled in accordance with its classification; and
- All wastes removed from the Project site will be recorded. Details will include the quantity of material removed, the contractor transporting it offsite, its fate (i.e., disposal or recycling) and its classification.

6. CONSULTATION

Consultation has been undertaken throughout the design of the Project and the preparation of this SEE. A pre-development application (pre-DA) meeting was held between AGL, ERM and Murrumbidgee Shire Council (Council) on 15 June 2022, to understand and consider specific requirements to address throughout the SEE. Council determined that detailed assessments would be required for biodiversity, Aboriginal cultural heritage and historic heritage, loss of agricultural land, traffic and transport and hazards, while desktop assessments would be sufficient to address bushfire, air quality, noise, soils and waste-related issues.

This section outlines AGL's strategic approach to engagement and consultation undertaken prior to the submission of this SEE.

6.1 Stakeholder and Community Engagement

A Stakeholder and Community Engagement approach has been developed to enable the effective communication of project-related information to the local community, relevant stakeholders, and agencies. The evidence of consultation conducted for the Project is included as **Appendix J**.

6.1.1 Objective

The aim of the stakeholder consultation is to articulate AGL's approach to working with stakeholders and local communities during the key stages of site identification due diligence, pre-planning application lodgement, planning application and exhibition period, construction and operation of the Project. This includes the following principles:

- Communicate respectfully and encourage feedback and input into the project;
- Respectful engagement with the local community, including with Traditional Owners, from the early stages of project planning, through to start of construction;
- Build Project teams who are accessible and responsive to local community feedback and concerns and provide timely information;
- Respect areas of important biodiversity and high cultural and landscape value;
- Minimise project impacts on highly productive agricultural land, where feasible; and
- Invest into the local community where possible, by providing local employment and procurement opportunities.

6.1.2 Methodology

The approach to stakeholder consultation is to ensure that stakeholders of the Project are aware of the proposed Project and to facilitate this, both public and targeted communications have been used to raise awareness.

6.1.3 Public Approach

The public approach leverages off publicly released media that was published following the execution of the contract between the proponent and the site owner and site lessee. An AGL media release and a subsequent Area News media article were released in March 2022 to announce the project and highlight project benefits. (Refer Press Release: AGL to power Riverina almonds with renewable energy and Media Article: AGL Energy and Olam Food partner to power agri-business with renewable energy | The Area News | Griffith, NSW)

6.1.4 Targeted consultation

The targeted approach to the engagement for the Project followed the same approach that the land lessee (OFI) utilises when engaging with stakeholders prior to harvest periods. This approach was used as the expected disruption during the construction of the development is akin or less than the disruption during harvest periods. This target approach aligns with the direction in the pre-DA meet to approach adjoining neighbours.

The targeted engagement involved the lessee (OFI) providing the stakeholder list of key neighbours who are provided information prior to harvest periods commencing. This list of contacts was utilised to provide:

- An emailed project information sheet; and
- A follow up phone call to verify that the circulated information sheet was obtained and also to prompt for any queries.

The stakeholder register log attached in **Appendix J** includes the details the dates and times these two communication pieces occurred.

6.1.5 Management of Community Issues

AGL will intend to provide prompt response to enquiries and to efficiently address identified issues from the community through the phone number and email address circulated in the project summary sheet.

6.2 Completed community engagement

AGL has undertaken community engagement to introduce the proposed Project, provide information and to gain insights from local community members and stakeholders.

A snapshot of activities undertaken to support this SEE, is highlighted in **Table 6-2** below.

Table 6-1 Summary of Communication and Engagement Activities Undertaken

Communication and Engagement Activities	Community Members Engaged	Date of Activity
Pre-DA meeting	ERM, AGL and Council planning team	15 June 2022
Correspondence via project summary sheet, email and/phone calls	Five (5) neighbours	4November 2022

An introduction to the Project was communicated via email on 4 November 2022 to five (5) neighbours located within 10 km of the Project Site. The letter included high level information about the proposed Project, contact details and advice regarding further information for community engagement.

7. ENVIRONMENTAL MANAGEMENT

This section of the SEE provides a consolidated summary of all proposed safeguards and environmental mitigation measures that form part of the proposed Project. It collates all commitments made in this SEE and includes a description of the measures that would be implemented to monitor and report on the environmental performance of the development.

7.1 Environmental Management Strategy

Potential environmental impacts will be avoided, minimised and managed through adoption of mitigation measures incorporated into all phases of the Project, including:

- Detailed design;
- Construction;
- Operations; and
- Maintenance and Decommissioning.

The strategy for ensuring these commitments are acted upon will be to prepare a number of management plans at relevant stages of the development. These may include:

- Construction Environmental Management Plan;
- Traffic Management Plan;
- Fire and Emergency Management Plan;
- Commissioning Plan; and
- Decommissioning Plan.

These management plans will include, but may not be restricted to, inclusion of all relevant safeguards and environmental mitigation measures identified in this SEE and any associated conditions of consent. The timing and scope of these management plans is detailed below.

7.2 Construction Environmental Management Plan

Prior to construction commencing a CEMP will be prepared and document the environmental procedures and controls that would be implemented throughout construction, including detail on how neighbours would be kept informed about the construction program and how any complaint would be received, resolved and reported.

The CEMP would describe the role, responsibility, authority and accountability of all key personnel involved in construction and detail all monitoring that would be undertaken. The CEMP would also comprise various sub-plans detailing the specific mitigation measures that would be implemented to avoid and manage potential environmental impacts. These would include plans covering traffic management, biodiversity, Aboriginal heritage, soil and water protection, dust, noise and vibration, waste management and bushfire prevention.

Environmental management measures outlined in this document would be incorporated, should it proceed. These measures will minimise any potential adverse impacts arising from the proposed works on the surrounding environment and would be incorporated into the Project’s CEMP.

AGL has prepared a project specific Construction Management Plan which is attached in **Appendix K**. The management measures are summarised in **Table 7-1** below.

Table 7-1 Kerarbury Orchard Solar Farm Development - Management Measures

Environmental Matter	Management Measures
Biodiversity	While adverse impacts from the Project to biodiversity values are unlikely, the Project can further reduce and/ or avoid potential impacts during the design and construction phase by employing the following recommended measures and controls: ■ Ensure sediment and erosion control measures are established during the construction phase of the Project; ■ The long-term management of weeds should be considered as part of the planning proposal and future development of this site; and ■ Vehicle hygiene protocols should be established and will assist to control the movement of both pathogens and weeds.
Heritage	It is considered unlikely that Aboriginal cultural heritage objects or historic heritage items or will occur within the Project site. The following recommendations are made as management guidelines in the unlikely event that cultural heritage items or Aboriginal objects are identified. ■ **Cultural Awareness Induction**: All personnel involved with ground breaking activities within the Project site should undertake a cultural awareness induction, which includes identification of potential Aboriginal and non-Aboriginal heritage objects, identification of historic heritage finds, and an understanding of the chance finds procedure. ■ **Chance Finds Procedure**: If suspected Aboriginal heritage objects or heritage items are found during works, the following Chance Find Procedure should be followed and applies to the entire Project site: - All activity in the immediate area should cease and the location should be cordoned off and an appropriately qualified heritage professional should be consulted; - Heritage NSW (DPC) should be immediately contacted; - Griffith Local Aboriginal Land Council should be notified (potential Aboriginal objects only); - An appropriately qualified heritage professional should record the location and attributes of the site and determine the significance of the find; and - Works will only recommence once the area has been cleared by further assessment. In the event of the discovery of human skeletal material (or suspected human skeletal material) during project activities in the Project site the following steps should be followed: - All activities and/or works in the immediate area must cease; - The State Police must be contacted along with Heritage NSW; and

Environmental Matter	Management Measures
	- Any sand/soils removed from the near vicinity of the find must be identified and set aside for assessment by the investigating authorities
Transport and Traffic	■ In order to mitigate any potential traffic and access impacts, the following measures should be considered: While presently no turn treatment is recommended, if the traffic generation associated with the Project or with the operations of the Kerarbury Orchard traffic exceed the estimates in this TIA, the turn treatment warrant assessment must be reassessed for intersection operation and safety; ■ A Construction Traffic Management Plan (CTMP) be prepared and approved by Murrumbidgee Council. The CTMP would outline details pertaining to construction activities proposed at the site and the associated traffic control measures to be implemented to manage the impacts. The CTMP also provide details on any oversize/overmass vehicles required for the construction works; and ■ A road dilapidation condition assessment of Sturt Highway to be undertaken prior to and following the completion of construction activities.
Noise	To ensure noise and vibration emissions are kept to acceptable limits, the following general and good practice mitigation and management measures are recommended: ■ Works to be carried out during standard construction work hours (i.e., 7 am to 6 pm Monday to Friday and 8 am to 1 pm Saturdays). Any work that is performed outside normal work hours or on Sundays or public holidays must be inaudible or undertaken with agreement from neighbours; ■ Choose appropriate machines for each task and adopt efficient work practices to minimise the total construction period and the number of noise/vibration sources on the Project site: - Where vibration generating works are required with the recommended safe working distances, consultation should be undertaken with the closest receptors to minimise disturbance and vibration monitoring should be undertaken; - Avoid unnecessary noise due to idling diesel engines and fast engine speeds when lower speeds are sufficient; ■ Ensure all machines used on the Project site are in good condition, with particular emphasis on exhaust silencers, covers on engines and transmissions and squeaking or rattling components. Excessively noisy machines should be repaired or removed from the Project site; ■ All plant, equipment and vehicles movements should be optimised in a forward direction to avoid triggering motion alarms that are typically required when these items are used in reverse; ■ If any formal noise complaints are received, operator attended noise measurements should be undertaken to measure and compare the Project site noise level contributions ($L_{Aeq, 15 minute}$) to the NMLs presented in this report. All Project site noise levels should be measured to exclude any influential source not associated with the Project:

Environmental Matter	Management Measures
	- If the measured Project noise levels comply with the NMLs presented in this report, no further mitigation or management measures are required; and - If the measured Project noise levels are above those presented in this report, further mitigation and/or management measures should be considered.
Agricultural land	In order to mitigate any potential impacts on agricultural resources, the following measures should be considered: ■ **Soil Impact Mitigation** - The following measures may be taken to limit the impacts on soil resources. - During solar panel installation, disturbed surfaces in construction areas should be sewn with grass and pasture species with starter fertiliser to provide stabilising ground cover and a healthy topsoil to provide long term protection against erosion; - At locations where earthworks are necessary, such as for construction of BESS pad, or site facilities, localised erosion and sediment controls will be placed in accordance with the Landcom (2014) guidelines; - Proposed long term stockpiles in areas associated with the higher impact activities where large amounts of soil will be displaced should be stripped of topsoil. Then the excavated subsoil (if requiring disturbance) should be placed on the exposed subsoil of the stockpile area to create a low-profile landform of subsoil. A thin layer of topsoil material from the stripped areas should be placed as a ‘cap’ over the subsoil stockpiles to promote vegetation growth. Topsoil materials should otherwise be stockpiled separately to subsoils; - Strip soil material to maximum excavation depths only; - Soil should ideally be stripped in a slightly moist condition. Material should not be stripped in either an excessively dry or wet condition; - Preservation and stabilisation of drainageways and minimisation of the extent and duration of any surface disturbance will be prioritised during construction; - Soil disturbance during operation of the Project should be minimal and limited to maintenance activities, involving very small, localised disturbance areas on an infrequent basis; - Standard erosion and sediment control measures should be implemented to minimise the potential for sediment export within areas to be disturbed during operations. These measures would be developed on a case-by-case basis and are likely to include measures such as sediment fencing, localised sediment traps, and progressive stabilisation with vegetation; - During operation, mounted solar panels should change orientation during the day, with any rainfall runoff being distributed in the area around each panel, and not drained permanently to a single point on the ground;

Environmental Matter	Management Measures
	■ **Monitoring Programs** - Erosion and Sediment Control Plan, Weed and Pest Management Plan; and Rehabilitation Plan will be prepared to manage impacts on agricultural land as a result of the Project. These management plans will be reviewed and revised where necessary to incorporate the requirements associated with the Project prior to commencement.
Air Quality	Implementation of the following mitigation measures during construction will minimise potential impacts to air quality: ■ Limit the area of soil disturbance at any one time; ■ Maintain all disturbed areas, stockpiles and handling areas in a manner that minimises dust emissions (including windblown, traffic-generated or equipment generated emissions); ■ Where required, undertake strategic watering to achieve dust suppression; ■ Where required, minimise vehicle movement and speed; ■ Avoid dust generating activities during windy and dry conditions; ■ Ensure all construction plant and equipment are operated and maintained to manufacturer's specifications in order to minimise exhaust emissions; ■ Restricting vehicle movements and ground disturbance to the minimum area that is safely practicable; and ■ If necessary, temporary cessation of some works during excessively dry and windy conditions.
Bushfire	The following bushfire mitigation measures will be provided for the Project: ■ A minimum 10 m asset protection zone (APZ) for the structures and associated; and buildings/infrastructure; and ■ The APZ must be maintained to the standard of an inner protection area (IPA) for the life of the development.
Waste	Implementation of the following mitigation measures during construction will minimise potential impacts to waste: ■ The work site will be kept free of rubbish and cleaned up at the end of each working day; ■ All waste that cannot be recycled will be disposed at a legally operating waste facility; ■ No waste will be burnt or buried on-site; ■ All opportunities for recycling will be implemented; ■ All waste would be classified in accordance with the EPA's Waste Classification Guidelines and stored and handled in accordance with its classification; and ■ All wastes removed from the Project site will be recorded. Details will include the quantity of material removed, the contractor transporting it offsite, its fate (i.e., disposal or recycling) and its classification.

8. CONCLUSION

The proposed Kerarbury Orchard Solar Farm Project would provide an important resource toward addressing Australia's climate change commitments. Specifically, the Project would generate enough power to service irrigation and other operations within the OLAM Kerarbury Almond Orchard. The public interest is supported by the Project as it is consistent with endorsed statutory instruments and would provide local social and economic benefits including (but not limited to) the following:

- Employment of up to 40 staff during construction;
- Predominantly local-based construction teams, providing additional benefit the local economy through:
  - Provision of labour:
    - Ground works from site preparation and ongoing maintenance;
    - Civil engineering, installation of infrastructure and ongoing maintenance;
  - Provision of goods and services:
    - Restaurants, hotels, and local businesses;
    - Renting plant and machinery including telehandlers, excavators, trailers, and tractors;
    - Purchasing tools and materials; and
    - Transport and logistics.

. Key considerations and constraints considered in this SEE, and subsequent mitigation measures and commitments made by AGL for the Project are outlined in **Section 6**. The design and site layout has also been informed by key environmental specialist assessments in Biodiversity, Cultural and Historic Heritage, Visual/Landscape Values, Traffic and Transport, Hydrology/Flooding and Impact on Agriculture, which has resulted in the proposed Project site layout presented in **Figure 3-1**.

The scale of the Project has been influenced by:

- Demand for new renewable electricity generation to meet broader NSW renewable generation targets;
- Commercial investment and viability considerations;
- Electricity grid capacity;
- Site accessibility;
- Environmental constraints on the proposed Project site; and
- Property boundaries.

The Project is considered to have an acceptable impact on local amenity. The Project would have some localised visual and construction noise impacts on a small number of receivers; however, the implementation of project-specific mitigation measures would result in minimisation of impacts and improve the acceptability of the Project on these receptors and the local community.

This SEE has demonstrated that the Project is permissible under the provisions of the Transport and Infrastructure SEPP 2021 and is consistent with the provisions of the Murrumbidgee LEP 2013. It is considered that the Project site is suited to solar electricity generation, with adequate capacity within the Kerarbury Orchard and in the local electricity network, proximity to a suitable electrical network and quality solar resource.

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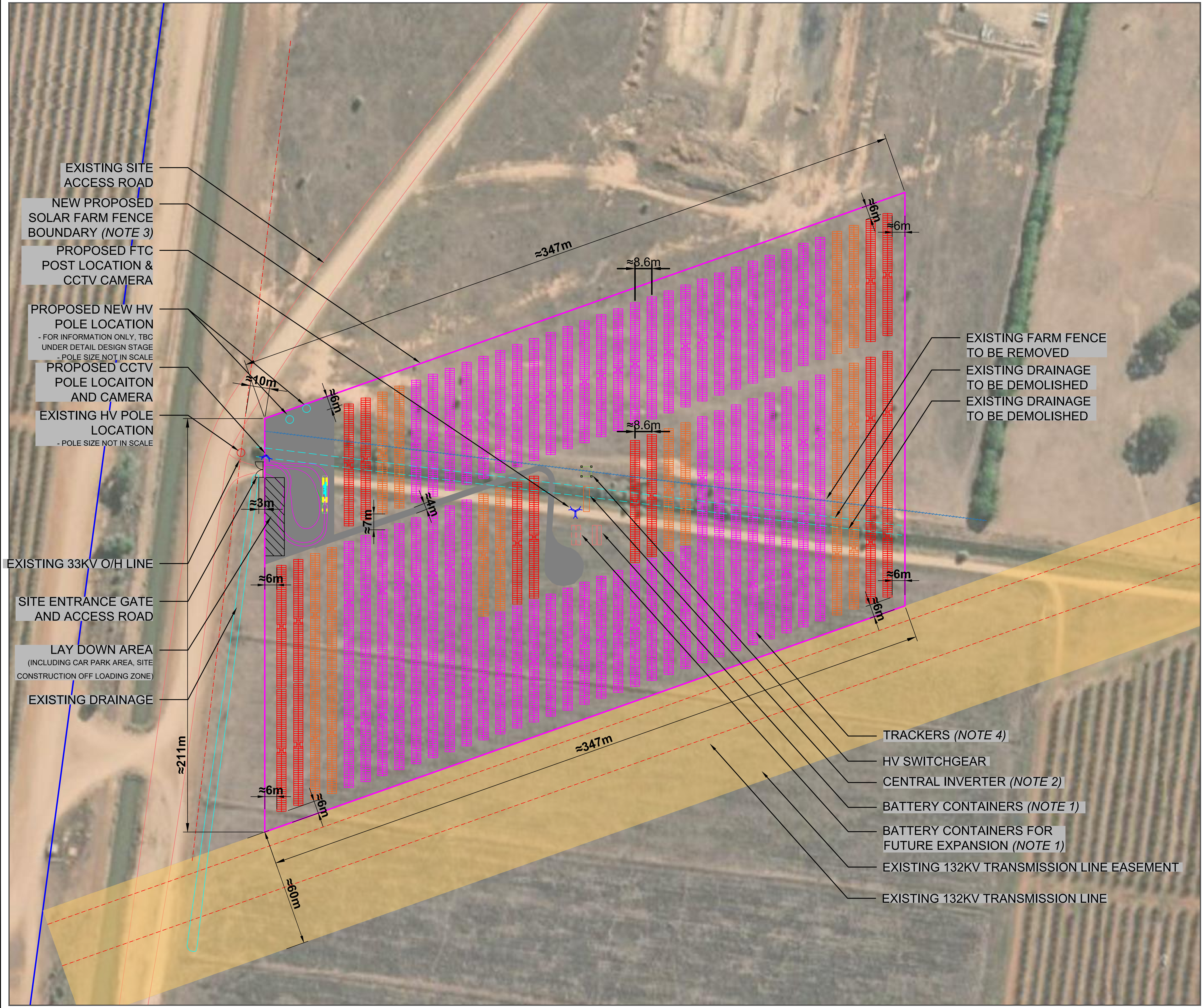
APPENDIX A DESIGN PLANS



GENERAL INFORMATION

SITE INFORMATION:

LAND AREA:	APPROX.7.0HA

PV MODULE:

MODULE PROVIDER:	TRINASOLAR
MODULE TYPE:	TSM-DEG19C.20-545W
MODULE POWER CLASS:	545W
NUMBER OF MODULES:	11016
SYSTEM DC CAPACITY:	6MWP

INVERTER:

INVERTER MODEL:	SG4950HV-MV
RATED AC CAPACITY:	4950KVA@50°C
NUMBER OF INVERTERS:	1
TOTAL AC CAPACITY:	4950KVA@50°C

BATTERY:

BATTERY PROVIDER:	SUNGROW
BATTERY MODEL:	SG2293UX
BATTERY QUANTITY:	2

TRACKER:

TRACKER PROVIDER:	FTCSOLAR
TRACKER TYPE:	VOYAGER
TRACKER QUANTITY:	102
TRACKER PITCH:	APPROX.8.6M

LEGEND:

- SITE ENTRANCE GATE AND ACCESS ROAD
- SOLAR FARM SECURITY FENCE
- SITE CAR PARK ZREA
- HV O/H POLE / HV UG/OH POLE
- ROAD / HIGHWAY
- BATTERY CONTAINER
- HV SWITCHBOARD PLATFORM
- EXISTING IRRIGATION CHANNEL TO BE DEMOLISHED
- CENTRAL INVERTER
- SITE BOUNDARY
- PV TRACKER
- PROPOSED NEW HV POLE POSITION (FOR INFORMATION ONLY)
- HV O/H LINE

Rev	Description	Date	Drwn.	Design.	Check.
F	CCTV POLE AND FTC POST LOCATION ADDED	16.11.22	X.T	X.T	R.Z
E	TYPO AMENDED	14.09.22	X.T	X.T	R.Z
D	MINOR UPDATES AS PER TO AGL COMMENTS	08.09.22	X.T	X.T	R.Z
C	MINOR UPDATES AS PER TO AGL COMMENTS	07.09.22	X.T	X.T	R.Z
B	SITE PLAN UPDATED AS PER AGL COMMENTS	01.09.22	X.T	X.T	R.Z
A	PRELIMINARY DESIGN	30.08.22	X.T	X.T	R.Z

PROJECT:

KERARBURY SOLAR FARM

16705 STURT HWY, DARLINGTON POINT, NSW 2706
-34.6139, 145.8334
DP750877 LOT 68 & LOT 69

CLIENT:

AGL ENERGY SOLUTIONS
699 BOURKE ST, DOCKLANDS, VIC 3008
T: 1300 660 704
EMAIL: energysolutions@agl.com.au
WEB: www.agl.com.au

ACLE
502/689 BURKE ROAD, CAMBERWELL, VIC 3124
T: (03) 9813 2307
EMAIL: admin@acle.com.au
WEB: www.acle.com.au

DRAWING TITLE:

SITE PLAN

NORTH DIRECTION

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SCALE 1:1800

DRAWING ISSUE: PRELIMINARY

SIZE A3

PROJECT No. PRJ_50624P1

DRAWING No. GE_1.1

Rev REV_F

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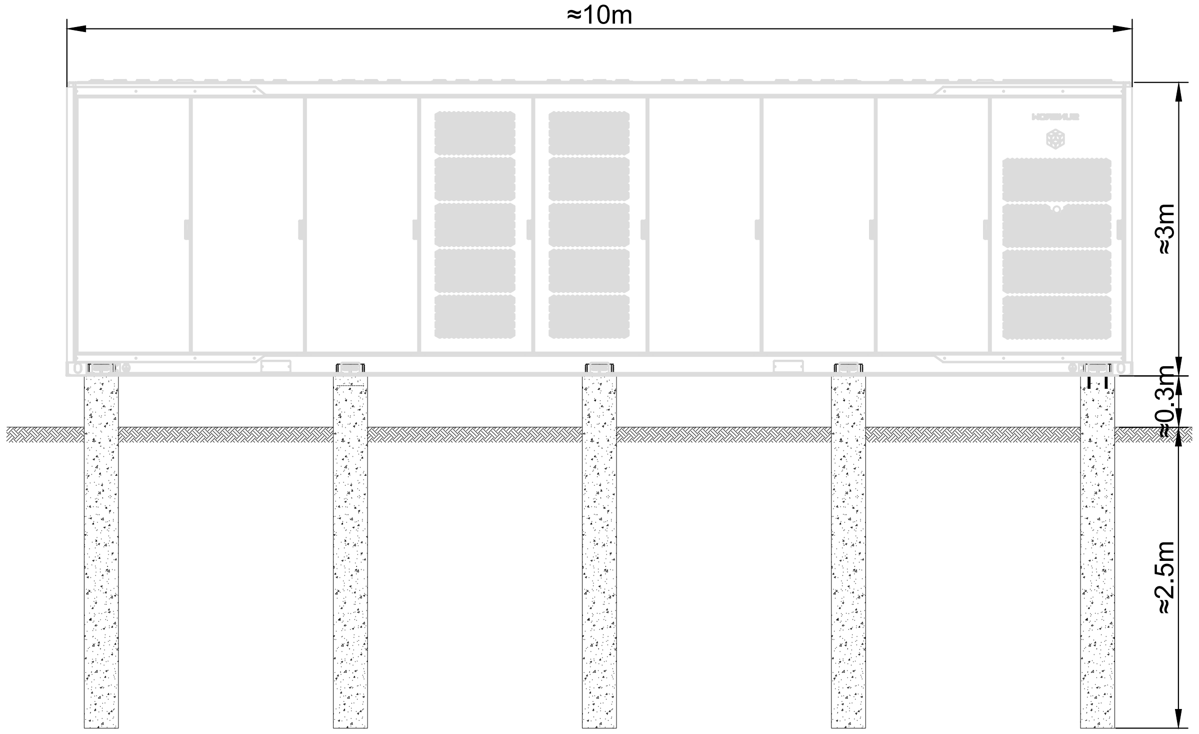
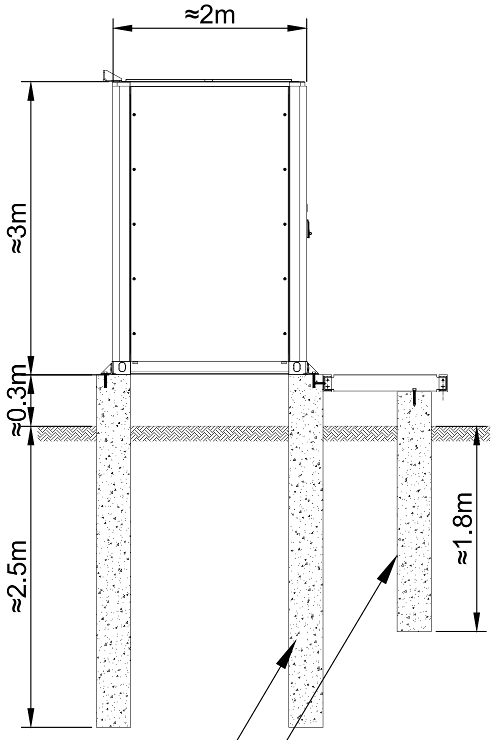


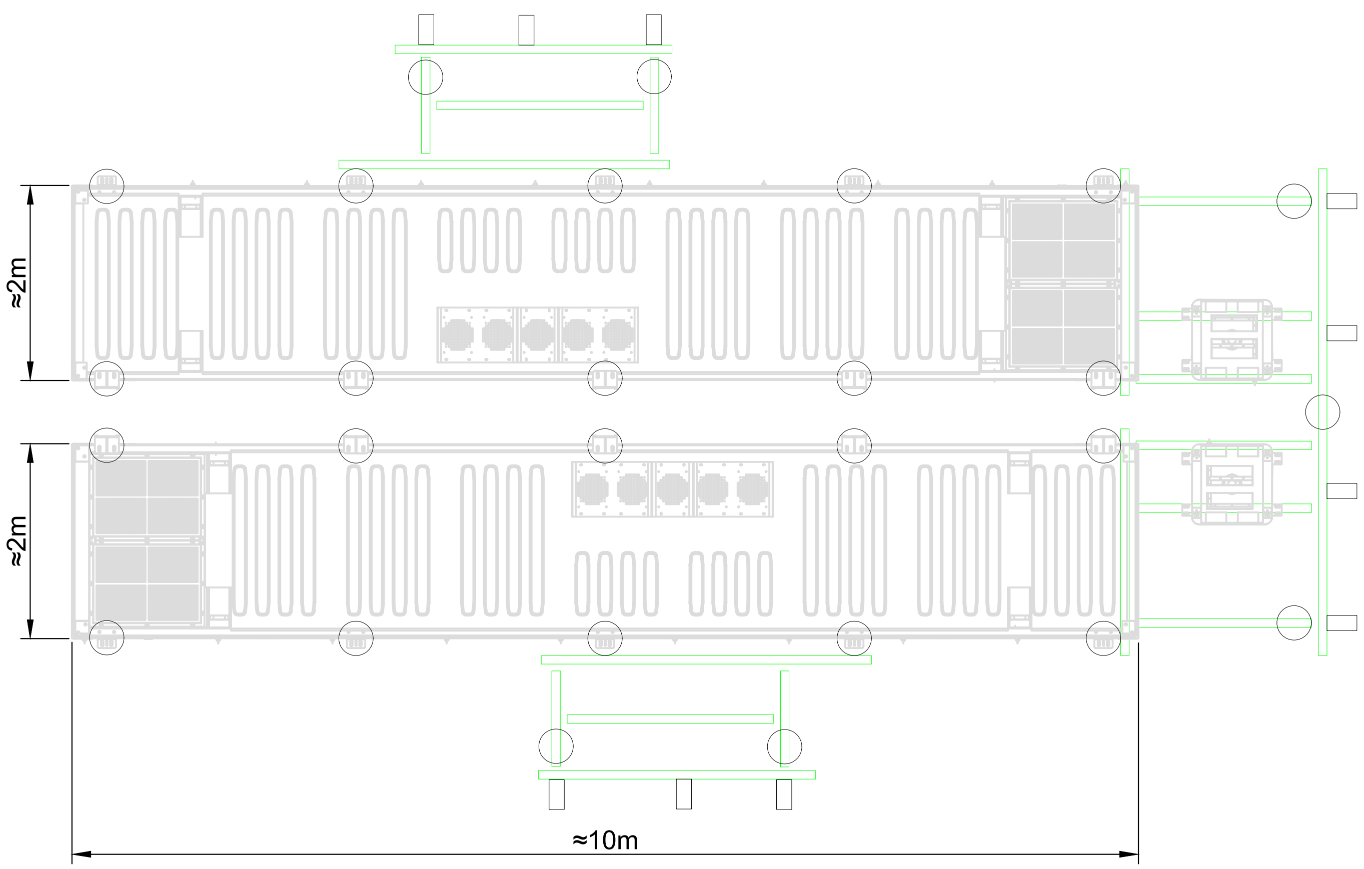
BATTERY CONTAINER SIDE VIEW



STRUCTURE FOUNDATION FOOTING

PLATFORM FOUNDATION FOOTING

BATTERY CONTAINER TOP VIEW



TYPICAL BATTERY CONTAINER

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- BATTERY TYPE: LFP BATTERY

GENERAL INFORMATION

SITE INFORMATION:

LAND AREA:	APPROX.7.0HA

PV MODULE:

MODULE PROVIDER:	TRINASOLAR
MODULE TYPE:	TSM-DEG19C.20-545W
MODULE POWER CLASS:	545W
NUMBER OF MODULES:	11016
SYSTEM DC CAPACITY:	6MWP

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BATTERY:

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BATTERY MODEL:	SG2293UX
BATTERY QUANTITY:	2

TRACKER:

TRACKER PROVIDER:	FTCSOLAR
TRACKER TYPE:	VOYAGER
TRACKER QUANTITY:	102
TRACKER PITCH:	APPROX.8.6M

NOTE:
DETAIL INFORMATION FOR BATTERY CONTAINER STRUCTURE DRAWING REFER TO "E22100805-BESS-S00-03-C1"

Rev	Description	Date	Drwn.	Design.	Check.
D	BATTERY FOUNDATION ARRANGEMENT UPDATED	16.11.22	X.T	X.T	R.Z
C	TYPO AMENDED	14.09.22	X.T	X.T	R.Z
B	TITLE BLOCK UPDATED	09.09.22	X.T	X.T	R.Z
A	PRELIMINARY DESIGN	05.09.22	X.T	X.T	R.Z

PROJECT:

KERARBURY SOLAR FARM

16705 STURT HWY, DARLINGTON POINT, NSW 2706
-34.6139, 145.8334
DP750877 LOT 68 & LOT 69

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WEB: www.acle.com.au

DRAWING TITLE:

GE_3.0_BATTERY CONTAINER ELEVATION

NORTH DIRECTION

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SCALE 1:55

DRAWING ISSUE: PRELIMINARY

SIZE A3

PROJECT No. PRJ_50624P1

DRAWING No. GE_3.0

Rev REV_D

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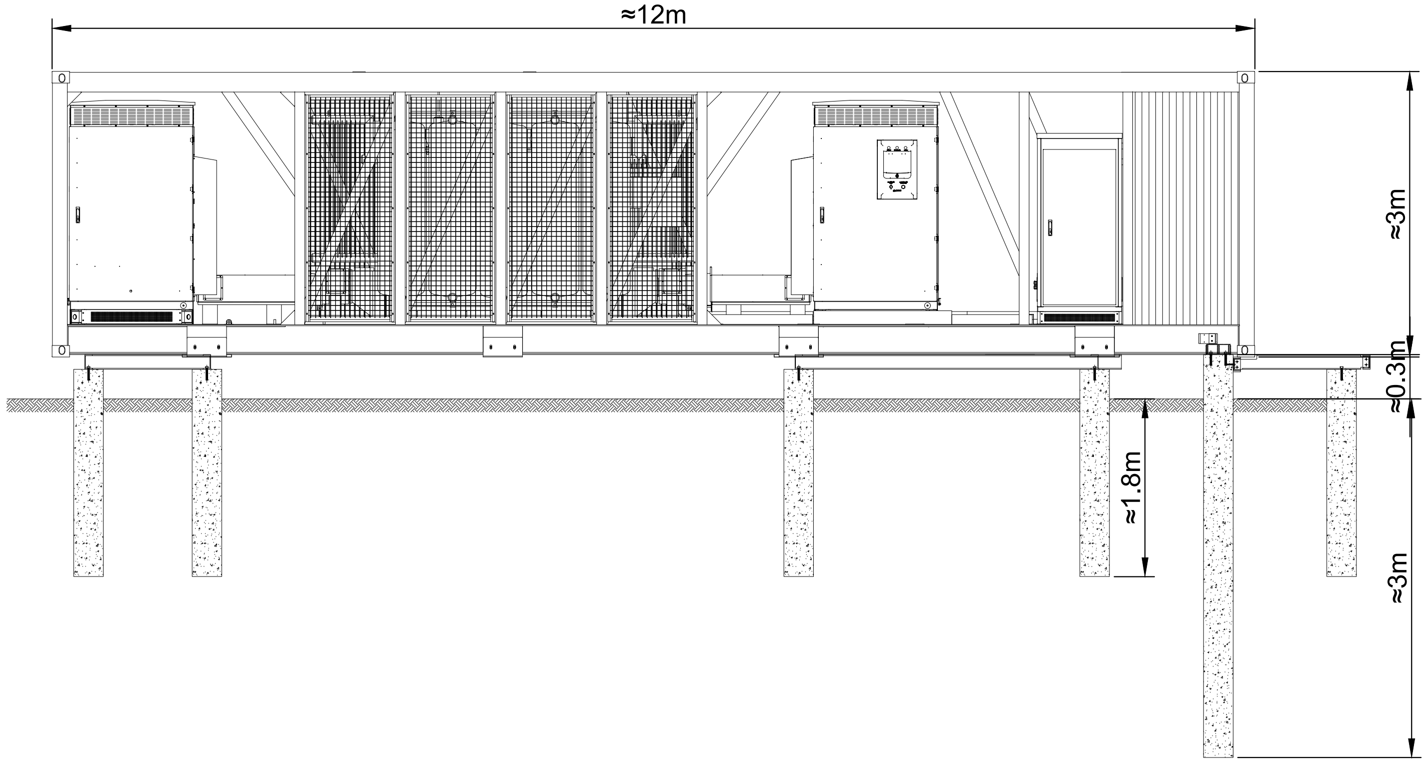

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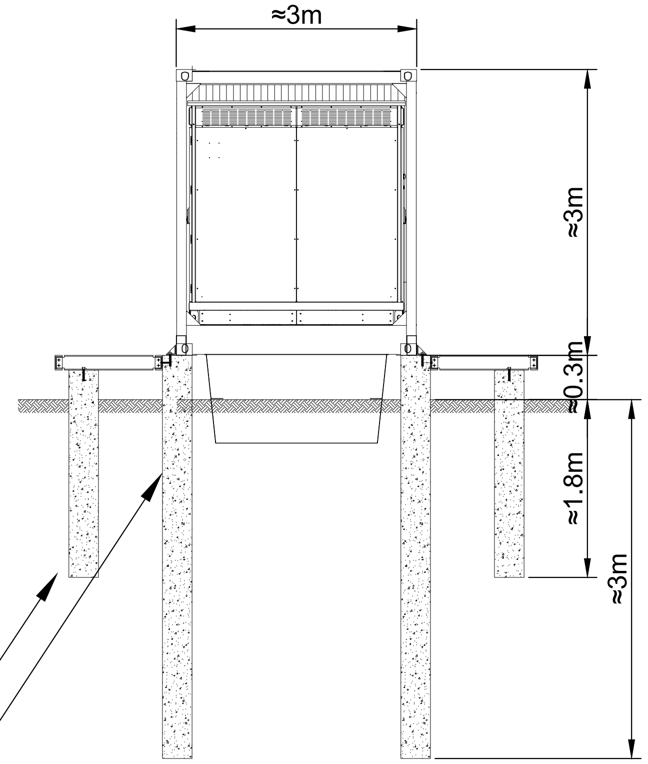
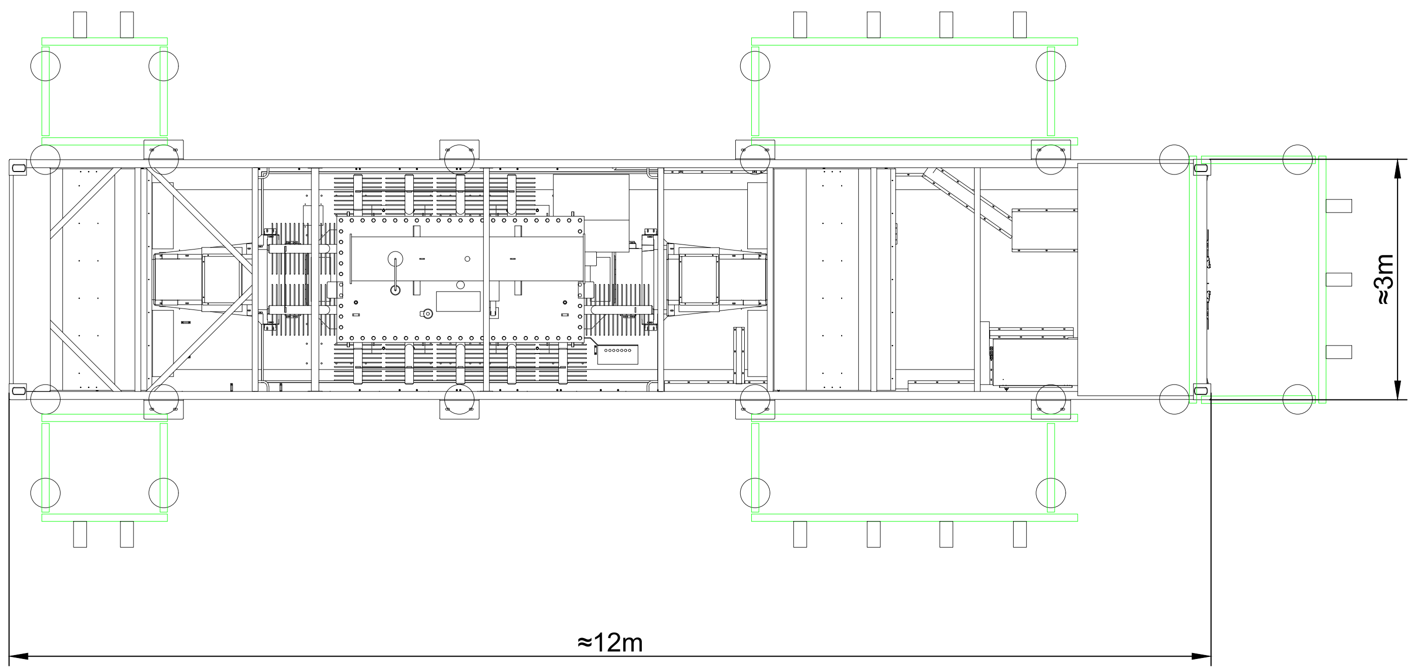


PLATFORM FOUNDATION FOOTING

STRUCTURE FOUNDATION FOOTING

CENTRAL INVERTER TOP VIEW



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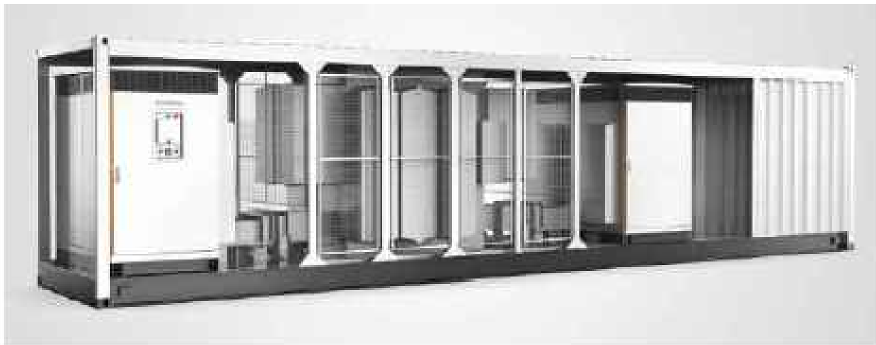

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TRACKER TYPE:	VOYAGER
TRACKER QUANTITY:	102
TRACKER PITCH:	APPROX.8.6M

NOTE:

DETAIL INFORMATION REFER TO CENTRAL INVERTER STRUCTURE DRAWING "E22100805-MVPS-S00-03-C1"

Rev	Description	Date	Drawn.	Design.	Check.
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C	TYPO AMENDED	14.09.22	X.T	X.T	R.Z
B	TITLE BLOCK UPDATED	09.09.22	X.T	X.T	R.Z
A	PRELIMINARY DESIGN	05.09.22	X.T	X.T	R.Z

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DRAWING TITLE:

GE_4.0_CENTRAL INVERTER ELEVATION

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SCALE 1:70

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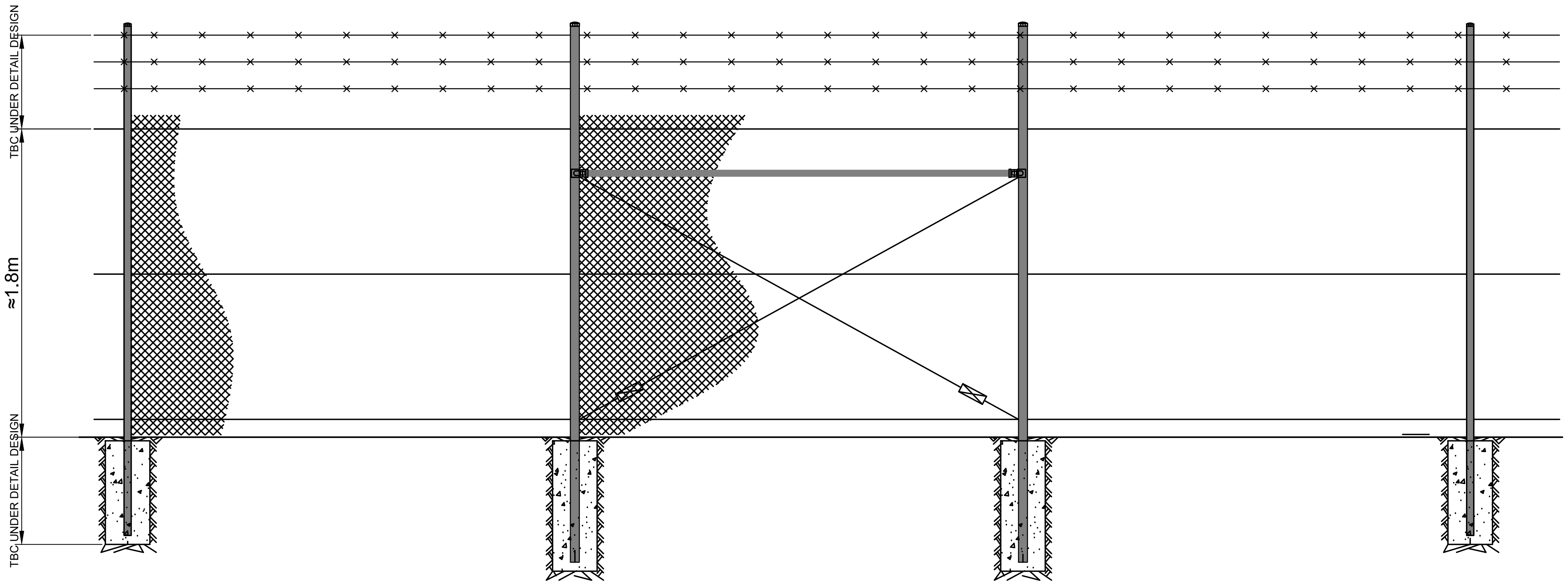
SIZE A3

PROJECT No. PRJ_50624P1

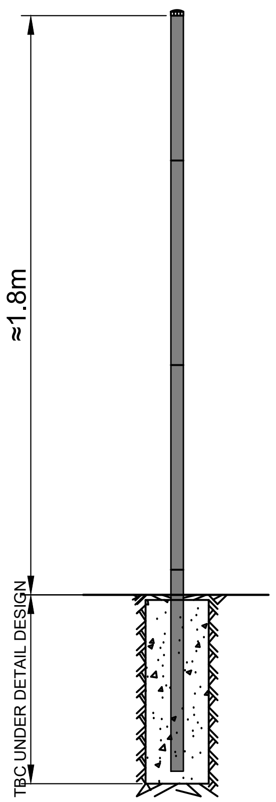
DRAWING No. GE_4.0

Rev REV_D

SECURITY FENCE FRONT VIEW



SECURITY FENCE SIDE VIEW



TYPICAL SECURITY FENCE

GENERAL INFORMATION

SITE INFORMATION:

LAND AREA:	APPROX.7.0HA

PV MODULE:

MODULE PROVIDER:	TRINASOLAR
MODULE TYPE:	TSM-DEG19C.20-545W
MODULE POWER CLASS:	545W
NUMBER OF MODULES:	11016
SYSTEM DC CAPACITY:	6MWP

INVERTER:

INVERTER MODEL:	SG4950HV-MV
RATED AC CAPACITY:	4950KVA@50°C
NUMBER OF INVERTERS:	1
TOTAL AC CAPACITY:	4950KVA@50°C

BATTERY:

BATTERY PROVIDER:	SUNGROW
BATTERY MODEL:	SG2293UX
BATTERY QUANTITY:	2

TRACKER:

TRACKER PROVIDER:	FTCSOLAR
TRACKER TYPE:	VOYAGER
TRACKER QUANTITY:	102
TRACKER PITCH:	APPROX.8.6M

Rev	Description	Date	Drwn.	Design.	Check.
D	BATTERY QUANTITY AND MODEL UPDATED	16.11.22	X.T	X.T	R.Z
C	TYPO AMENDED	14.09.22	X.T	X.T	R.Z
B	TITLE BLOCK UPDATED	09.09.22	X.T	X.T	R.Z
A	PRELIMINARY DESIGN	05.09.22	X.T	X.T	R.Z

PROJECT:

KERARBURY SOLAR FARM

16705 STURT HWY, DARLINGTON POINT, NSW 2706
-34.6139, 145.8334
DP750877 LOT 68 & LOT 69

CLIENT:

AGL ENERGY SOLUTIONS
699 BOURKE ST, DOCKLANDS, VIC 3008
T: 1300 660 704
EMAIL: energysolutions@agl.com.au
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GE_5.0_SECURITY FENCE ELEVATION

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SIZE A3

PROJECT No. PRJ_50624P1

DRAWING No. GE_5.0

Rev REV_D

TRACKER FRONT VIEW
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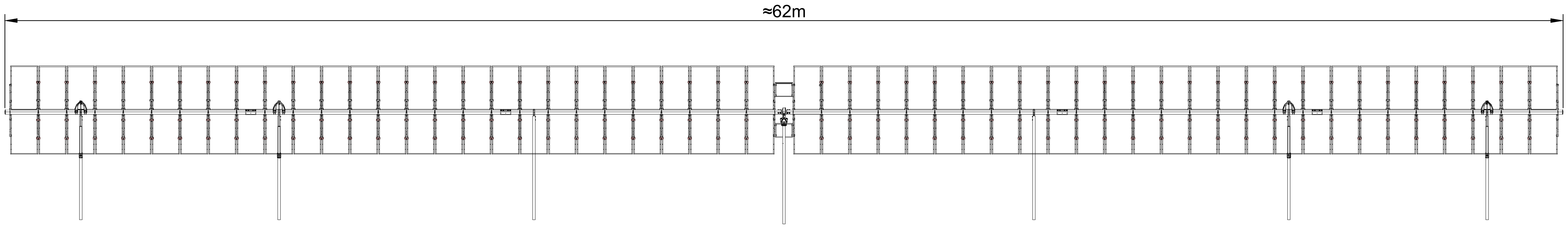
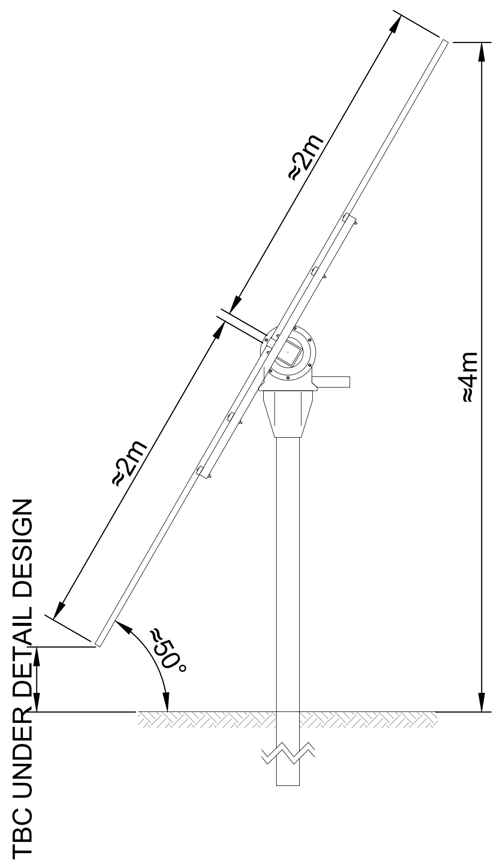
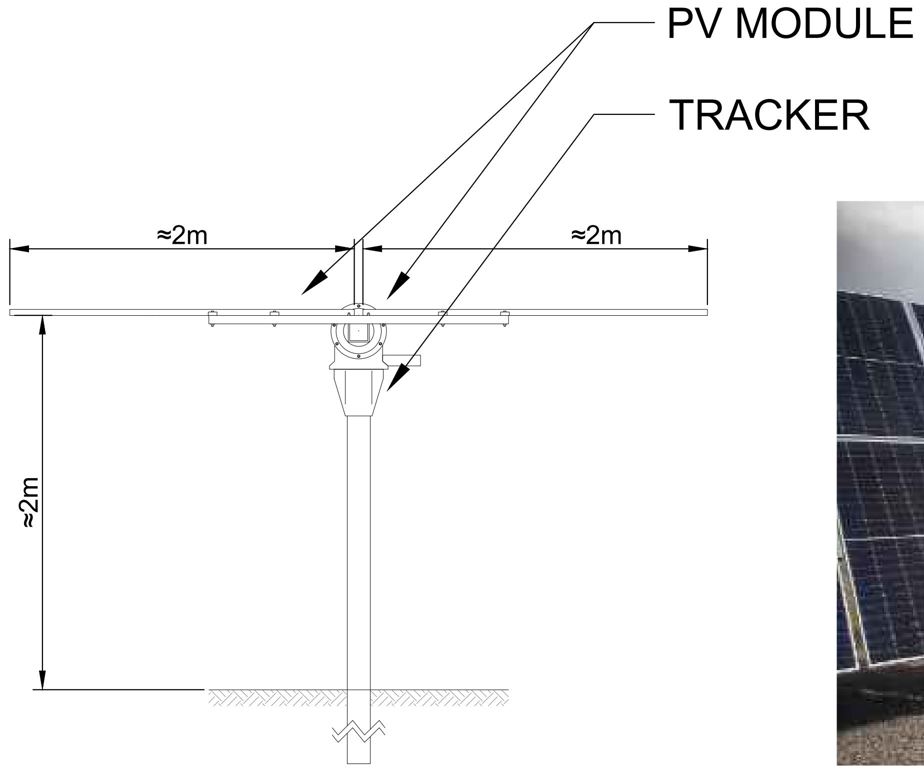




TRACKER N-S ELEVATION@MAX. TILT
SCALE 1:45



TRACKER N-S ELEVATION@0°
SCALE 1:45

TYPICAL TRACKER
- SINGLE AXIS TRACKER
- TWO MODULE IN PORTRAIT

GENERAL INFORMATION

SITE INFORMATION:

LAND AREA:	APPROX.7.0HA

PV MODULE:

MODULE PROVIDER:	TRINASOLAR
MODULE TYPE:	TSM-DEG19C.20-545W
MODULE POWER CLASS:	545W
NUMBER OF MODULES:	11016
SYSTEM DC CAPACITY:	6MWP

INVERTER:

INVERTER MODEL:	SG4950HV-MV
RATED AC CAPACITY:	4950KVA@50°C
NUMBER OF INVERTERS:	1
TOTAL AC CAPACITY:	4950KVA@50°C

BATTERY:

BATTERY PROVIDER:	SUNGROW
BATTERY MODEL:	SG2293UX
BATTERY QUANTITY:	2

TRACKER:

TRACKER PROVIDER:	FTCSOLAR
TRACKER TYPE:	VOYAGER
TRACKER QUANTITY:	102
TRACKER PITCH:	APPROX.8.6M

Rev	Description	Date	Drwn.	Design.	Check.
D	BATTERY QUANTITY AND MODEL UPDATED	16.11.22	X.T	X.T	R.Z
C	TYPO AMENDED	14.09.22	X.T	X.T	R.Z
B	TITLE BLOCK UPDATED	09.09.22	X.T	X.T	R.Z
A	PRELIMINARY DESIGN	05.09.22	X.T	X.T	R.Z

PROJECT:
KERARBURY SOLAR FARM
16705 STURT HWY, DARLINGTON POINT, NSW 2706
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SCALE

DRAWING ISSUE: PRELIMINARY

SIZE: A3

PROJECT No. PRJ_50624P1

DRAWING No. GE_6.0

Rev REV_D

APPENDIX B EPBC PROTECTED MATTERS SEARCH TOOL RESULTS

Australian Government

Department of Climate Change, Energy, the Environment and Water

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected. Please see the caveat for interpretation of information provided here.

Report created: 17-Nov-2022

Summary

Matters of National Environment Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance (Ramsar	4
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	4
Listed Threatened Species:	23
Listed Migratory Species:	9

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at https://www.dcceew.gov.au/parks-heritage/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Lands:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	15
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None
Habitat Critical to the Survival of Marine Turtles:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have

State and Territory Reserves:	1
Regional Forest Agreements:	None
Nationally Important Wetlands:	None
EPBC Act Referrals:	3
Key Ecological Features (Marine):	None
Biologically Important Areas:	None
Bioregional Assessments:	None
Geological and Bioregional Assessments:	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar Wetlands) [Resource Information]

Ramsar Site Name	Proximity	Buffer Status
Banrock station wetland complex	400 - 500km upstream from Ramsar site	In feature area
Hattah-kulkyne lakes	200 - 300km upstream from Ramsar site	In feature area
Riverland	400 - 500km upstream from Ramsar site	In feature area
The coorong, and lakes alexandrina and albert wetland	500 - 600km upstream from Ramsar site	In feature area

Listed Threatened Ecological Communities [Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.
Status of Vulnerable, Disallowed and Ineligible are not MNES under the EPBC Act.

Community Name	Threatened Category	Presence Text	Buffer Status
Buloke Woodlands of the Riverina and Murray-Darling Depression Bioregions	Endangered	Community may occur within area	In feature area
Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia	Endangered	Community likely to occur within area	In feature area
Weeping Myall Woodlands	Endangered	Community likely to occur within area	In feature area
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	Critically Endangered	Community likely to occur within area	In feature area

Listed Threatened Species [Resource Information]

Status of Conservation Dependent and Extinct are not MNES under the EPBC Act.
Number is the current name ID.

Scientific Name	Threatened Category	Presence Text	Buffer Status
BIRD			

Scientific Name	Threatened Category	Presence Text	Buffer Status
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat likely to occur within area	In feature area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area	In feature area
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Grantiella picta Painted Honeyeater [470]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat known to occur within area	In feature area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area	In feature area
Pedionomus torquatus Plains-wanderer [906]	Critically Endangered	Species or species habitat known to occur within area	In feature area
Polytelis swainsonii Superb Parrot [738]	Vulnerable	Species or species habitat known to occur within area	In feature area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area	In feature area
FISH			
Galaxias rostratus Flathead Galaxias, Beaked Minnow, Flat-headed Galaxias, Flat-headed Jollytail, Flat-headed Minnow [84745]	Critically Endangered	Species or species habitat may occur within area	In feature area
Maccullochella macquariensis Trout Cod [26171]	Endangered	Species or species habitat may occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Maccullochella peelii			
Murray Cod [66633]	Vulnerable	Species or species habitat known to occur within area	In buffer area only
Macquaria australasica			
Macquarie Perch [66632]	Endangered	Species or species habitat may occur within area	In feature area
FROG			
Crinia sloanei			
Sloane's Froglet [59151]	Endangered	Species or species habitat may occur within area	In feature area
Litoria raniformis			
Growling Grass Frog, Southern Bell Frog, Green and Golden Frog, Warty Swamp Frog, Golden Bell Frog [1828]	Vulnerable	Species or species habitat known to occur within area	In feature area
MAMMAL			
Nyctophilus corbeni			
Corben's Long-eared Bat, South-eastern Long-eared Bat [83395]	Vulnerable	Species or species habitat may occur within area	In feature area
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT)			
Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Endangered	Species or species habitat known to occur within area	In feature area
PLANT			
Austrostipa wakoolica			
[66623]	Endangered	Species or species habitat may occur within area	In buffer area only
Brachyscome papillosa			
Mossgiel Daisy [6625]	Vulnerable	Species or species habitat may occur within area	In feature area
Lepidium monoplocoides			
Winged Pepper-cress [9190]	Endangered	Species or species habitat likely to occur within area	In feature area
Maireana cheelii			
Chariot Wheels [8008]	Vulnerable	Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Swainsona murrayana			
Slender Darling-pea, Slender Swainson, Murray Swainson-pea [6765]	Vulnerable	Species or species habitat likely to occur within area	In feature area
REPTILE			
Hemiaspis damelii			
Grey Snake [1179]	Endangered	Species or species habitat may occur within area	In feature area

Listed Migratory Species

[Resource Information]

Scientific Name	Threatened Category	Presence Text	Buffer Status
Migratory Marine Birds			
Apus pacificus			
Fork-tailed Swift [678]		Species or species habitat likely to occur within area	In feature area
Migratory Terrestrial Species			
Motacilla flava			
Yellow Wagtail [644]		Species or species habitat may occur within area	In feature area
Myiagra cyanoleuca			
Satin Flycatcher [612]		Species or species habitat may occur within area	In feature area
Migratory Wetlands Species			
Actitis hypoleucos			
Common Sandpiper [59309]		Species or species habitat may occur within area	In feature area
Calidris acuminata			
Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area	In feature area
Calidris ferruginea			
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area	In feature area
Calidris melanotos			
Pectoral Sandpiper [858]		Species or species habitat may occur within area	In feature area
Gallinago hardwickii			
Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area	In feature area

Other Matters Protected by the EPBC Act

Listed Marine Species			[Resource Information]
Scientific Name	Threatened Category	Presence Text	Buffer Status
Bird			
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area	In feature area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area	In feature area
Bubulcus ibis as Ardea ibis Cattle Egret [66521]		Species or species habitat may occur within area overfly marine area	In feature area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area	In feature area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area overfly marine area	In feature area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area overfly marine area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Chalcites osculans as Chrysococcyx osculans			
Black-eared Cuckoo [83425]		Species or species habitat likely to occur within area overfly marine area	In feature area
Gallinago hardwickii			
Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area overfly marine area	In feature area
Haliaeetus leucogaster			
White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area	In feature area
Merops ornatus			
Rainbow Bee-eater [670]		Species or species habitat may occur within area overfly marine area	In feature area
Motacilla flava			
Yellow Wagtail [644]		Species or species habitat may occur within area overfly marine area	In feature area
Myiagra cyanoleuca			
Satin Flycatcher [612]		Species or species habitat may occur within area overfly marine area	In feature area
Neophema chrysostoma			
Blue-winged Parrot [726]		Species or species habitat likely to occur within area overfly marine area	In feature area
Numenius madagascariensis			
Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area	In feature area
Rostratula australis as Rostratula benghalensis (sensu lato)			
Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area overfly marine area	In feature area

Extra Information

State and Territory Reserves [Resource Information]

Protected Area Name	Reserve Type	State	Buffer Status
Murrumbidgee Valley	National Park	NSW	In buffer area only

EPBC Act Referrals [Resource Information]

Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Not controlled action				
Improving rabbit biocontrol: releasing another strain of RHDV, sthrn two thirds of Australia	2015/7522	Not Controlled Action	Completed	In feature area
INDIGO Central Submarine Telecommunications Cable	2017/8127	Not Controlled Action	Completed	In feature area
Not controlled action (particular manner)				
INDIGO Marine Cable Route Survey (INDIGO)	2017/7996	Not Controlled Action (Particular Manner)	Post-Approval	In feature area

Caveat

1 PURPOSE

This report is designed to assist in identifying the location of matters of national environmental significance (MNES) and other matters protected by the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) which may be relevant in determining obligations and requirements under the EPBC Act.

The report contains the mapped locations of:

- World and National Heritage properties;
- Wetlands of International and National Importance;
- Commonwealth and State/Territory reserves;
- distribution of listed threatened, migratory and marine species;
- listed threatened ecological communities; and
- other information that may be useful as an indicator of potential habitat value.

2 DISCLAIMER

This report is not intended to be exhaustive and should only be relied upon as a general guide as mapped data is not available for all species or ecological communities listed under the EPBC Act (see below). Persons seeking to use the information contained in this report to inform the referral of a proposed action under the EPBC Act should consider the limitations noted below and whether additional information is required to determine the existence and location of MNES and other protected matters.

Where data are available to inform the mapping of protected species, the presence type (e.g. known, likely or may occur) that can be determined from the data is indicated in general terms. It is the responsibility of any person using or relying on the information in this report to ensure that it is suitable for the circumstances of any proposed use. The Commonwealth cannot accept responsibility for the consequences of any use of the report or any part thereof. To the maximum extent allowed under governing law, the Commonwealth will not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance

3 DATA SOURCES

Threatened ecological communities

For threatened ecological communities where the distribution is well known, maps are generated based on information contained in recovery plans, State vegetation maps and remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species

Threatened, migratory and marine species distributions have been discerned through a variety of methods. Where distributions are well known and if time permits, distributions are inferred from either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc.) together with point locations and described habitat; or modelled (MAXENT or BIOCLIM habitat modelling) using

Where little information is available for a species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc.).

In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More detailed distribution mapping methods are used to update these distributions

4 LIMITATIONS

The following species and ecological communities have not been mapped and do not appear in this report:

- threatened species listed as extinct or considered vagrants;
- some recently listed species and ecological communities;
- some listed migratory and listed marine species, which are not listed as threatened species; and
- migratory species that are very widespread, vagrant, or only occur in Australia in small numbers.

The following groups have been mapped, but may not cover the complete distribution of the species:

- listed migratory and/or listed marine seabirds, which are not listed as threatened, have only been mapped for recorded
- seals which have only been mapped for breeding sites near the Australian continent

The breeding sites may be important for the protection of the Commonwealth Marine environment.

Refer to the metadata for the feature group (using the Resource Information link) for the currency of the information.

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

APPENDIX C BIODIVERSITY ASSESSMENT REPORT

AGL – Kerarbury Solar Farm

Biodiversity Values Assessment Report

15 November 2022

Project No.: 0640174

The business of sustainability

ERM

Document details	
Document title	AGL – Kerarbury Solar Farm
Document subtitle	Biodiversity Values Assessment Report
Project No.	0640174
Date	15 November 2022
Version	0.2
Author	Samantha Sanders
Client Name	AGL Energy Services Pty Ltd

Document history

				ERM approval to issue		
Version	Revision	Author	Reviewed by	Name	Date	Comments
Draft	0.1	Samantha Sanders	Matt Davis	Karie Bradfield	28.10.2022	
Final	0.2	Samantha Sanders	Shema Thadathil	Karie Bradfield	15.11.2022	

Signature Page

15 November 2022

AGL – Kerarbury Solar Farm

Biodiversity Values Assessment Report

Samantha Sanders Ecologist	Matt Davis Principal Ecologist
Danyil Skora Project Manager	Karie Bradfield Partner

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CONTENTS

List of Tables

List of Figures

Acronyms and Abbreviations

Name	Description
AOBV	Areas of Outstanding Biodiversity Value
BAM	Biodiversity Assessment Method
BAR	Biodiversity Assessment Report
BC Act	NSW Biodiversity Conservation Act 2016
BDAR	Biodiversity Development Assessment Report
BOS	Biodiversity Offsets Scheme
BOSET	Biodiversity Offsets Scheme Entry Threshold
DCCEEW	Commonwealth Department of Climate Change, Energy, the Environment and Water.
DPIE	NSW Department of Planning, Industry and Environment
EIS	Environment Impact Statement
EP&A Act	NSW Environmental Planning and Assessment Act 1979
EP&A Regulation	Environmental Planning and Assessment Regulation 2000
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999
ha	hectare
km	kilometre
LGA	Local Government Areas
Locality	refers to an area within a 10 km buffer around the Project site
MNES	Matters of National Environmental Significance
NSW	New South Wales
PMST	Protected Matters Search Tool
TEC	threatened ecological communities
VIS	Vegetation Information System
WoNS	Weeds of National Significance

1. INTRODUCTION

This Biodiversity Values Assessment Report has been prepared on behalf of AGL Energy Solutions (AGL) in support of a Development Application (DA) and Statement of Environmental Effects (SoEE) seeking approval for a Solar Farm at 16705 Sturt Hwy, Darlington Point, NSW, 2706. The Project is proposed to occupy a maximum of 7 ha within Lots 68 and 69 of DP 750877. The Project site has access from a private road off the Sturt Highway, Darlington Point, and is located approximately 15 km southwest of the township of Darlington Point. The Project site is contained wholly within the Murrumbidgee Council Local Government Area (LGA) (refer to Figure 1.1).

The purpose of this assessment is to characterise the biodiversity values of the Project site, and to identify the known or potential occurrence of (or habitat for) any species, populations or ecological communities that are listed as threatened under the NSW *Biodiversity Conservation Act 2016* (BC Act) or the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

This report provides an assessment of whether the proposed activity is likely to result in a significant impact to flora, fauna and ecological communities listed under the BC Act and the EPBC Act. It also recommends mitigation measures to minimise impacts where required. The assessment was informed by a combination of desktop reviews, database searches and observations of the general conditions and values from a site visit completed on 5th October 2022.

1.1 Description of the Proposed Development

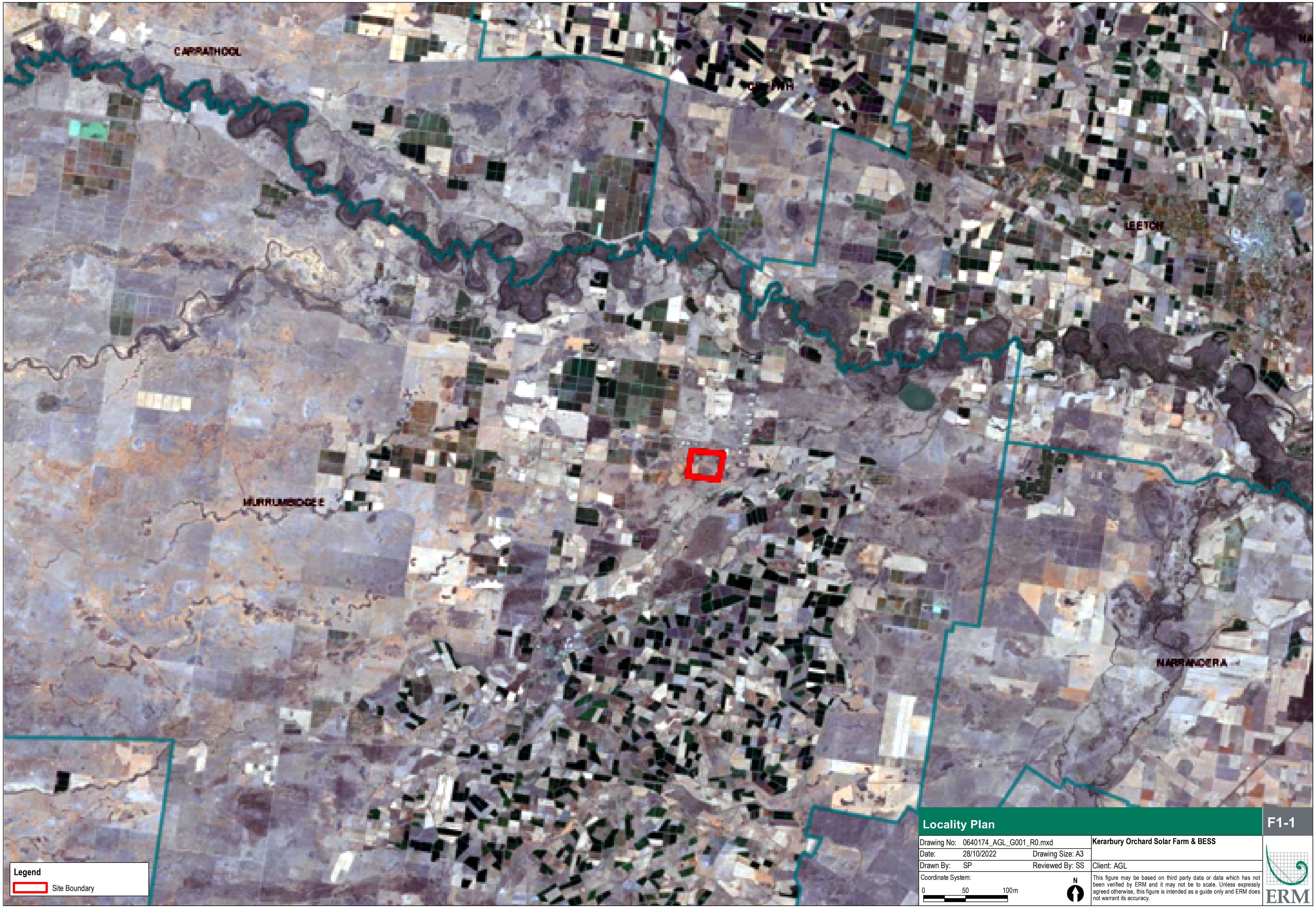
The total Project site is approximately 7 hectares (ha), with a solar farm footprint of approximately 6.1 ha, and a capacity of up to 4.95 megawatts (MW AC), a Battery Energy Storage System (BESS) footprint of up to 0.003 ha (30 m^2) with a capacity of up to 4.586 MW hr including any additional supporting infrastructure. This will be subject to final grid connection and design. The overall site context of the proposed Kerarbury Solar Farm is depicted in Figure 1.1 and the solar farm array is presented Figure 1.2. The site has been cleared in the past for agricultural use, as an orchard, and is predominantly non-native grassland.

1.2 Existing Environment

It is understood that the proposed project is located along the Sturt Highway within the Murrumbidgee Local Government Area and is currently zoned as RU1 ‘Primary Production’ under the *Murrumbidgee Local Environment Plan 2013* (*Murrumbidgee LEP*).

The site is located south of the Murrumbidgee River. The nearest water course is Gum Creek located approximately 2.5 km to the north of the Project Site. The site has been largely cleared of woody vegetation and has been used for agricultural activities.

The Project site is situated within the NSW Riverina Bioregion, which covers areas of southwest NSW and extends into central-north Victoria. The Bioregion contains part of the Murray, Murrumbidgee, Lachlan and Goulburn River catchments. The Riverina Bioregion contains a broad range of native flora and fauna, supported by a persistently dry semi-arid climate characterised by hot summers and cool winters. Fauna habitats throughout the bioregion have been heavily impacted by intensive land clearance for agriculture and development.



Locality Plan

F1-1

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Date: 28/10/2022	Drawing Size: A3		
Drawn By: SP	Reviewed By: SS		Client: AGL
Coordinate System:	0 50 100m	N	This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.

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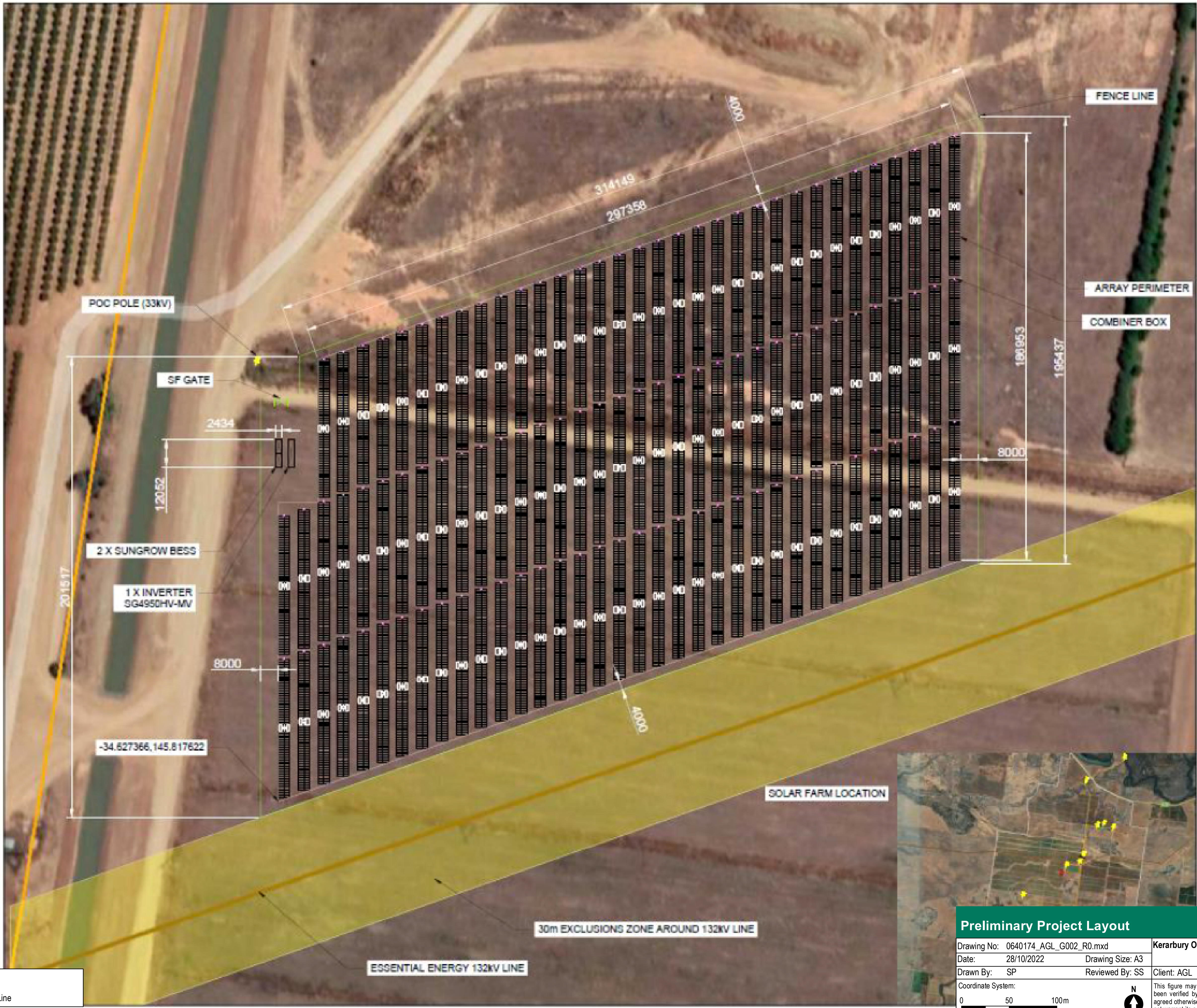

Legend

Fence Line

Preliminary Project Layout

F1-2

Drawing No: 0640174_AGL_G002_R0.mxd		Kerarbury Orchard Solar Farm & BESS
Date: 28/10/2022	Drawing Size: A3	
Drawn By: SP	Reviewed By: SS	Client: AGL
Coordinate System:		This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.

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2. LEGISLATION

Table 2.1 below provides a description of the relevant legislative context. This report addresses the objectives and requirements of the legislation as it relates to the identification of biodiversity and ecological values.

Table 2.1 Legislation applicable to the Kerarbury Solar Farm

Commonwealth Legislation

Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*

The *EPBC Act* requires approval of the Commonwealth Minister for the Environment for actions that are likely to have a significant impact on Matters of National Environmental Significance (MNES) as assessed in accordance with the EPBC Significant Impact Guidelines 1.1. The *EPBC Act* is administered by the Commonwealth Department of Agriculture, Water and the Environment (DAWE) and lists threatened species, ecological communities and other MNES. Any proposed action that is expected to have an impact on MNES must be referred to the Minister for assessment under the *EPBC Act*, or assessed under the existing bilateral agreement, or accredited process between the Commonwealth and the State of New South Wales (NSW).

As outlined within Section 5, **no MNES have been identified or are likely to occur within the Project site and the proposed solar farm is unlikely to trigger a referral under the *EPBC Act***.

NSW Statutory Legislation and Guidelines

***Biodiversity Conservation Act 2016* (BC Act)**

The NSW *Biodiversity Conservation Act 2016* (*BC Act*) establishes mechanisms for:

- the management and protection of listed threatened species of native flora and fauna (excluding fish and marine vegetation) and threatened ecological communities (TECs),
- the listing of threatened species, TECs and key threatening processes,
- the development and implementation of recovery and threat abatement plans,
- the declaration of critical habitat,
- the consideration and assessment of threatened species impacts in development assessment process; and
- Biodiversity Offsets Scheme (BOS), including the Biodiversity Values Map and Biodiversity Assessment Method (BAM) to identify serious and irreversible impacts (SAII).

The *BC Act* establishes a regulatory framework for assessing and offsetting biodiversity impacts on proposed developments. Where development consent is granted, the authority may impose as a condition of consent an obligation to retire a number and type of biodiversity credits determined under the Biodiversity Assessment Method (BAM). A Biodiversity Values Map and Biodiversity Offsets Scheme Entry Threshold (BOSET) tool are available to identify the presence of mapped biodiversity values within land proposed for development as well as the clearing thresholds that would trigger application of the BAM. A review of the BOSET confirms that no areas of high biodiversity values are currently mapped within the Project site and provided that less than 1 ha of native vegetation is to be cleared, the Project will not exceed the BOS threshold and does not trigger entry into the BOS.

The environmental impact of development proposals that do not exceed the Biodiversity Offset Scheme Threshold and will not otherwise have a significant impact on biodiversity values as assessed by the test of significance as set out in s7.3 of the *BC Act* will continue to be assessed under s79C of the *Environmental Planning and Assessment Act 1979*.

Environmental Planning and Assessment Act 1979

Environmental Planning and Assessment Act 1979 (*EP&A Act*) and the *Environmental Planning and Assessment Regulation 2000* (*EP&A Regulation*) provide the framework for development and environmental assessment in NSW. The *EP&A Act* contains a number of different planning approval pathways for the assessment of development proposals in NSW, including Part 4 (typically private developments), Part 4.1 (State Significant Developments), Part 5 (typically public infrastructure developments), and Part 5.1 (State Significant Infrastructure). The proposed Solar Farm will be assessed under Part 4 of the *EP&A Act*, and Murrumbidgee Council is the determining authority for the purposes of the *Act*.

Local Land Services Act 2013

The *Local Land Services Act 2013* (*LLS Act*) regulates the management of vegetation on rural land. The amendments to the *LLS Act* have resulted in a change to the criteria for native vegetation clearing. There are now three different land categories for clearing on rural land:

- Category 1 – 'Exempt land' which will not be subject to clearing approval,
- Category 2 – 'Regulated Land' on which clearing of native vegetation may be carried out with or without approval in accordance with an 'allowable activity' or 'code' under the *LLS Act*, and
- 'Excluded Land' – Land not categorised in the Regulatory Maps and to which the *LLS Act* does not apply.

A review of the Native Vegetation Regulatory Map (Regulatory Map) (accessed 26th October 2022) confirms that the Project site is not mapped as either exempt or regulated land and assessment under Part 4 of the *EP&A Act* will apply.

Biosecurity Act 2015

Under the NSW *Biosecurity Act 2015* all landowners have a responsibility to control noxious weeds on their property. This is referred to as a General Biosecurity Duty.

The General Biosecurity Duty states "*Any person who deals with biosecurity matter or a carrier and who knows, or ought reasonably to know, the biosecurity risk posed or likely to be posed by the biosecurity matter, carrier or dealing has a biosecurity duty to ensure that, so far as is reasonably practicable, the biosecurity risk is prevented, eliminated or minimised*." The general biosecurity duty applies to all weeds listed in Schedule 3 of the *Biosecurity Act*. Primary weeds have been identified in different Local Government Areas (LGA) due to the level of threat infestation they represent, some of the Weeds of National Significance (WoNS) are also listed as Primary Weeds in LGAs.

A strategic plan for each weed will be required (if present) to define responsibilities and identify strategies and actions to control the weed species. These can be downloaded from:
http://www.environment.gov.au/biodiversity/invasive/weeds/weeds/lists/wons.html

No Primary Weeds or WoNS have been recorded within the Project site.

Fisheries Management Act 1994

The *Fisheries Management Act 1994* provides for the conservation, protection and management of fisheries, aquatic systems and habitats in NSW. Similar to the BC Act, the *Fisheries Management Act 1994* lists threatened species, populations and ecological communities of fish and marine vegetation.

No aquatic or riparian habitats are available within the Project site. The closest habitat mapped within the NSW Department of Primary Industries, Fisheries Spatial Data Portal (accessed 26th October 2022) is the Gum Creek, approximately 2.8 km northwest of the Project site.

The Project will not result in any direct or indirect impacts on any aquatic habitats and will not require a permit under the *Fisheries Management Act 1994*.

SEPP (Biodiversity and Conservation) 2021

The *State Environmental Planning Policy (Biodiversity and Conservation) 2012* commenced on 1st March 2022. The *SEPP (Biodiversity and Conservation) 2021* consolidates, transfers and repeals provisions of the following 11 SEPPS:

- *SEPP (Vegetation in Non-Rural Areas) 2017,*
- *SEPP (Koala Habitat Protection) 2020,*
- *SEPP (Koala Habitat Protection) 2021,*
- *Murray Regional Environmental Plan No 2—Riverine Land,*
- *SEPP 19—Bushland in Urban Areas,*
- *SEPP No 50—Canal Estate Development,*
- *SEPP (Sydney Drinking Water Catchment) 2011,*
- *Sydney Regional Environmental Plan No 20—Hawkesbury-Nepean River (No 2—1997),*
- *Sydney Regional Environmental Plan (Sydney Harbour Catchment) 2005,*
- *Greater Metropolitan Regional Environmental Plan No 2—Georges River Catchment,* and
- *Willandra Lakes Regional Environmental Plan No 1—World Heritage Property.*

The Project site has been completely cleared of native vegetation and does not invoke any areas of concern highlighted *within SEPP (Biodiversity and Conservation) 2021*. No trees will be impacted by the proposed works and the provisions of the SEPP do to apply.

3. METHODOLOGY

3.1 Desktop Review

The desktop review included analysis of the following online resources:

- NSW Threatened Biodiversity Data Collection, including the Wildlife Atlas (BioNET), Vegetation Information System (VIS) database and threatened species profiles. Accessed on 26th October 2022;
- Results of the Commonwealth EPBC Act Protected Matters Search Tool (PMST) identifying threatened species and communities with potential to occur within the locality (10 km buffer around the Project boundary). Accessed on 26th October 2022;
- NSW SEED mapping to identify Plant Community Types (PCT), listed threatened species or communities or known or likely to occur at the Project site; Mitchell Landscapes, map of interim Biographic Regionalisation of Australia (IBRA) version 7. Accessed on 26th October 2022;
- Biodiversity Offset Scheme Entry Threshold (BOSET) mapping, version 8. Accessed on 26 October 2022via https://www.lmbc.nsw.gov.au/Maps/index.html?viewer=BOSETMap;
- Atlas of Living Australia (ALA) database. Accessed on 26th October 2022; and
- Local Government databases.

3.2 Field Surveys

A one-day site visit was undertaken by Elspeth Mackenzie, ERM Principal Consultant, on Wednesday 5 October 2022, representing a total of 8 person hours.

The purpose of the site visit was to identify the presence of important biological values within the Project site. Important biological values included:

- The presence of threatened fauna and flora species, or supporting habitat;
- Threatened ecological communities; and
- Habitat and resources considered important for threatened species or ecological communities.

Assessments targeted potential threatened flora species, koala habitat, hollow bearing trees, and native grasslands. Fauna observations were undertaken opportunistically across the duration of the field survey. Survey methodologies were designed to rapidly assess biodiversity values and were not undertaken in accordance with the NSW Biodiversity Assessment Method (BAM).

3.3 Likelihood of Occurrence

Consistent with the accepted approach for biodiversity assessment, a likelihood of occurrence assessment was undertaken, informed by desktop sources and the results of the field survey. Desktop sources identified a number of fauna species listed under the EPBC Act and BC Act that have been recorded previously or are predicted to occur within a 10 km buffer of the Project site. The likelihood of occurrence approach refines the desktop generated list using site-specific and specific-species habitat information. Desktop sources are indicative only and likelihood rankings, particularly in regard to the presence of preferred habitat, are conservative. The assessment ranks the likelihood of the species occurring within the Project site through analysis of species distribution information and the presence of specific habitat attributes as identified through the desktop analysis and field survey. The criteria applied are outlined in Table 3.1.

Table 3.1 Likelihood of Occurrence Criteria

	Preferred habitat exists	Suitable habitat exists[1]	Habitat does not exist[2]
Records within the Project site (based field investigations)	Known	Known	Known
Records in the Locality[3]	Likely	Potential	Unlikely
No records in the Locality, but the Project site is within known distribution	Potential	Unlikely	Unlikely
No records in the Locality, and the Project site is outside of distribution	Unlikely	Unlikely	Unlikely

1. *Habitat may be considered suitable, but not preferred because: some desired habitat features may be present, but not all; habitat may have poor connectivity; or habitat may be known to be disturbed.*
2. *Based on sources reviewed and/ or field survey results.*
3. *'Locality' refers to a 10 km buffer of the Project site.*

3.4 Assessment of Significance

As the Project does not exceed the biodiversity offsets scheme threshold (refer to Section 2), the test of significance applies.

Section 7.2 of the *BC Act* provides that development under the *EP&A Act* is likely to significantly affect threatened species if:

a) it is likely to significantly affect threatened species or ecological communities, or their habitats, according to the test in section 7.3, or

b) the development exceeds the biodiversity offsets scheme threshold if the biodiversity offsets scheme applies to the impacts of the development on biodiversity values, or

c) it is carried out in a declared area of outstanding biodiversity value.

The test has been applied to those threatened species and ecological communities that have been recorded or are considered likely to occur and which may be affected either directly or indirectly by the proposed development or activity (refer to Appendix A).

A species does not have to be considered as part of the test of significance if recent and reliable data, relating to the site and derived from field surveys consistent with DPIE guidelines, clearly show that the species:

1) does not occur in the study area, and

2) will not use on-site habitats on occasion, and

3) will not be influenced by off-site impacts of the proposal.

An Assessment of Significance (AOS), also referred to as a test of significance, was not undertaken for the Project, as no threatened species or communities have been identified as having the potential to be impacted by the proposed development.

3.5 Assumptions and Limitations

The site and desktop assessment undertaken provides an overview of the biodiversity values that exist within the Project site. The one-day survey was undertaken across the site to gain a general understanding of the types of species and habitat features that occur.

The absence of a species from a database list or observational studies does not confirm its absence from the Project site.

The lack of existing records from databases may indicate a low historic sampling effort in the region, as opposed to an absence of species. Similarly, the timing of the October 2022 site visit precludes the detection of a number of migratory and wader species that are typically absent from the area at that time of the year. It must also be noted that it was raining on the day of the survey, therefore, some fauna species were likely to have been seeking shelter.

To overcome these limitations, the likelihood of occurrence is based on the precautionary approach and identify species that have the potential to occur rather than relying on species sightings alone.

4. RESULTS

The general landscape within the locality is largely cleared, agricultural landscape dominated by heavily grazed pastures. The site contains several dams and irrigation lines due to its agricultural use as an orchard.

Key landscape features and biodiversity values within the Project site are summarised in Table 4.1 below.

Table 4.1 Summary of Landscape Features and Biodiversity Values

Landscape Feature	Summary Notes
IBRA Bioregion	NSW Riverina Bioregion, Murrumbidgee Subregion (RIV02)
Vegetation	The Project site is highly disturbed and completed cleared due to a long history of intensive agricultural and farming practices. The site is almost densely populated by Barley grass (*Hordeum* spp.) and Shaftal Clover (*Trifolium resupinatum*) and has a limited diversity of other native and introduced species including small native shrubs, herbs, and weeds. There are no trees remaining on the Project site, with the exception of scattered Weeping Myall *Acacia pendula* trees.
Threatened ecological communities	Due to the historical land use, there are no Threatened Ecological Communities (TEC) on the Project site. Potential TEC within the broader locality include: ■ 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 NSW), ■ Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions, ■ Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions, ■ *Allocasuarina luehmannii* Woodland in the Riverina and Murray-Darling Depression Bioregions, ■ Sandhill Pine Woodland in the Riverina, Murray-Darling Depression and NSW South Western Slopes bioregions, and ■ *Acacia melvillei* Shrubland in the Riverina and Murray-Darling Depression bioregions.
Rivers, Streams and Estuaries	There are no rivers, streams or estuaries within the Project site. Cooinbill Creek runs along the southern boundary of the site and Gum Creek runs across the northern boundary of the site. The site contains several dams and irrigation lines.

Landscape Feature	Summary Notes
Threatened species	There are no threatened species recorded within the Project site. Under the BC Act, six bird species have been recorded within the nearby Murrumbidgee National Park and surrounds (approximately 3.8 km to the northeast): ■ Blue-billed Duck (*Oxyura australis*) - Vulnerable under the BC Act, ■ White-bellied Sea-Eagle (*Haliaeetus leucogaster*) - Vulnerable under the *BC Act*, ■ Black Falcon (*Falco subniger*) - Vulnerable under the BC Act, ■ Superb Parrot (*Polytelis swainsonii*) – Vulnerable under the *BC Act*, ■ Speckled Warble (*Chthonicola sagittate*) - Vulnerable under the BC Act, ■ Grey-crowned Babbler (eastern subspecies) (*Pomatostomus temporalis temporalis*) – Vulnerable under the *BC Act*, and ■ Diamond Firetail (*Stagonopleura guttata*) – Vulnerable under the *BC Act*. Based on the results of the desktop assessment and site survey, there is potential for the White-bellied Sea-Eagle, Black Falcon and the Diamond Firetail to visit the wider site, however, due there being no impact by the proposed development an Assessment of Significance was not necessary.
Areas of Geological Significance	There are no karst, caves, crevices, cliffs or other areas of geological significance within the Project site.
Areas of Outstanding Biodiversity Value (AOBV)	There are no Areas of Outstanding Biodiversity Value (AOBV) within the Project site.
High Biodiversity Values Map	The Project site is not located within any state, national or internationally protected areas.
Hollows and Hollow Bearing Trees	There are no hollow bearing trees located within the Project site.

4.1 Vegetation

The NSW State Vegetation Type Map (SVTM) identified two Plant Community Types (PCTs) within the Project site (Figure 4.1):

- PCT 0: Non-native vegetation (PCT 0); and
- PCT 44: Forb-rich Speargrass - Windmill Grass - White Top grassland of the Riverina.

An addition two PCTs were identified in the wider site locality, via the SVTM (Figure 4.1), these include:

- PCT 13: Black Box - Lignum woodland wetland of the inner floodplains in the semi-arid (warm) climate zone (mainly Riverina Bioregion and Murray Darling Depression Bioregion); and
- PCT 19: Cypress Pine woodland of source-bordering dunes mainly on the Murray and Murrumbidgee River floodplains.

NSW State Vegetation Type Map (SVTM)

F4-1

Drawing No: 0640174_AGL_G003_R0.mxd		Kerarbury Orchard Solar Farm & BESS
Date: 28/10/2022	Drawing Size: A3	
Drawn By: SP	Reviewed By: SS	Client: AGL
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The Project site is highly disturbed and completely cleared due to a long history of intensive agricultural and farming practices, therefore the PCTs identified in the SVTM are no longer likely to exist within the project locality. The site is almost exclusively made up of non-native Barley grass (*Hordeum spp.)* and Shaftal Clover (*Trifolium resupinatum*) and has a limited diversity of native ground cover species (Figure 4.2). There are no trees remaining on the Project site, with the exception occasional Weeping Myall located outside the footprint for the proposed development.

Figure 4.2 Vegetation within the Project Site

A total of 17 flora species were identified within the Project site. A full list of species recorded during the field surveys is provided in Table 4.2. No threatened flora species were identified.

Of the 17 species identified, 11 of these are invasive flora species. *Echium plantagineum* is not restricted in accordance with State Legislation, however, it is considered a Noxious Weed in NSW.

Table 4.2 Flora identified during October 2022 Field Survey

Scientific name	Common name	EPBC Act	BC Act
Acacia pendula	Weeping Myall	-	-
**Avena spp.*	Wild Oats	-	-
**Bromus diandrus*	Great Brome Grass	-	-
Calotis cuneifolia	Purple Burr-daisy	-	-
Chrysocephalum apiculatum	Common Everlasting	-	-
**Cirsium vulgare*	Bull Thistle	-	-
**Echium plantagineum*	Paterson's Curse	-	-
**Hirschfeldia incana*	Hairy Brassica	-	-
**Hordeum spp.*	Barley Grass	-	-
**Malva parviflora*	Small-flowered Mallow	-	-
**Marrubium vulgare*	White Horehound	-	-
Sclerolaena birchii	Galvanised Burr	-	-
Sida spp.	-	-	-
**Sonchus oleraceus*	Milk Thistle	-	-
**Trifolium arvense var. arvense*	Haresfoot Clover	-	-
**Trifolium resupinatum*	Shaftal Clover	-	-
Typha orientalis	Bullrush	-	-

*Note: * denotes non-native species;*

4.2 Threatened Ecological Communities

Six (6) BC listed TECs are likely to occur within the broader locality.

- 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 NSW);
- Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions (Endangered);
- Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions (Endangered);
- *Allocasuarina luehmannii* Woodland in the Riverina and Murray-Darling Depression Bioregions (Endangered);
- Sandhill Pine Woodland in the Riverina, Murray-Darling Depression and NSW South Western Slopes bioregions (Endangered); and
- *Acacia melvillei* Shrubland in the Riverina and Murray-Darling Depression bioregions (Endangered).

No EPBC listed TECs were identified during the desktop study or field surveys.

During field surveys it was confirmed that the Project site has been historically cleared and subject to a range of disturbances including intensive agricultural practices and livestock grazing.

<u>The project site does not consist of vegetation considered a TEC under the *EPBC Act* or the *BC Act*.</u>

4.3 Habitat Values

During the field surveys there were no habitat features or high biodiversity values identified.

There were no large trees, dense vegetation, fallen timber, surface rocks or burrows observed within the Project site.

4.4 Fauna Species Recorded

A total of one (1) mammal species was recorded during the October 2022 field survey (Table 4.3). There were zero (0) birds, insects, reptiles, amphibians, or invasive fauna species identified during the field survey.

Fauna species were identified opportunistically throughout the survey, noting that no targeted surveys were undertaken.

Table 4.3 Fauna identified during October 2021 Field Survey

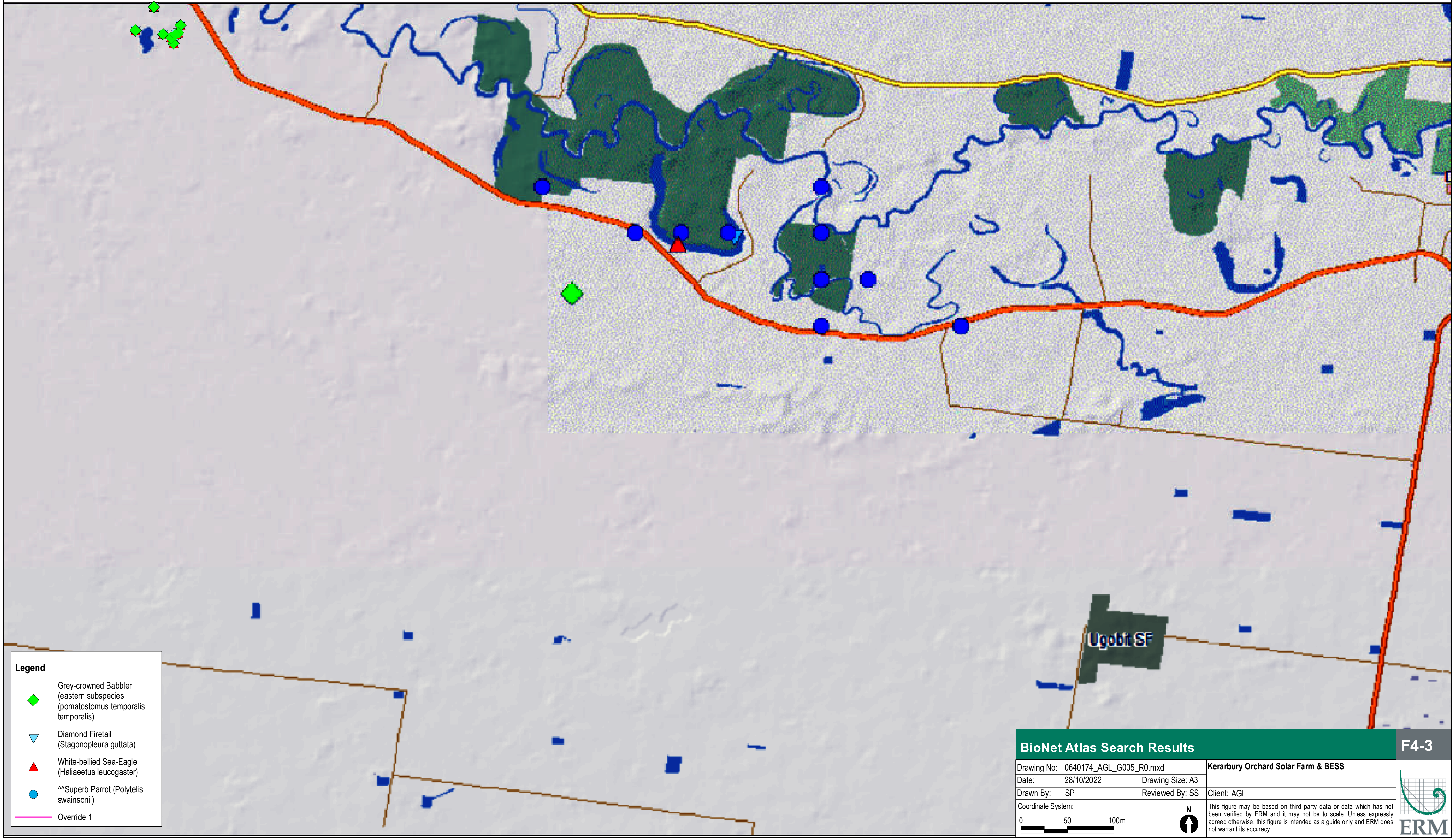
Scientific name	Common name	EPBC Act	BC Act
Mammal			
Macropus giganteus	Eastern Grey Kangaroo	-	-

4.5 Threatened Species

No listed threatened species or ecological communities have been recorded within the Project site.

There are six (6) threatened bird species that have been recorded adjacent to the Project site, within the Murrumbidgee National Park and surrounds (approximately 3.8 km to the northeast) (Figure 4.3 and Figure 4.4):

- Blue-billed Duck (*Oxyura australis*) - Vulnerable under the BC Act;
- White-bellied Sea-Eagle (*Haliaeetus leucogaster*) - Vulnerable under the *BC Act*;
- Black Falcon (*Falco subniger*) - Vulnerable under the BC Act;
- Superb Parrot (*Polytelis swainsonii*) – Vulnerable under the *BC Act*;
- Speckled Warbler (*Chthonicola sagittate*) - Vulnerable under the BC Act;
- Grey-crowned Babbler (eastern subspecies) (*Pomatostomus temporalis temporalis*) – Vulnerable under the *BC Act*; and
- Diamond Firetail (*Stagonopleura guttata*) – Vulnerable under the *BC Act*.



BioNet Atlas Search Results

F4-3

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Drawn By: SP	Reviewed By: SS	Client: AGL
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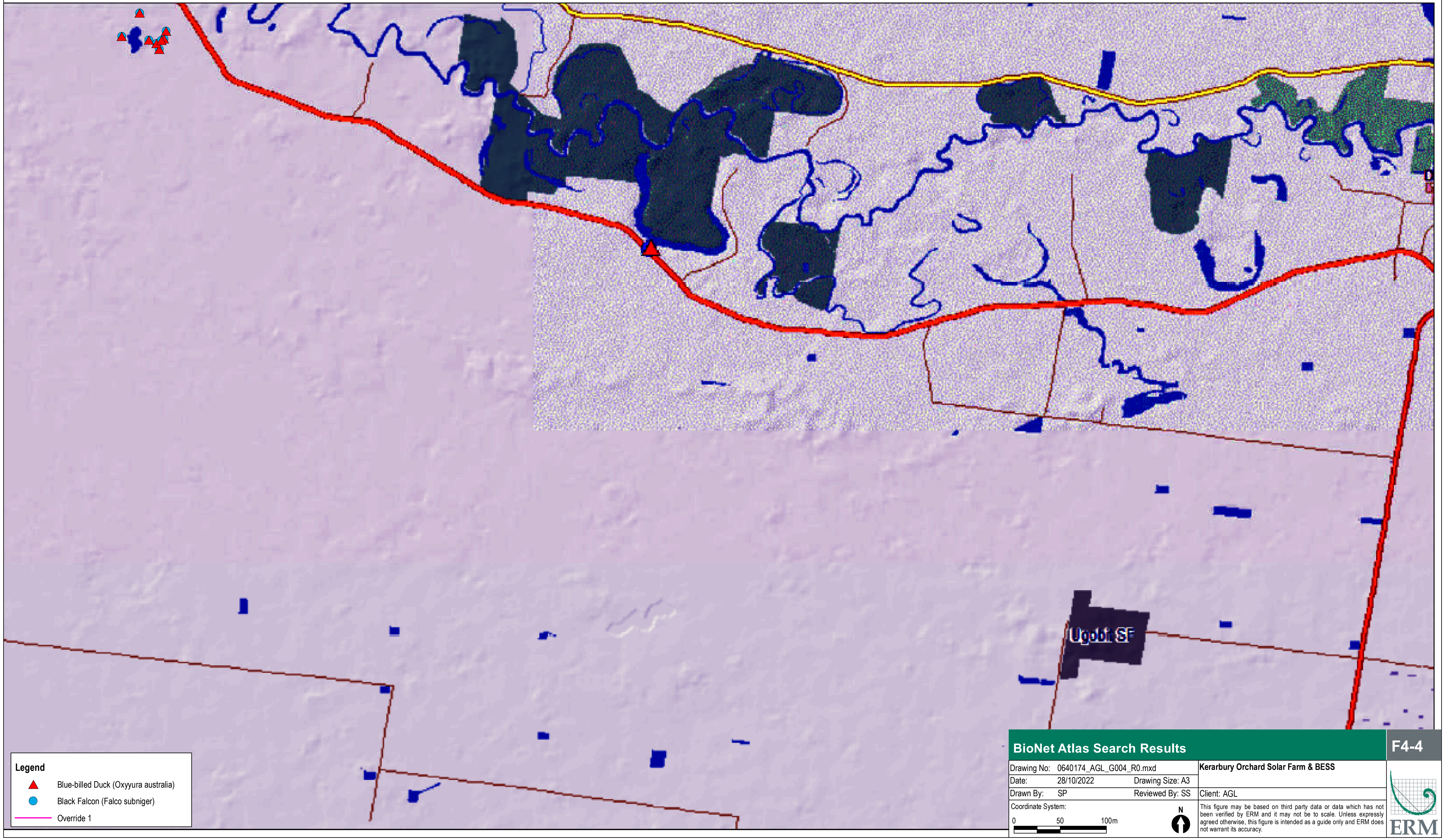

BioNet Atlas Search Results

F4-4

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Coordinate System:	0 50 100m N	This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.

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5. CONSIDERATION OF MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE (MNES)

Based on the results of the desktop assessment and the field survey, a preliminary assessment of Matters of National Environmental Significance (MNES) within the Project site has been provided in Table 5.1.

Table 5.1 MNES within the Project Site

MNES	Relevance to the Project site
World heritage properties	There are no world heritage properties within the Project site.
National heritage properties	There are no national heritage properties within the Project site.
Ramsar wetlands of international importance	There are no wetlands of international importance associated with the Project site and the 10 km radius applied for the desktop study. Four Ramsar sites were identified in the PMST, including: ■ The Coorong, and Lakes Alexandrina and Albert Wetland (500 – 600 km upstream from Ramsar site), ■ Banrock Station Wetland Complex (400 – 500 km upstream from Ramsar site), ■ Riverland (400 – 500 km upstream from Ramsar site) and, ■ Hattah-Kulkyne Lakes (200 - 300km upstream from Ramsar site). There will be no direct or indirect impacts to these Ramsar wetlands as a result of the proposed development, due to the distance they are located from the Project site and the negligible amount of disturbance to exotic ground covers in the catchments from the proposed development.
Listed threatened species and communities	No EPBC Act listed threatened species or ecological communities have been recorded within the Project site. Four Threatened Ecological Communities were recorded in the locality of the wider site, however, due to the agricultural history of the area none were found on the Project site, these include: ■ Weeping Myall Woodlands, ■ Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia, ■ Buloke Woodlands of the Riverina and Murray-Darling Depression Bioregions, and ■ White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland. The MNES search revealed 23 species to likely exist in the locality of the wider site (10 km radius). Due to the site being mostly cleared of native habitat it is unlikely that site would be inhabited by the species. These species will not be directly impacted by the proposed solar farm development and additional mitigation measures have been recommended to ensure no indirect impacts occur within the identified priority management area.
Migratory species	Not identified within the locality of the Project site
Commonwealth marine area	Not identified within the locality of the Project site
The Great Barrier Reef Marine Park	Not applicable to this Proposal
Nuclear actions	Not applicable to this Proposal
Water resources	Not applicable to this Proposal

Under the EPBC Act a referral is required to the Australian Government Department of Climate Change, Energy, the Environment and Water (DCCEW). For projects, or ‘actions’, that are likely to have a significant impact on a MNES or the environment on Commonwealth land. The Australian Government Minister for the Environment determines whether or not the Proposal will need formal assessment and approval under the EPBC Act. If so, that Proposal is a controlled action under the EPBC Act.

The Proposal is not considered likely to affect MNES or environment on Commonwealth land.

6. SUMMARY AND RECOMMENDATIONS

Based on the results of the desktop surveys and one day field survey, the Project site does not contain any areas of high biodiversity value and is characterised by completed cleared and heavily grazed pastures. There were no large trees, dense vegetation, fallen timber, surface rocks, animal burrows or other habitat features observed during the field survey.

No listed threatened species, their habitats, or ecological communities, as defined under the BC Act or EPBC Act have been recorded within the Project site.

While adverse impacts from the Project to biodiversity values are unlikely, the Project can further reduce and/ or avoid potential impacts during the design and construction phase by employing the following recommended measures and controls:

- Ensure sediment and erosion control measures are established during the construction phase of the project;
- The long-term management of weeds should be considered as part of the planning proposal and future development of this site; and
- Vehicle hygiene protocols should be established and will assist to control the movement of both pathogens and weeds.

7. REFERENCES

NSW National Parks and Wildlife Service (2003) *The Bioregions of New South Wales: their biodiversity, conservation and history* NSW National Parks and Wildlife Service Hurstville.

APPENDIX A LIKELIHOOD OF OCCURRENCE

Type	Scientific Name	Common Name	Status (BC Act)	Status (EPBC Act)	BioNet Records with 10 km	Habitat Summary	Likelihood of Occurrence	Observed During Field Survey
Birds	*Oxyura australis*	Blue-billed Duck	V, P	-	1	The Blue-billed Duck is endemic to south-eastern and south-western Australia. It is widespread in NSW, but most common in the southern Murray-Darling Basin area. Birds disperse during the breeding season to deep swamps up to 300 km away. It is generally only during summer or in drier years that they are seen in coastal areas. The Blue-billed Duck prefers deep water in large permanent wetlands and swamps with dense aquatic vegetation. The species is completely aquatic, swimming low in the water along the edge of dense cover. Blue-billed Ducks will feed by day far from the shore, particularly if dense cover is available in the central parts of the wetland. Blue-billed Ducks are partly migratory, with short-distance movements between breeding swamps and overwintering lakes with some long-distance dispersal to breed during spring and early summer. Young birds disperse in April-May from their breeding swamps in inland NSW to non-breeding areas on the Murray River system and coastal lakes.	Considering the records within the locality but the lack of suitable habitat, this species is **unlikely** to occur within the project boundary.	No

Type	Scientific Name	Common Name	Status (BC Act)	Status (EPBC Act)	BioNet Records with 10 km	Habitat Summary	Likelihood of Occurrence	Observed During Field Survey
Bird	*Numenius madagascariensis*	Eastern Curlew, Far Eastern Curlew	-	CE	0 (MNES Results)	The Eastern Curlew is a wader bird with primarily coastal distribution in Australia. In NSW the species occurs across the entire coast but is mainly found in estuaries such as the Hunter River, Port Stephens, Clarence River, Richmond River and ICOLLs of the south coast. It generally occupies coastal lakes, inlets, bays and estuarine habitats, and in New South Wales is mainly found in intertidal mudflats and sometimes saltmarsh of sheltered coasts. Occasionally, the species occurs on ocean beaches (often near estuaries), and coral reefs, rock platforms, or rocky islets. It forages in or at the edge of shallow water, occasionally on exposed algal mats or waterweed, or on banks of beach-cast seagrass or seaweed. It roosts on sandy spits and islets, especially on dry beach sand near the high-water mark, and among coastal vegetation including low saltmarsh or mangroves. May also roost on wooden oyster leases or other similar structures. The Eastern Curlew is carnivorous, mainly eating crustaceans (including crabs, shrimps and prawns), small molluscs, as well as some insects.	Considering the lack of records within the locality and the lack of suitable habitat, this species is **unlikely** to occur within the project boundary.	No
Bird	*Pedionomus torquatus*	Plains-wanderer	E	CE	0 (MNES Results)	Plains-wanderers live in semi-arid, lowland native grasslands that typically occur on hard red-brown soils. These grasslands support a high diversity of plant species, including a number of state and nationally threatened species. Habitat structure appears to play a more important role than plant species composition. Preferred habitat of the Plains-wanderer typically comprises 50% bare ground, 10% fallen litter, and 40% herbs, forbs and grasses. Most of the grassland habitat of the Plains-wanderer is <5 cm high, but some vegetation up to a maximum of 30 cm is important for concealment, as long as grass tussocks are spaced 10-20 cm apart. During prolonged drought, the denudation of preferred habitats may force birds into marginal denser and taller grassland habitats that become temporarily suitable.	Considering the lack of records within the locality and the lack of suitable habitat, this species is **unlikely** to occur within the project boundary.	No
Bird	*Calidris ferruginea*	Curlew Sandpiper	E	CE, Mi, Ma	0 (MNES Results)	The Curlew Sandpiper is a small migratory shorebird that visits Australia during its non-breeding season. The species is present in Australia between August and November. The Curlew Sandpiper is distributed around most of the Australian coastline (including Tasmania). It occurs along the entire coast of NSW, particularly in the Hunter Estuary, and sometimes in freshwater wetlands in the Murray-Darling Basin. Inland records are probably mainly of birds pausing for a few days during migration. It generally occupies littoral and estuarine habitats, and in New South Wales is mainly found in intertidal mudflats of sheltered coasts. It also occurs in non-tidal swamps, lakes and lagoons on the coast and sometimes inland. It forages in or at the edge of shallow water, occasionally on exposed algal mats or waterweed, or on banks of beach-cast seagrass or seaweed. It roosts on shingle, shell or sand beaches; spits or islets on the coast or in wetlands; or sometimes in salt marsh, among beach-cast seaweed, or on rocky shores. Curlew Sandpipers are omnivorous, feeding on worms, molluscs, crustaceans, insects and some seeds.	Considering the lack of records within the locality and the lack of suitable habitat, this species is **unlikely** to occur within the project boundary.	No
Bird	*Botaurus poiciloptilus*	Australasian Bittern	E	E	0 (MNES Results)	The Australasian Bittern is a large, stocky bird, reaching up to 75 cm in length. The species favours permanent freshwater wetlands with tall, dense vegetation, particularly bullrushes (*Typha* spp.) and spikerushes (*Eleocharis* spp.). They hide during the day amongst dense reeds or rushes and feed mainly at night on frogs, fish, yabbies, spiders, insects and snails. Breeding occurs in summer from October to January; nests are built in secluded places in densely vegetated wetlands on a platform of reeds; there are usually six olive-brown eggs to a clutch.	Considering the lack of records within the locality and the lack of suitable habitat, this species is **unlikely** to occur within the project boundary	No

Type	Scientific Name	Common Name	Status (BC Act)	Status (EPBC Act)	BioNet Records with 10 km	Habitat Summary	Likelihood of Occurrence	Observed During Field Survey
Bird	*Rostratula australis*	Australian Painted Snipe	E	E	0 (MNES Results)	The Australian Painted Snipe is small freshwater wader. Prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber. Nests on the ground amongst tall vegetation, such as grasses, tussocks or reeds. The nest consists of a scrape in the ground, lined with grasses and leaves. Breeding is often in response to local conditions; generally occurs from September to December. Incubation and care of young is all undertaken by the male only. Forages nocturnally on mud-flats and in shallow water. Feeds on worms, molluscs, insects and some plant-matter.	Considering the lack of records within the locality and the lack of suitable habitat, this species is **unlikely** to occur within the project boundary	No
Bird	*Leipoa ocellata*	Malleefowl	E	V	0 (MNES Results)	The stronghold for this species in NSW is the mallee in the south west centred on Mallee Cliffs NP and extending east to near Balranald and scattered records as far north as Mungo NP. West Predominantly inhabit mallee communities, preferring the tall, dense and floristically-rich mallee found in higher rainfall (300 - 450 mm mean annual rainfall) areas. Utilises mallee with a spinifex understorey, but usually at lower densities than in areas with a shrub understorey. Less frequently found in other eucalypt woodlands, such as Inland Grey Box, Ironbark or Bimble Box Woodlands with thick understorey, or in other woodlands such dominated by Mulga or native Cypress Pine species. Prefers areas of light sandy to sandy loam soils and habitats with a dense but discontinuous canopy and dense and diverse shrub and herb layers. of the Darling River a population also occurs in the Scotia mallee including Tarawi NR and Scotia Sanctuary, and is part of a larger population north of the Murray River in South Australia.	Considering the lack of records within the locality and the lack of suitable habitat, this species is **unlikely** to occur within the project boundary	No
Bird	*Grantiella picta*	Painted Honeyeater	V	V	0 (MNES Results)	The Painted Honeyeater inhabits Boree/ Weeping Myall (Acacia pendula), Brigalow (A. harpophylla) and Box-Gum Woodlands and Box-Ironbark Forests. A specialist feeder on the fruits of mistletoes growing on woodland eucalypts and acacias. Prefers mistletoes of the genus Amyema. Insects and nectar from mistletoe or eucalypts are occasionally eaten. Nest from spring to autumn in a small, delicate nests hanging within the outer canopy of drooping eucalypts, she-oak, paperbark or mistletoe branches.	Considering the lack of records within the locality and the lack of suitable habitat, this species is **unlikely** to occur within the project boundary.	No
Bird	*Falco hypoleucos*	Grey Falcon			0 (MNES Results)	The Grey Falcon is sparsely distributed in NSW, chiefly throughout the Murray-Darling Basin, with the occasional vagrant east of the Great Dividing Range. The breeding range has contracted since the 1950s with most breeding now confined to arid parts of the range. There are possibly less than 5000 individuals left. Population trends are unclear, though it is believed to be extinct in areas with more than 500mm rainfall in NSW. The Grey Flacon is usually restricted to shrubland, grassland and wooded watercourses of arid and semi-arid regions, although it is occasionally found in open woodlands near the coast. Preys primarily on birds, especially parrots and pigeons, using high-speed chases and stoops; reptiles and mammals are also taken. Like other falcons it utilises old nests of other birds of prey and ravens, usually high in a living eucalypt near water or a watercourse; peak laying season is in late winter and early spring; two or three eggs are laid.	Considering the lack of records within the locality and the lack of preferred habitat, this species is **unlikely** to occur within the project boundary	No

Type	Scientific Name	Common Name	Status (BC Act)	Status (EPBC Act)	BioNet Records with 10 km	Habitat Summary	Likelihood of Occurrence	Observed During Field Survey
Bird	*Chthonicola sagittata*	Speckled Warbler	V, P	-	1 ALA Recording	The Speckled Warbler has a patchy distribution throughout south-eastern Queensland, the eastern half of NSW and into Victoria, as far west as the Grampians. The species is most frequently reported from the hills and tablelands of the Great Dividing Range, and rarely from the coast. There has been a decline in population density throughout its range, with the decline exceeding 40% where no vegetation remnants larger than 100ha survive. The Speckled Warbler lives in a wide range of *Eucalyptus* dominated communities that have a grassy understorey, often on rocky ridges or in gullies. Typical habitat would include scattered native tussock grasses, a sparse shrub layer, some eucalypt regrowth and an open canopy. Large, relatively undisturbed remnants are required for the species to persist in an area.	Considering the records within the locality but the lack of suitable habitat within the Project site, this species is **unlikely** to occur within the project boundary.	No
Birds	*Haliaeetus leucogaster*	White-bellied Sea-Eagle	V, P	-	2	The White-bellied Sea-eagle is a migratory species that is distributed around the Australian coastline, including Tasmania, and well inland along rivers and wetlands of the Murray Darling Basin. In New South Wales it is widespread along the east coast, and along all major inland rivers and waterways. Habitats are characterised by the presence of large areas of open water including larger rivers, swamps, lakes, and the sea. Occurs at sites near the sea or seashore, such as around bays and inlets, beaches, reefs, lagoons, estuaries and mangroves; and at, or in the vicinity of freshwater swamps, lakes, reservoirs, billabongs and saltmarsh. Terrestrial habitats include coastal dunes, tidal flats, grassland, heathland, woodland, and forest (including rainforest).	Considering the records within the locality, the migratory nature of the species, the presence of suitable habitat, this species has the **potential** to occur within the project boundary although the intensive grazing and lack of any shelter habitat would deter this species.	No
Birds	*Falco subniger*	Black Falcon	V, P	-	1	The Black Falcon is widely, but sparsely, distributed in New South Wales, mostly occurring in inland regions. Some reports of 'Black Falcons' on the tablelands and coast of New South Wales are likely to be preferable to the Brown Falcon. In New South Wales there is assumed to be a single population that is continuous with a broader continental population, given that falcons are highly mobile, commonly travelling hundreds of kilometres (Marchant & Higgins 1993). The Black Falcon occurs as solitary individuals, in pairs, or in family groups of parents and offspring. The Black Falcon is known or predicted to occur in sub-regions of the Riverina Interim Biogeographic Regionalisation of Australia Region.	Considering the records within the locality, the migratory nature of the species, the presence of suitable habitat, this species has the **potential** to occur within the project boundary although the intensive grazing and lack of any shelter habitat would deter this species.	No
Birds	*Polytelis swainsonii*	Superb Parrot	V, P, 3	V	25	The Superb Parrot is found throughout eastern inland NSW. On the South-western Slopes their core breeding area is roughly bounded by Cowra and Yass in the east, and Grenfell, Cootamundra and Coolac in the west. Birds breeding in this region are mainly absent during winter, when they migrate north to the region of the upper Namoi and Gwydir Rivers. The other main breeding sites are in the Riverina along the corridors of the Murray, Edward and Murrumbidgee Rivers where birds are present all year round. The Superb Parrot inhabit Box-Gum, Box-Cypress-pine and Boree Woodlands and River Red Gum Forest. In the Riverina the birds nest in the hollows of large trees (dead or alive) mainly in tall riparian River Red Gum Forest or Woodland. On the South West Slopes nest trees can be in open Box-Gum Woodland or isolated paddock trees. Species known to be used are Blakely's Red Gum, Yellow Box, Apple Box and Red Box. Nest in small colonies, often with more than one nest in a single tree. Breed between September and January. May forage up to 10 km from nesting sites, primarily in grassy box woodland.	Considering the records within the locality but the lack of suitable habitat within the Project site, this species is **unlikely** to occur within the project boundary.	No

Type	Scientific Name	Common Name	Status (BC Act)	Status (EPBC Act)	BioNet Records with 10 km	Habitat Summary	Likelihood of Occurrence	Observed During Field Survey
Birds	*Pomatostomus temporalis temporalis*	Grey-crowned Babbler (eastern subspecies)	V, P	-	2	The Grey-crowned Babbler inhabits open Box-Gum Woodlands on the slopes, and Box-Cypress-pine and open Box Woodlands on alluvial plains. Woodlands on fertile soils in coastal regions. Flight is laborious so birds prefer to hop to the top of a tree and glide down to the next one. Birds are generally unable to cross large open areas. It lives in family groups that consist of a breeding pair and young from previous breeding seasons. A group may consist of up to fifteen birds. All members of the family group remain close to each other when foraging. It is insectivorous and it forages on the trunks and branches of eucalypts and other woodland trees or on the ground, digging and probing amongst litter and tussock grasses. It builds nests that are used as dormitory and roosting and uses them all year round. It breeds between July and February. Territory ranges from one to 50 hectares (usually ten hectares) and are defended all year.	Considering the records within the locality but the lack of suitable habitat, this species is **unlikely** to occur within the project boundary.	No
Birds	*Stagonopleura guttata*	Diamond Firetail	V, P	-	1	Diamond Firetails are found in open grassy woodland, heath and farmland or grassland with scattered trees. Diamond Firetails feed on the ground and generally eat ripe or partially ripe seeds and can be seen hopping around on the ground. They occasionally eat insects and their larvae. The Diamond Firetail builds a nest with green grass blades and stems and lines it with fine grasses and feathers. The nest can be found in trees and shrubs with dense foliage and has sometimes been known to build in the base of a hawk's nest	Considering the records within the locality and the presence of suitable habitat, this species has the **potential** to occur within the project boundary although the intensive grazing and lack of any shelter habitat would deter this species.	No
Fish	*Galaxias rostratus*	Flathead Galaxias, Beaked Minnow, Flat-headed Galaxias, Flat-headed Jollytail, Flat-headed Minnow	-	CE	0 (MNES Results)	Flathead Galaxias are found in still or slow moving water bodies such as wetlands and lowland streams. The species has been recorded forming shoals. They have been associated with a range of habitats including rock and sandy bottoms and aquatic vegetation. Flathead Galaxias spawn in spring and lay slightly adhesive demersal eggs. Flathead Galaxias, also known as Murray jollytail are a small native fish that are known from the southern part of the Murray Darling Basin. They have been recorded in the Macquarie, Lachlan, Murrumbidgee and Murray Rivers in NSW. They have not been recorded and are considered locally extinct in the lower Murray, Murrumbidgee, Macquarie and Lachlan Rivers. The species is now only known from the upper Murray River near Tintaldra and wetland areas near Howlong.	Considering the lack of records within the locality and the lack of suitable habitat, this species is **unlikely** to occur within the project boundary.	No
Fish	*Macquaria australasica*	Macquarie Perch	-	E	0 (MNES Results)	Originally widespread through the more midland–upland streams and rivers in the south-east corner of the Murray–Darling Basin, the distribution of this fish is now greatly reduced and patchy. Habitat for the Macquarie perch is bottom or mid-water in slow-flowing rivers with deep holes, typically in the upper reaches of forested catchments with intact riparian vegetation. Macquarie perch also do well in some upper catchment lakes. In some parts of its range, the species is reduced to taking refuge in small pools which persist in midland–upland areas through the drier summer periods.	Considering the lack of records within the locality and the lack of suitable habitat, this species is **unlikely** to occur within the project boundary.	No
Fish	*Maccullochella macquariensis*	Trout Cod	-	E	0 (MNES Results)	Trout Cod habitat is not well understood, but they appear to favour deep, fast flowing waters. Cover is vital, and they are often found sheltering under snags (woody debris).	Considering the lack of records within the locality and the lack of suitable habitat, this species is **unlikely** to occur within the project boundary.	No

Type	Scientific Name	Common Name	Status (BC Act)	Status (EPBC Act)	BioNet Records with 10 km	Habitat Summary	Likelihood of Occurrence	Observed During Field Survey
Fish	*Maccullochella peelii*	Murray Cod	-	V	0 (MNES Results)	It occurs naturally in the waterways of the Murray–Darling Basin in a wide range of warm water habitats that range from clear, rocky streams to slow flowing turbid rivers and billabongs. The upper reaches of the Murray and Murrumbidgee Rivers are considered too cold to contain suitable habitat.	Considering the lack of records within the locality and the lack of suitable habitat, this species is **unlikely** to occur within the project boundary.	No
Amphibian	*Crinia sloanei*	Sloane's Froglet	V	E	0 (MNES Results)	The Sloane's Froglet is a small ground dwelling frog. It is typically associated with periodically inundated areas in grassland, woodland and disturbed habitats. Sloane's Froglet has been recorded from widely scattered sites in the floodplains of the Murray-Darling Basin, with the majority of records in the Darling Riverine Plains, NSW South Western Slopes and Riverina bioregions in New South Wales.	Considering the lack of records within the locality and the lack of suitable habitat, this species is **unlikely** to occur within the project boundary.	No
Amphibian	*Litoria raniformis*	Growling Grass Frog, Southern Bell Frog, Green and Golden Frog, Warty Swamp Frog, Golden Bell Frog	E	V	0 (MNES Results)	Usually found in or around permanent or ephemeral Black Box/Lignum/Nitre Goosefoot swamps, Lignum/Typha swamps and River Red Gum swamps or billabongs along floodplains and river valleys. They are also found in irrigated rice crops, particularly where there is no available natural habitat. Breeding occurs during the warmer months and is triggered by flooding or a significant rise in water levels. The species has been known to breed anytime from early spring through to late summer/early autumn (Sept to April) following a rise in water levels. Outside the breeding season animals disperse away from the water and take shelter beneath ground debris such as fallen timber and bark, rocks, grass clumps and in deep soil cracks.	Considering the lack of records within the locality and the lack of suitable habitat, this species is **unlikely** to occur within the project boundary.	No
Mammal	*Phascolarctos cinereus* (combined populations of Qld, NSW and the ACT)	Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory)	E	E	0 (MNES Results)	The Koala is an arboreal marsupial that inhabits eucalypt woodlands and forests. The species feed on the foliage of more than 70 species of eucalypt and 30 non-eucalypt species.	Considering the lack of records within the locality and the lack of suitable habitat, this species is **unlikely** to occur within the project boundary.	No
Mammal	*Nyctophilus corbeni*	Corben's Long-eared Bat, South-eastern Long-eared Bat	V	V	0 (MNES Results)	Inhabits a variety of vegetation types, including mallee, bulloke Allocasuarina leuhmanni and box eucalypt dominated communities, but it is distinctly more common in box/ironbark/cypress-pine vegetation that occurs in a north-south belt along the western slopes and plains of NSW and southern Queensland. Roosts in tree hollows, crevices, and under loose bark. Slow flying agile bat, utilising the understorey to hunt non-flying prey - especially caterpillars and beetles - and will even hunt on the ground. Mating takes place in autumn with one or two young born in late spring to early summer.	Considering the lack of records within the locality and the lack of suitable habitat, this species is **unlikely** to occur within the project boundary.	No

Type	Scientific Name	Common Name	Status (BC Act)	Status (EPBC Act)	BioNet Records with 10 km	Habitat Summary	Likelihood of Occurrence	Observed During Field Survey
Plant	*Lepidium monoplocoides*	Winged Pepper-cress	E	E	0 (MNES Results)	Widespread in the semi-arid western plains regions of NSW. Collected from widely scattered localities, with large numbers of historical records but few recent collections. There is a single collection from Broken Hill and only two collections since 1915, the most recent being 1950. Also previously recorded from Bourke, Cobar, Urana, Lake Cargelligo, Balranald, Wanganella and Deniliquin. Recorded more recently from the Hay Plain, south-eastern Riverina, and from near Pooncarie. Occurs on seasonally moist to waterlogged sites, on heavy fertile soils, with a mean annual rainfall of around 300-500 mm. Predominant vegetation is usually an open woodland dominated by *Allocasuarina luehmannii* (Bulloak) and/or eucalypts, particularly *Eucalyptus largiflorens* (Black Box) or *Eucalyptus populnea* (Poplar Box). The field layer of the surrounding woodland is dominated by tussock grasses. Recorded in a wetland-grassland community comprising *Eragrostis australasicus, Agrostis avenacea, Austrodanthonia duttoniana, Homopholis proluta, Myriophyllum crispatum, Utricularia dichotoma* and *Pycnosorus globosus,* on waterlogged grey-brown clay. Also recorded from a *Maireana pyramidata* shrubland. Flowers from late winter to spring, or August to October. The species is highly dependent on seasonal conditions. Occurs in periodically flooded and waterlogged habitats and does not tolerate grazing disturbance.	Considering the lack of records within the locality but the presence of suitable habitat, this species is **unlikely** to occur within the project boundary.	No
Plant	*Austrostipa wakoolica*	null	E	E	0 (MNES Results)	Confined to the floodplains of the Murray River tributaries of central-western and south-western NSW, with localities including Manna State Forest, Matong, Lake Tooim, Merran Creek, Tulla, Cunninyeuk and Mairjimmy State Forest (now part of South West Woodland Nature Reserve). Grows on floodplains of the Murray River tributaries, in open woodland on grey, silty clay or sandy loam soils; habitats include the edges of a lignum swamp with box and mallee; creek banks in grey, silty clay; mallee and lignum sandy-loam flat; open Cypress Pine forest on low sandy range; and a low, rocky rise. Associated species *include Callitris glaucophylla, Eucalyptus microcarpa, E. populnea, Austrostipa eremophila, A. drummondii, Austrodanthonia eriantha* and *Einadia nutans*. Flowers from October to December, mainly in response to rain.	Considering the lack of records within the locality but the presence of suitable habitat, this species is **unlikely** to occur within the project boundary.	No
Plant	*Swainsona murrayana*	Slender Darling-pea, Slender Swainson, Murray Swainson-pea	V	V	0 (MNES Results)	The species has been collected from clay-based soils, ranging from grey, red and brown cracking clays to red-brown earths and loams. Grows in a variety of vegetation types including bladder saltbush, black box and grassland communities on level plains, floodplains and depressions and is often found with Maireana species. Plants have been found in remnant native grasslands or grassy woodlands that have been intermittently grazed or cultivated. Plants produce winter-spring growth, flower in spring to early summer and then die back after flowering. They re-shoot readily and often carpet the landscape after good cool-season rains. The species may require some disturbance and has been known to occur in paddocks that have been moderately grazed or occasionally cultivated.	Considering the lack of records within the locality but the presence of suitable habitat, this species is **unlikely** to occur within the project boundary.	No

Type	Scientific Name	Common Name	Status (BC Act)	Status (EPBC Act)	BioNet Records with 10 km	Habitat Summary	Likelihood of Occurrence	Observed During Field Survey
Plant	*Maireana cheelii*	Chariot Wheels	V	V	0 (MNES Results)	Restricted to the southern Riverina region of NSW, mainly in the area between Deniliquin and Hay. Also has a limited distribution in Victoria where very rare. NSW collections have mainly been from the Moulamein, Deniliquin and Hay districts, including Tchelery and Zara Stations. There is an outlying record from "Wangareena east of Wanaaring". Usually found on heavier, grey clay soils with *Atriplex vesicaria* (Bladder Saltbush). Recorded on the Hay Plain in *Atriplex vesicaria, Maireana aphylla* and *Acacia homalophylla* shrublands. Soils include heavy brown to red-brown clay-loams, hard cracking red clay, other heavy texture-contrast soils. Tends to grow in shallow depressions, often on eroded or scalded surfaces, and does not extend to the higher soils in the habitat. It has been found on the edges of bare, windswept claypans, in shallow depressions of eroded surfaces where rainwater collects and on a "shelf" in the crabhole complex of heavy grey soils. Associated species include *Atriplex vesicaria, Maireana pentagona, M. excavata, M. ciliata, Cressa cretica, Avena fatua* and *Acacia homalophylla*. Flowering time is mostly spring to summer. Bears fruits mostly from September to November.	Considering the lack of records within the locality but the presence of suitable habitat, this species is **unlikely** to occur within the project boundary.	No
Plant	*Brachyscome papillosa*	Mossgiel Daisy	V	V	0 (MNES Results)	The Mossgiel Daisy is endemic to NSW and chiefly occurs within the Riverina Bioregion, from Mossgiel in the north, Murrumbidgee Valley (Yanga) National Park in the south west to Urana in the south east. Sites are scattered across this Bioregion including the Jerilderie area, the Hay Plain (Maude and Oxley) and around Darlington Point. Recorded primarily in clay soils on Bladder Saltbush (*Atriplex vesicaria*) and Leafless Bluebush (*Maireana aphylla*) plains, but also in grassland and in Inland Grey Box (*Eucalyptus microcarpa*) - Cypress Pine (*Callitris spp.*) woodland. Flowers from June to December.	Considering the lack of records within the locality but the presence of suitable habitat, this species is **unlikely** to occur within the project boundary.	No
Reptile	*Hemiaspis damelii*	Grey Snake	-	E	0 (MNES Results)	In NSW, point location records indicate this species occurs as separate subpopulations, predominantly associated with the lower reaches of major westerly flowing rivers, including the Gwydir, Namoi, Castlereagh, Macquarie, Lachlan and Murrumbidgee River systems. The grey snake is predominately active at dusk or at night. A recent survey from the Murrumbidgee catchment found that grey snakes forage for frogs along wetlands within 30 m of the water edge and not in the adjacent woodland or shrubland vegetation There is no information available about the home range size or dispersal ability of this species, however, considering its small size and strong affiliation with discrete wetland habitats, home ranges size is unlikely to exceed that of larger floodplain species and it is considered to have a limited dispersal ability.	Considering the lack of records within the locality but the presence of suitable habitat, this species is **unlikely** to occur within the project boundary.	No

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

APPENDIX D CULTURAL HERITAGE DUE DILIGENCE, ABORIGINAL CULTURAL HERITAGE ASSESSMENT REPORT & ARCHAEOLOGICAL TECHNICAL REPORT

Kerarbury Orchard Solar Farm and BESS

Cultural Heritage Due Diligence Assessment Report

15 November 2022

Project No.: 0586215

The business of sustainability

ERM

Document details	
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Signature Page

15 November 2022

Kerarbury Orchard Solar Farm and BESS

Cultural Heritage Due Diligence Assessment Report

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Acronyms and Abbreviations

Name	Description
AHIMS	Aboriginal Heritage Information Management System
AHIP	Aboriginal Heritage Impact Permit
BESS	Battery Energy Storage System
CHDD	Cultural Heritage Due Diligence Assessment
DA	Development Application
DCP	Development Control Plan
DPC	Department of Premier and Cabinet
DPE	Department of Planning and Environment
EP&A Act	*Environmental Planning and Assessment Act 1979*
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
ERM	Environmental Resources Management Australia Pty Ltd
ha	Hectares
Heritage Act	*Heritage Act 1977*
LEP	Local Environmental Plan
LGA	Local Government Area
MLEP	Murrumbidgee LEP 2013
MWac	Megawatt, Alternating Current
NPW Act	*National Parks and Wildlife Act 1974*
NSW	New South Wales
REP	Regional Environmental Plan
RNE	Register of the National Estate
SHR	State Heritage Register

EXECUTIVE SUMMARY

This Cultural Heritage Due Diligence Assessment Report (CHDD) has been prepared on behalf of AGL in support of a Development Application (DA) that seeks approval for a solar farm and battery energy storage system (BESS) in the Riverina region of NSW. The Project Area is contained within Lots 68 and 69 of DP 750877, Sturt Highway, Darlington Point, NSW. It is approximately 7 hectares (ha) in size, consisting of a rhomboidal plot of land bounded by almond tree orchards.

The total Project Area includes a solar farm footprint of approximately 6.1 ha, with a capacity of up to 4.95 megawatts (MWac), a BESS footprint of up to 0.003 ha (30 m^2) with a capacity of up to 4.586 MWhr including any additional supporting infrastructure. This will be subject to final grid connection and design.

This report has been prepared to investigate the presence of Aboriginal and non-Aboriginal (Historic) heritage items and values within the Project Area and provide preliminary assessment of impacts to heritage values (if identified). The report aims to provide management and mitigation measures to avoid or mitigate impacts to known heritage values, where appropriate and feasible. Preparation of this report required the following tasks to be undertaken:

- background historical research and review of previous reports;
- heritage register and database searches;
- mapping of heritage items;
- site inspection;
- assessment of potential impacts from the proposal; and
- preparation of recommendations for management of heritage values at the site.

A search of the Aboriginal Heritage Information Management System (AHIMS) database identified that there were no registered sites within the Project Area (or within 1 km of the two impacted Lot on Plans). A search of statutory and non-statutory heritage registers was undertaken, which indicated that there are no previously recorded historic heritage sites within the Project Area.

Based on the results of the background research and register searches, the following predictive statements are made:

- the Project Area has low Aboriginal archaeological potential;
- there is an absence of landforms indicative of Aboriginal cultural heritage sensitivity, such as water sources and high ridges, as the Project Area is within flat plains landforms and 2.5 km away from the nearest water source;
- if Aboriginal archaeological sites are identified, these would most likely consist of stone artefact sites; and
- there is low potential for historical archaeological sites or heritage structures within the Project Area.

Pedestrian survey of the Project Area was undertaken by Elspeth Mackenzie, ERM archaeologist on Wednesday 5 October 2022. The Project Area consisted of an area across two ploughed paddocks, with grass and weeks growing consistently across the whole area. The only exposure noted was a track running between the two paddocks. Soils were noted to be fine and clay rich, with no stone material noted. No Aboriginal or historic heritage sites were identified within the Project Area during inspection. Ground surface visibility was extremely low, owing to grass and weed coverage.

The key findings of the Aboriginal heritage assessment are summarised below:

- no previously recorded Aboriginal heritage sites were identified within or in close proximity to the Project Area;
- no Aboriginal heritage sites were identified within the Project Area during this investigation;
- the Project Area has low potential to contain subsurface Aboriginal cultural material; and
- the Project Area is not known to contain Aboriginal cultural heritage values.

The key findings of the historic heritage assessment are summarised below:

- no previously recorded historic heritage sites are registered within or in close proximity to the Project Area;
- background review indicated low potential for historic heritage to be identified within the Project Area;
- no new historic heritage sites were identified during the site inspection; and
- the Project Area retains low potential for historical archaeological finds.

Based on the results of this due diligence investigation, it is considered unlikely that Aboriginal cultural heritage objects or historic heritage items or will occur within the Project Area. Although unlikely, there remains a possibility that Aboriginal and historic cultural heritage objects of value may be identified during the course of works. The following recommendations are made as management guidelines in the unlikely event that cultural heritage items or Aboriginal objects are identified.

- Cultural Awareness Induction: All personnel involved with ground breaking activities within the Project Area should undertake a cultural awareness induction, which includes identification of potential Aboriginal and non-Aboriginal heritage objects, identification of historic heritage finds, and an understanding of the chance finds procedure.
- Chance Finds Procedure: If suspected Aboriginal heritage objects or heritage items are found during works, the following Chance Find Procedure should be followed and applies to the entire Project Area:
  - all activity in the immediate area should cease and the location should be cordoned off and an appropriately qualified heritage professional should be consulted;
  - Heritage NSW (DPC) should be immediately contacted;
  - Griffith Local Aboriginal Land Council should be notified (potential Aboriginal objects only);
  - an appropriately qualified heritage professional should record the location and attributes of the site and determine the significance of the find; and
  - works will only recommence once the area has been cleared by further assessment.
- In the event of the discovery of human skeletal material (or suspected human skeletal material) during project activities in the Project Area the following steps should be followed:
  - all activities and/or works in the immediate area must cease;
  - the State Police must be contacted along with Heritage NSW; and
  - any sand/soils removed from the near vicinity of the find must be identified and set aside for assessment by the investigating authorities.

1. INTRODUCTION

This Cultural Heritage Due Diligence Assessment Report (CHDD) has been prepared on behalf of AGL in support of a Development Application (DA) that seeks approval for a solar farm and battery energy storage system (BESS) in the Riverina region of NSW (the Project).

1.1 Site Identification

The Project Area is contained within Lots 68 and 69 of DP 750877, Sturt Highway, Darlington Point, NSW. It is approximately 7 hectares (ha) in size, consisting of a rhomboidal plot of land bounded by almond tree orchards.

The Project Area is shown in *Figure 1.1*.

1.2 Description of the Proposed Development

AGL is proposing to develop a 4.95 MWac solar farm and 4.586 MWhr BESS within the site location identified above. The total project area is approximately 7 ha, with a solar farm footprint of approximately 6.1 ha, a BESS footprint of 0.003 ha and including additional infrastructure, subject to final grid connection and project design.

1.3 Purpose of the Report

This report has been prepared to investigate the presence of Aboriginal and non-Aboriginal (Historic) heritage items and values within the Project Area and provide preliminary assessment of impacts to heritage values (if identified). The report aims to provide management and mitigation measures to avoid or mitigate impacts to known heritage values, where appropriate and feasible.

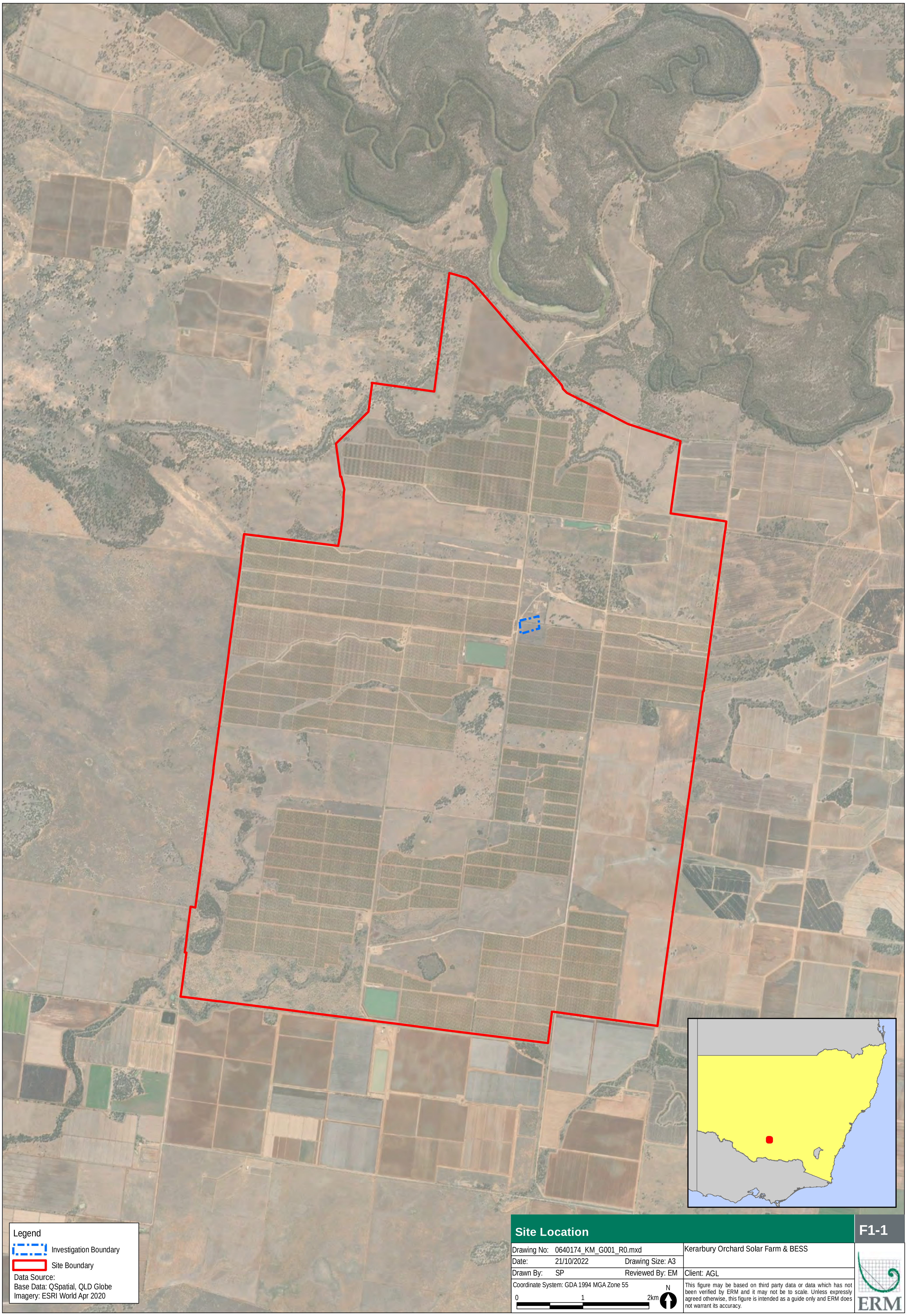
1.4 Methodology

Preparation of this report required the following tasks to be undertaken:

- background historical research and review of previous reports;
- heritage register and database searches;
- mapping of heritage items;
- site inspection;
- assessment of potential impacts from the proposal; and
- preparation of recommendations for management of heritage values at the site.

1.5 Authorship

This report has been authored by ERM Principal Heritage Consultant, Elspeth. Technical Review was provided by ERM Senior Consultant Alyce Haast. Quality Assurance review was provided by ERM Partner, Karie Bradfield.



Site Location

F1-1

Drawing No: 0640174_KM_G001_R0.mxd	Kerarbury Orchard Solar Farm & BESS
Date: 21/10/2022 Drawing Size: A3	
Drawn By: SP Reviewed By: EM	Client: AGL
Coordinate System: GDA 1994 MGA Zone 55	This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.

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2. LEGISLATIVE CONTEXT

2.1 Commonwealth Legislation

2.1.1 Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act; as amended 2004) provides the framework for the Commonwealth Government's environmental legislation. The EPBC Act outlines a legal framework for the protection and management of nationally and internationally important flora, fauna, ecological communities and heritage places. A number of heritage listings were established under the EPBC Act including the Commonwealth Heritage List, National Heritage List, and Register of National Estate (now repealed).

2.2 NSW State Legislation

2.2.1 Environmental Planning and Assessment Act 1979

The *Environmental Planning and Assessment Act 1979* (EP&A Act) is administered by the NSW Department of Planning and Environment (DPE). This Act requires that environmental impacts are considered as part of the development assessment process, including impacts on Aboriginal and non-Aboriginal heritage.

2.2.2 Heritage Act 1977

The *Heritage Act 1977* is administered by Heritage NSW and aims to protect the natural and cultural heritage of NSW. The *Heritage Act 1977* provides blanket protection for surface and sub-surface relics and for heritage items of state significance listed on the State Heritage Register (SHR). The Act defers to local planning instruments under the EP&A Act for the protection of items of local significance (‘items of the environmental heritage”).

2.2.3 National Parks and Wildlife Act 1974

All Aboriginal objects within the State of New South Wales are protected under Part 6, and particularly Section 90, of the *National Parks and Wildlife Act 1974* (NPW Act).

Under section 5 of the Act, “Aboriginal Object” means any deposit, object or material evidence (not being a handicraft made for sale) relating to the Aboriginal habitation of the area that comprises New South Wales, being habitation before or concurrent with (or both) the occupation of that area by persons of non-Aboriginal extraction, and includes Aboriginal remains.

Sites of traditional significance that do not necessarily contain archaeological materials may be gazetted as ‘Aboriginal places’ and are protected under section 84 of the Act. This protection applies to all sites, regardless of their significance or land tenure. Under section 90, a person who, without first obtaining the consent of the Director-General, knowingly destroys, defaces or damages, or knowingly causes or permits the destruction or defacement of or damage to, an Aboriginal object or Aboriginal place is guilty of an offence.

It is required that an Aboriginal Heritage Impact Permit (AHIP) be obtained for any impact to an Aboriginal object or place. Heritage NSW is the responsible authority, with the Director General of that department as the consent authority.

2.3 Local Legislation

2.3.1 Murrumbidgee Local Environmental Plan 2013

The Murrumbidgee Local Environmental Plan 2013 (MLEP 2013) makes local environmental planning provisions for land within the Murrumbidgee Council Local Government Area (LGA), including those for land zoning, conservation and urban design. Schedule 5 (Environmental Heritage) provides a list of all registered heritage items within the Murrumbidgee Council LGA, including conservation areas and archaeological sites. The MLEP 2013 is also accompanied by a series of maps, including heritage overlays that provide the location of heritage items listed under Schedule 5.

2.4 Heritage Registers and Databases

2.4.1 Statutory Listings

National Heritage List

The Australian National Heritage List contains natural, historic, and Aboriginal places deemed to be of outstanding heritage significance to Australia. Before a site is placed on the list, a nominated place is assessed against nine criteria by the Australia Heritage Council.

NSW State Heritage Register

The SHR is a list of items of State heritage significance administered by Heritage NSW. The register was created in 1999 and lists approximately 1,500 items in both public and private ownership; the range of items is diverse and includes many archaeological sites.

Aboriginal Heritage Information Management System (AHIMS) Database

The AHIMS database provides information concerning previously recorded Aboriginal sites in NSW. AHIMS stores data regarding a sites' location, site type, site features and a unique site identification number for all registered Aboriginal heritage sites in NSW.

Section 170 Registers

Section 170 of the Heritage Act requires all NSW state agencies to identify, conserve and manage the heritage assets owned, managed and occupied by that agency. In order to facilitate this, Section 170 heritage registers were established for all NSW government agencies. These registers are held and maintained by each state agency and updated as assets are acquired, altered, or decommissioned.

Local and Regional Planning Instruments

Statutory listings for Heritage items in NSW can be included in Regional Environmental Plans (REPs), Development Control Plans (DCPs) and Local Environmental Plans (LEPs), these plans are prepared as a result of the NSW EP&A Act. Their aim is to ensure that the significance of heritage items, sites and/or places is integrated into the planning and development control processes in order to ensure their preservation. Statutory heritage listings are maintained in Schedule 5 of the standard LEP. For this report, the relevant document is the MLEP 2013.

2.4.2 Non-Statutory Listings

Register of the National Estate

The Register of the National Estate (RNE) is a non-statutory archive of natural, historic and Aboriginal places and incorporates over 13,000 places. Originally compiled between 1976 and 2003 by the Australian Heritage Commission, the register is now maintained by the Australian Heritage Council. Following amendments to the Australian Heritage Council Act 2003, the RNE was frozen on 19 February 2007, which means that no new places can be added, or removed. Since February 2012 the RNE has been maintained as a non-statutory listing.

National Trust of Australia NSW

The National Trust of Australia maintains a register of landscapes, townscapes, buildings, industrial sites, cemeteries and other heritage places which the Trust determines to have cultural significance. This register is non-statutory, but provides an indication of places considered significant by the wider community.

3. ENVIRONMENTAL CONTEXT

3.1 Bioregion Overview

The Project Area is within the Riverina Bioregion, which is situated in southwest NSW extending into central-north Victoria. The Riverina Bioregion extends from Ivanhoe in the north to Bendigo in the south, and from Narrandera in the east to Balranald in the west. The major waterways within this bioregion are the Murray and Murrumbidgee Rivers, and associated tributaries.

The bioregion is characterised by a dry semi-arid climate, with hot summers and cool winters. Seasonal temperatures do not vary greatly across the bioregion. Highest rainfall occurs in May and September, with summer rain occurring as a result of localised thunderstorms.

3.2 Topography and Hydrology

The Project Area is situated on a flat plain with minimal variance in elevation. The surrounding area also consists of plains, with no obvious hills or ridges within visual range. The Project Area contains no water courses, with the nearest permanent water source identified as Gum Creek, approximately 2.5 km to the north of the Project Area. A channel of the Murrumbidgee River is located 3.9 km to the north of the Project Area, although the river proper is 5.9 km distant.

The Riverina is comprised of a complex network of river channels and floodplains which overlie ancient river systems. The streams in the Riverina are characterised by low gradients with significant variability in river flow. The oldest of the ancient river systems are currently comprised of deeply buried channels which have been filled by sand and gravels and date to 15,000 to 30,000 years ago . These 'prior streams' are generally identified by their slightly raised nature above the existing floodplain (Williams 2011). More recent 'ancestral rivers' are more closely associated with current drainage networks which are found as winding depressions across the landscape.

Significant changes to the hydrological landscape occurred between the Pleistocene and Holocene periods which coincided with a period of increased aridity. This increased aridity restricted the flow of paleochannels with the modern drainage regime for the Riverina estimated to have developed between 15,000 to 10,000 years ago.

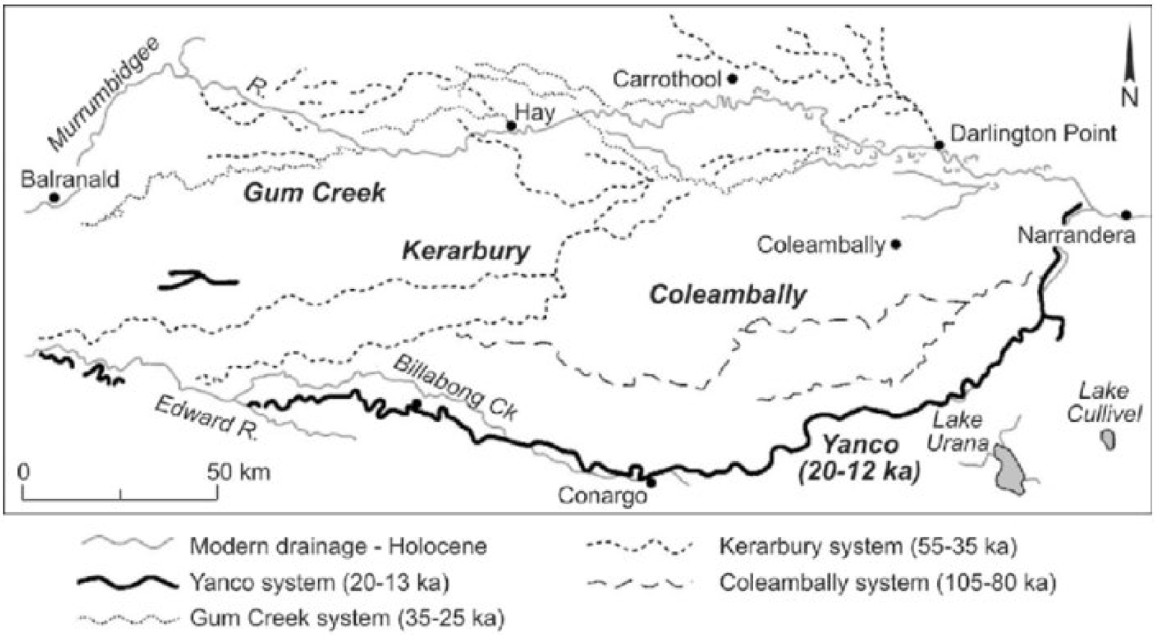


Figure 5.1: Phases of paleochannels across the Riverina (Page et al 2009: 22)

One of these paleochannels, the Gum Creek system, leaves the modern Murrumbidgee directly north of the Project Area near Yarradda Lagoon and follows the Gum and Uara Creeks. It is highly sinuous and partly superimposed by the modern creek systems (Pardoe & Martin 2011). Past Aboriginal occupation is likely to have focused upon resources associated with these earlier stream features, suggesting evidence of occupation would be present around these landscapes.

3.3 Geology and Soils

The bioregion is dominated by Quarternary age river channels, floodplains, backplains, swamps, lakes and lunettes. The bioregion sits atop three overlapping alluvial fans, centred on the eastern half of the Murray Basin. Basement rocks are early Palaeozoic sediments and granites of the Lachlan Fold Belt, although almost no outcrops occur in the Riverina.

The underlying geology of the Project Area consists of Shepparton Formation which formed in a fluvio-lacustrine environment between the Pleistocene and Holocene. The Shepparton Formation consists of unconsolidated to poorly consolidated variegated and mottled clay, silt, silty clay, with intercalated lenses of fine to coarse sand and gravel. The formation has been partially modified by pedogenesis and groundwater table fluctuation (NSW eSpade 2022).

The soils within the Project Area are vertosols characterised by a high clay content that has the potential for cracking (NSW eSpade 2022). Archaeologically, vertosols are prone to frequent subsurface movement due to cracking and it is unlikely that intact archaeological deposits would occur within these soils.

3.4 Flora and Fauna

Rivers across the bioregion support river red gum (*Eucalyptus camaldulensis*) and river cooba (*Acacia stenophylla*), while the perimeter floodplains support black box (*Eucalyptus largiflorens*) and woodlands dominated with salt-tolerant grasses. Across the plains, away from watercourses, vegetation is predominantly saltbush shrubland composes of old man saltbush (*Atriplex nummalaria*), bladder saltbush (*Atriplex vesicaria*), cotton bush (*Maireana aphylla*) and grasslands (*Danthonia spp* and *Stipa spp*) (Eardley 1999).

The Riverina Bioregion supports a great deal of significant fauna, including the superb parrot (*Polytelis swainsonii*), sugar glider (*Petaurus breviceps*), feathertail glider (*Acrobates pygmaeus*), squirrel glider (*Petaurus norfolcensis*), brush-tailed phascogale (*Phascogale tapoatafa*), koala (*Phascolarctos cinereus*), carpet python (Morelia spilota), freckled duck (*Stictonetta naevosa*) and peregrine falcon (*Falco peregrinus*) (Eardley 1999). Rivers also support a number of fish species, including the endangered trout cod (*Maccullochella macquariensis*) and Macquarie perch (*Macquaria australasica*).

3.5 Project Area Setting

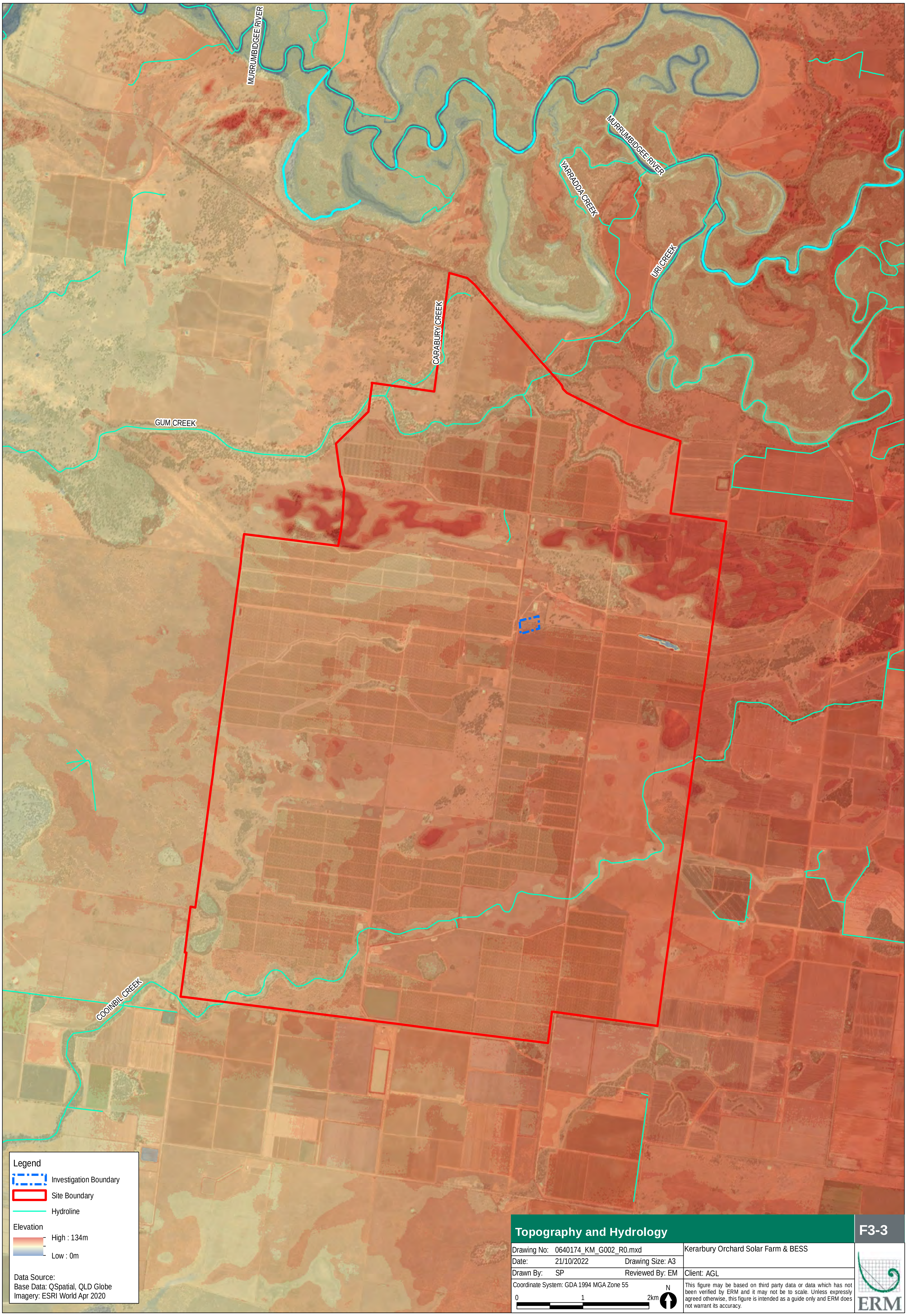
The Project Area is situated within Rural land approximately 17 km south-west of the Darlington Point township. Surrounding lands are primarily used for agricultural production or grazing. There are some agricultural structures in the vicinity or the Project Area, and a fence line, track, irrigation ditch and transmission line run through.

3.6 Land Use and Disturbance

Initial background research has indicated that the Project Area has remained cleared farming land for much of its colonial and modern history. The land has been ploughed for orchard planting and subject to construction of drainage channels and associated infrastructure. These activities have resulted in significance disturbance to the ground surface.

Land Use and Disturbance F3-2

Drawing No: 0640174_KM_G003_R0.mxd		Kerarbury Orchard Solar Farm & BESS
Date: 21/10/2022	Drawing Size: A3	
Drawn By: SP	Reviewed By: EM	Client: AGL
Coordinate System: GDA 1994 MGA Zone 55		This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.



MURRUMBIDGEE RIVER
MURRUMBIDGEE RIVER
YARRADDA CREEK
URI CREEK
CARABURY CREEK
GUM CREEK
COOINBIL CREEK
Legend
Investigation Boundary
Site Boundary
Hydroline
Elevation
High : 134m
Low : 0m
Data Source:
Base Data: QSpatial, QLD Globe
Imagery: ESRI World Apr 2020
Topography and Hydrology
F3-3
Drawing No: 0640174_KM_G002_R0.mxd
Date: 21/10/2022
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4. HISTORICAL CONTEXT

4.1 Aboriginal Culture in the Riverina

The Project Area is located within the lands of the Wiradjuri language group. Tindale (1974) described the Wiradjuri language area as “on the Lachlan River and south from Condobolin to Booligal; at Carrathool, Wagga-Wagga, Cootamundra, Cowra, Parkes, Trundle; east to Gundagai, Boorowa, and Rylstone; at Wellington, Mudgee, Bathurst, and Carcoar; west along Billabong Creek to beyond Mossgiel; southwest to near Hay and Narrandera; south to Howlong on upper Murray; at Albury and east to about Tumbarumba. They visited Yass for ceremonies with the Ngunawal tribe”.

Wiradjuri was one of the largest tribal groupings in Australia, with many smaller subgroupings. The Wiradjuri who lived in the region of the Project Area are likely to have lived in small and highly mobile family groups who came together regularly to participate in trade, marriage and ceremonial gatherings. The Darlington Point area has been suggested as a traditional ceremonial region where “a good deal of food may have been available at certain times of the year” (Read 1983:24).

Naturalist George Bennett recorded the diet of the Wiradjuri of the eastern Riverina and neighbouring regions as including flying squirrel, kangaroo, wallaby, wombat, koala, possum, emu, duck, swan, snake, goanna, platypus, ant eggs, insects, fish, mussels, yabbies, plant tubers, berries and seeds (1834:173). The traditional subsistence economy was centred on the river corridors and their hinterlands.

4.2 Early European Exploration and Settlers

Initial European settlement of the areas surrounding Darlington Point, was directly related to over-land cattle routes between NSW and Victoria. Settlement extended along the banks of the Murrumbidgee from Wagga Wagga and reached the ford in the river at the location of the current township of Darlington Point by the early 1830s. While initial relations between these settlers and the Wiradjuri were reportedly non-violent, a severe drought between 1834 and 1838 increased tension and competition for food, and resulted in organised armed raids against the Wiradjuri, who retaliated with a guerrilla style resistance. The conflict concluded with a massacre of Wiradjuri on an island in the Murrumbidgee at Narrandera (approximately 67 km from the Project Area) in 1841 (Kelleher Nightingale Consulting 2018).

John Peter took up the first run in the area and named his property ‘Cooba’, reportedly after the Wiradjuri word ‘coob’ for a common local tree. Settlement around the river ford continued and the township was officially surveyed and reserved in the early 1850s. At this period, beginning in 1853, river steamers began plying the Murrumbidgee and Darlington Point became a refuelling station along the route (Sydney Morning Herald 2004). By 1855 another run named ‘Karrabory’ had been taken up by William Macleay and his brother Alex. William was elected to parliament in this year as the Member for the Lachlan and Lower Darling, later succeeding the Member for the Murrumbidgee in 1859 which he retained until 1874. In 1855 Walter Cark was noted as owner of the adjoining ‘Karrabung’ station, and William, Alex and Walter shortly afterwards entered into partnership and renamed their combined properties ‘Kerarbury’. Despite residing in Sydney since his election, William Macleay retained in interest in ‘Kerarbury’, visiting it as part of expeditions to expand his renowned entomology collection (Fletcher 1929).

Sheep overtook cattle as the predominant stock of the region during the 1860s, including at ‘Kerarbury’.

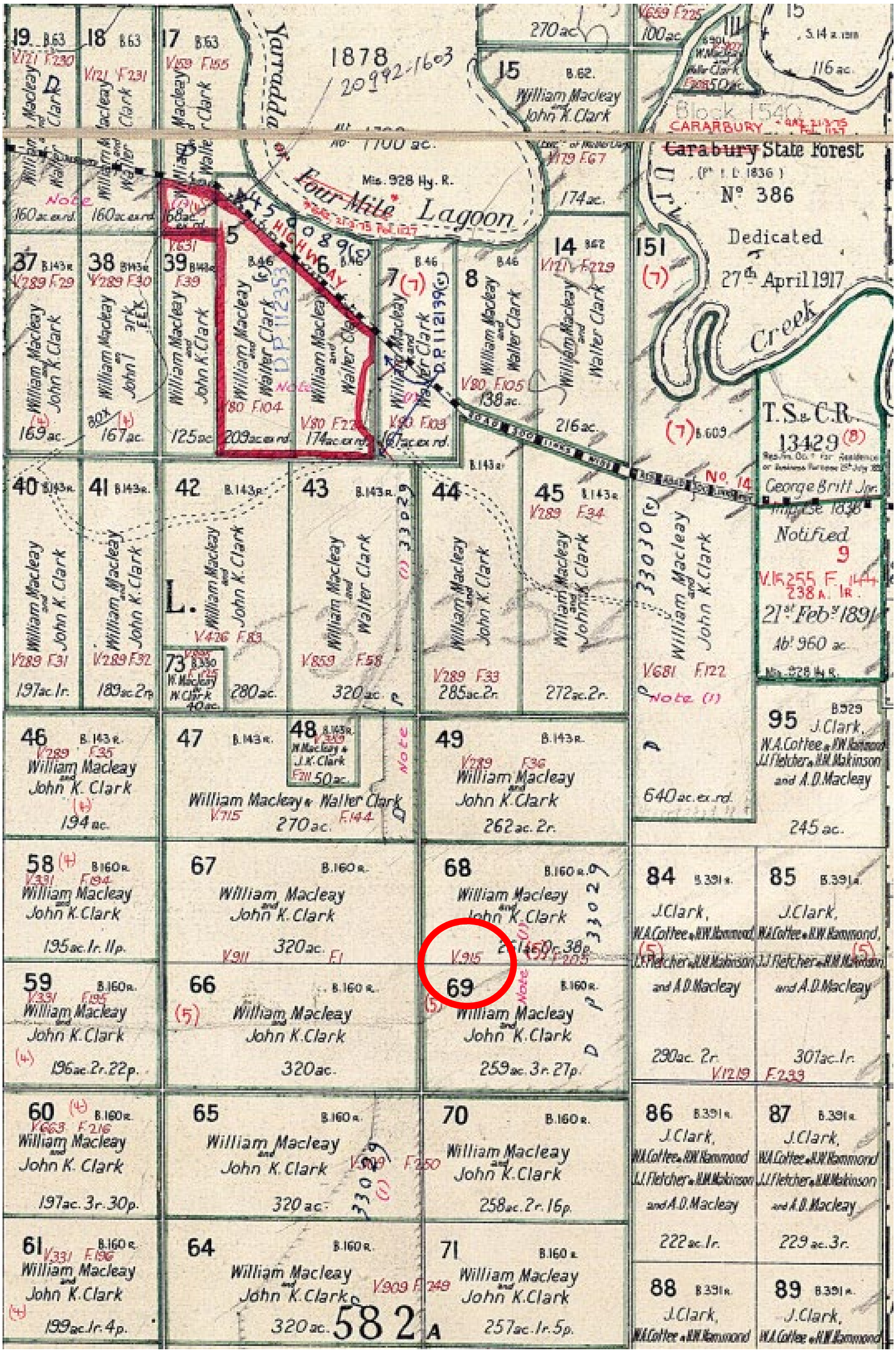


Figure 4.1 Portion of Historic Map, Parish of Carabury – 1918 edition of 1878 original (approximate location of Project Area in red circle) (Historical Land Records Viewer)

4.3 Historic Timeline – Key Events

The following historic timeline summarises key events within the Darlington Point, Murrumbidgee region and the Kerarbury Station itself.

Table 4.1 Historic Timeline of Key Events

Date	Event
Pre-1830s	Area occupied by the Wiradjuri.
1828-1831	Captain Charles Sturt's first expedition down the Murrumbidgee River.
1830s	Colonial settlement extended from Wagga Wagga to a ford which provided a crossing across the Murrumbidgee when the river was low (now Darlington Point). Cattle production became the predominant industry of the region.
1834-1838	Severe drought in the region resulted in armed conflict between settlers and the Wiradjuri.
1839	William Macleay arrives in Australia in March from London, travelling on the *Royal George* and spends some years living on and managing properties along the Lower Murrumbidgee.
1844	John Peter took up the first run beyond Darlington Point and named his property 'Cooba'.
c.1850	The township of Darlington Point was surveyed.
1853	River steamers began to ply the Murrumbidgee River, and Darlington Point became a refuelling station.
1855	William Macleay was noted as owner of the 'Karrabory' station with his brother Alex. William was elected to parliament in this year as the Member for the Lachlan and Lower Darling, later succeeding the Member for the Murrumbidgee in 1859 which he retained until 1874. Walter Cark was noted as owner of the 'Karrabung' station. The three shortly afterwards entered into partnership and renamed their combined properties 'Kerarbury'.
1860s – 1870s	Despite residing in Sydney since his election, William Macleay retained in interest in 'Kerarbury', visiting it as part of expeditions to expand his renowned entomology collection. Sheep became the predominant stock of the region, including at 'Kerarbury'.
1880	The Warangesda Aboriginal Mission was established 4 km from Darlington Point.
1888	Some time after the death of Walter Clark, William and Alex Macleay and John Kerr Clark sold 'Kerarbury' to Messrs J.S. Horsfall & Co.
1912	The Murrumbidge Irrigation Area was established, heralding the region becoming a significant horticultural producer while still maintaining a strong sheep industry.
1919	'Kerarbury' purchased by Messrs Armstrong, Bell Ltd. from Messrs J.S. Horsfall & Co.
1927	'Kerarbury' purchased by Messrs Coughlan Bros. from Messrs Armstrong, Bell Ltd. The property was subdivided and the Homestead half was sold, the rest continued trading as Kerarbury Pastoral Co.
2015	Rural Funds Group, backed by a 22 year 9 month lease with Olam, purchased 'Kerarbury' and the adjoining property 'Kamelda' from the Toscan brothers to develop a total of 1500 ha into Kerarbury Orchard.
2016	An additional 1000 ha were added to the Kerarbury Orchard development for Olam.

5. ARCHAEOLOGICAL CONTEXT

5.1 Heritage Register Searches

5.1.1 Aboriginal Heritage

The Aboriginal Heritage Information Management System (AHIMS) database provides an active list of known Aboriginal sites in NSW, recording the location, type and status of known Aboriginal sites in NSW. A basic search of the AHIMS database was undertaken on 17 October 2022, with the following details:

Client Service ID: 722891 & 722894
Datum: GDA Zone 55
Lot: 68 DP750877 & 69 DP750877
Buffer: 1 km

The basic search identified that there were no registered sites within the search area (*Appendix A*).

5.1.2 Historic Heritage

A search of the following statutory and non-statutory heritage registers was undertaken in the process of preparing this report:

- Commonwealth Heritage Register;
- Australian National Heritage;
- State Heritage Inventory;
- Section 170 Registers;
- Murrumbidgbee LEP 2011, Schedule 5;
- Register of the National Estate; and,
- National Trust.

The register searches indicated that there are no known heritage sites within or immediately adjacent to the Project Area. The closest known heritage item is “The Homestead (formerly Kerarbury Station)” (Item I3), which is 1.7 km west of the Project Area. This site is an historic site of local significance listed on Schedule 5 of the Murrumbidgee LEP 2013 (*Figure 5.2*).

5.2 Previous Archaeological Investigations

Few archaeological investigations have been conducted in the region around Darlington Point or the Project Area. The few that have occurred identified culturally modified trees, artefact scatters and hearths; a variety of site types which demonstrate that the region was utilised for a diverse range of activities. The assessments and their results are summarised in *Table 5.1*.

Table 5.1 Previous archaeological investigations summary

Author	Year	Title	Results
Thompson	1982	Survey of Aboriginal and Historical Sites. Darlington Point – Yanco 432kv Transmission Line	■ 24 culturally modified trees ■ 2 possible culturally modified trees ■ 1 artefact scatter ■ 4 isolated artefacts ■ 1 hearth ■ 15 possible hearths

Author	Year	Title	Results
Biosis	2017	Preliminary Ecological, Heritage and Planning Advice: Darlington Point Solar Development Site, NSW	■ 4 possible culturally modified trees
Kelleher Nightingale Consulting	2018	Darlington Point Solar Farm: Aboriginal Cultural Heritage Assessment	■ 4 culturally modified trees ■ 1 possible culturally modified tree ■ 1 artefact scatter

The paucity of archaeological investigations across the region prohibits the development of strong conclusions regarding landscape trends, however it is noted that sites are generally located on flat landforms, the majority of which are within one kilometre of a permanent water source or drainage line. The distribution of culturally modified trees is further restricted to areas where natural processes or modern land use practices have not removed them.

5.3 Predictive Model

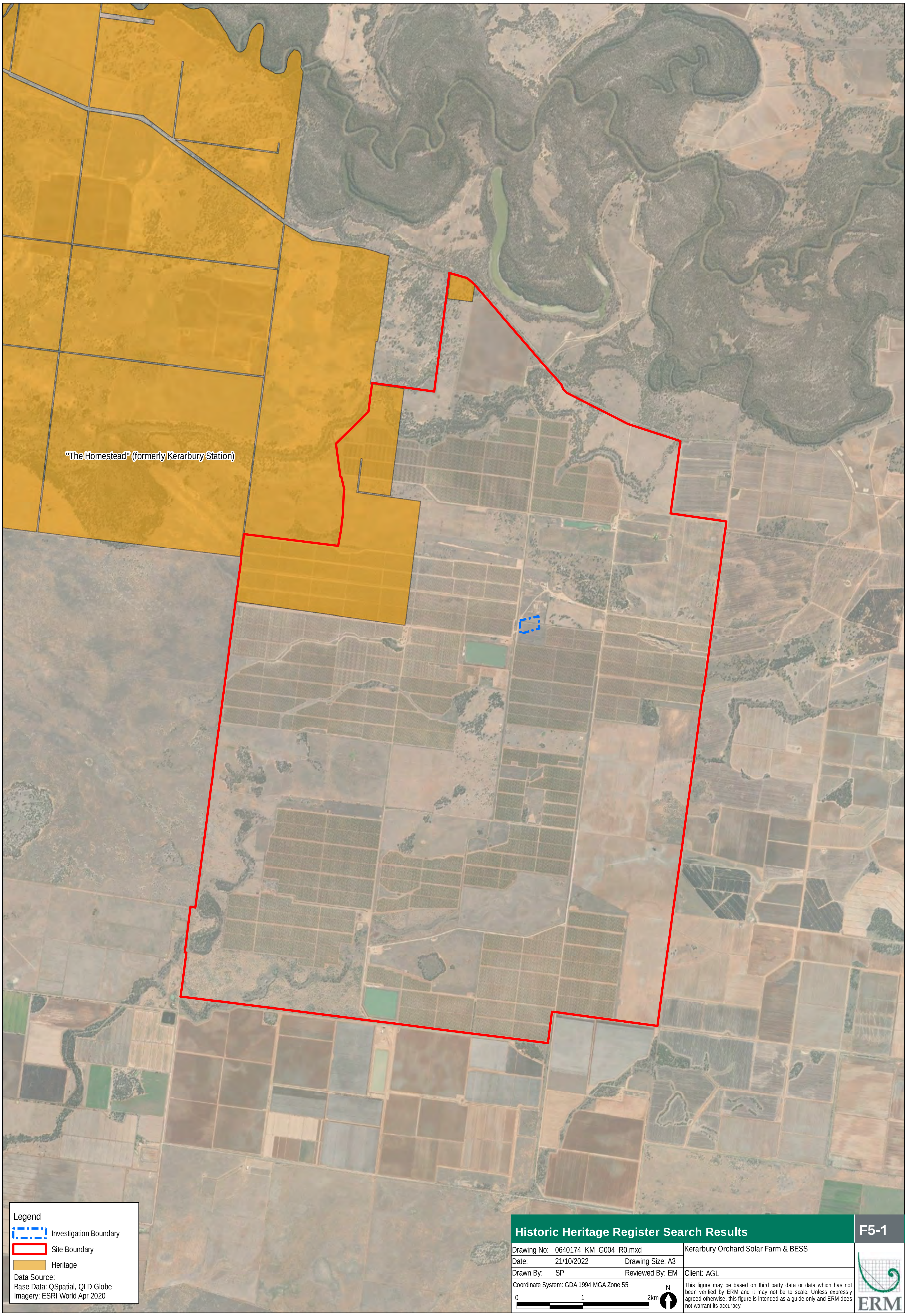
The knowledge gained from examining landforms, geology, regional archaeological patterns, and prior archaeological reports have enabled a set of parameters to be established to predict the potential location of Aboriginal sites within the Project Area. Much of the material used by Aboriginal people to produce survival equipment (such as wood, bone, shell and fibre material) are highly perishable and do not often survive in the archaeological record. Material culture that has survived, often found in locations where Aboriginal people camped, are generally non-perishable items such as stone artefacts, grinding grooves and scarred trees. *Table 5.2* provides a list of the types of Aboriginal cultural heritage sites that would be most likely to be present in the Project Area.

Table 5.2 Sites that may be present within the Project Area

Site Types	Definition
Stone artefact scatters	Stone artefact scatter sites, also known as open campsites, are usually indicated by surface scatters of stone artefacts and sometimes blackened stones and charcoal. When such sites are buried by sediment they may not be noticeable unless exposed by erosion or disturbed by modern activities. The term campsite is used as a convenient label which, in the case of open sites, does not necessarily imply that Aboriginal people actually camped on the site; rather it indicates only that some type of activity was carried out there.
Isolated finds	Sites consisting of only one identified stone artefact, isolated from any other artefacts or archaeological evidence. They are generally indicative of sporadic past Aboriginal land use.

Based on the results of the background research and register searches, the following predictive statements are made:

- the Project Area has low Aboriginal archaeological potential;
- there is an absence of landforms indicative of Aboriginal CH sensitivity, such as water sources and high ridges, as the Project Area is within flat plains landforms and 2.5 km away from the nearest water source;
- if Aboriginal archaeological sites are identified, these would most likely consist of stone artefact sites; and
- there is low potential for historical archaeological sites within the Project Area.


"The Homestead" (formerly Kerarbury Station)
Legend
Investigation Boundary
Site Boundary
Heritage
Data Source:
Base Data: QSpatial, QLD Globe
Imagery: ESRI World Apr 2020
Historic Heritage Register Search Results
F5-1
Drawing No: 0640174_KM_G004_R0.mxd
Date: 21/10/2022
Drawing Size: A3
Drawn By: SP
Reviewed By: EM
Kerarbury Orchard Solar Farm & BESS
Client: AGL
Coordinate System: GDA 1994 MGA Zone 55
0
1
2km
N
This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.
ERM

6. SITE INSPECTION

6.1 Site Inspection Methodology

The site inspection consisted of a pedestrian survey of the Project Area, conducted from west-east. Survey commenced in the southern portion of the Project Area and moved to the northern portion (*Figure 6.1*).

6.2 Site Inspection Results

Pedestrian survey of the Project Area was undertaken by Elspeth Mackenzie, ERM archaeologist on Wednesday 5 October 2022. The southern portion of the Project Area consists of a ploughed paddock, with tall grass and weeds currently growing consistently across the whole area (*Photograph 6.1).* A track runs east-west across the north and a transmission line runs east-west across the south of the area. The topography is generally flat, with little variation in elevation. Ground surface was uneven, due to former crop ploughing. Soils were noted to be fine and clay rich, with no stone material noted.

The northern portion of the Project Area consists of a highly disturbed paddock with evidence of significant earthworks. It has less tall grass and weeds, which are also currently growing consistently across the whole area (*Photograph 6.2).* The topography is also generally flat, with little variation in elevation. Soils were noted to be fine and clay rich, with no stone material noted.

No Aboriginal or historic heritage sites were identified within the Project Area during inspection. Ground surface visibility was generally low, owing to thick vegetation coverage. The boundary of "The Homestead (former Kerarbury Station)" is not visible from the Project Area.

A full description of each paddock is provided in *Table 6.1*.

Photograph 6.1 Southern paddock facing south (ERM 2022)

Photograph 6.2 Northern paddock facing east (ERM 2022)

Table 6.1 Survey Results

Paddock	Land Use Zone	Description	GSV (%)	Sites Identified	Photograph (ERM 2022)
Southern	**Former:** Orchard **Current:** Nil	Generally flat topography with uneven ploughed ground surface. Only exposure noted was track along northern fenceline. An irrigation ditch runs parallel to the track between it and the fenceline. An earth bund supporting a transmission line runs parallel through the southern section. Tall grass and weed vegetation covers the entire area with a few small trees present in the irrigation ditch.	2	Nil	
Northern	Former: Unknown Current: Nil	Generally flat topography with evidence of earthworks across the paddock. Low grass and weed vegetation covers the entire area with a few small trees present in scattered locations.	0	Nil	

7. CONCLUSIONS AND RECOMMENDATIONS

The following provides a summary of the key findings of this report, and outlines recommendations for management and mitigation of identified heritage values within the Project Area.

7.1 Conclusions

7.1.1 Aboriginal Heritage

The key findings of the Aboriginal heritage assessment are summarised below:

- no previously recorded Aboriginal heritage sites were identified within or in close proximity to the Project Area;
- no Aboriginal heritage sites were identified within the Project Area during this investigation;
- based on the underlying clay-based soil and high level of historic disturbance the Project Area has low potential to contain subsurface Aboriginal cultural material; and
- the Project Area is not known to contain Aboriginal cultural heritage values.

7.1.2 Historic Heritage

The key findings of the historic heritage assessment are summarised below:

- no previously recorded historic heritage sites are registered within or in close proximity to the Project Area;
- background review indicated low potential for historic heritage to be identified within the Project Area;
- no new historic heritage sites were identified during the site inspection; and
- the Project Area retains low potential for historical archaeological finds.

7.2 Recommendations

Based on the results of this due diligence investigation, it is considered unlikely that Aboriginal cultural heritage objects or historic heritage items or will occur within the Project Area. Although unlikely, there remains a possibility that Aboriginal and historic cultural heritage objects of value may be identified during the course of works. The following recommendations are made as management guidelines in the unlikely event that cultural heritage items or Aboriginal objects are identified.

7.2.1 Cultural Awareness Induction

- All personnel involved with ground breaking activities within the Project Area should undertake a cultural awareness induction, which includes identification of potential Aboriginal and non-Aboriginal heritage objects, identification of historic heritage finds, and an understanding of the chance finds procedure.

7.2.2 Chance Finds Procedure

- If suspected Aboriginal heritage objects or heritage items are found during works, the following Chance Find Procedure should be followed and applies to the entire Project Area:
  - all activity in the immediate area should cease and the location should be cordoned off and an appropriately qualified heritage professional should be consulted;
  - Heritage NSW (DPC) should be immediately contacted;
  - Griffith Local Aboriginal Land Council should be notified (potential Aboriginal objects only);

  - an appropriately qualified heritage professional should record the location and attributes of the site and determine the significance of the find; and
  - works will only recommence once the area has been cleared by further assessment.
- In the event of the discovery of human skeletal material (or suspected human skeletal material) during project activities in the Project Area the following steps should be followed:
  - all activities and/or works in the immediate area must cease;
  - the State Police must be contacted along with Heritage NSW; and
  - any sand/soils removed from the near vicinity of the find must be identified and set aside for assessment by the investigating authorities.

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STATEMENT OF LIMITATIONS

This report is based solely on the scope of work described in Section 1 (Scope of Work) and performed by Environmental Resources Management Australia Pty Ltd (ERM) as commissioned by AGL (the Client). The Scope of Work was governed by a contract between ERM and the Client (Contract).

No limitation, qualification or caveat set out below is intended to derogate from the rights and obligations of ERM and the Client under the Contract.

The findings of this report are solely based on, and the information provided in this report is strictly limited to that required by the Scope of Work. Except to the extent stated otherwise, in preparing this report ERM has not considered any question, nor provides any information, beyond that required by the Scope of Work.

This report was prepared in October 2022 and is based on conditions encountered and information reviewed at the time of preparation. The report does not, and cannot, take into account changes in law, factual circumstances, applicable regulatory instruments or any other future matter. ERM does not, and will not, provide any on-going advice on the impact of any future matters unless it has agreed with the Client to amend the Scope of Work or has entered into a new engagement to provide a further report.

Unless this report expressly states to the contrary, ERM's Scope of Work was limited strictly to identifying typical environmental conditions associated with the subject site(s) and does not evaluate the condition of any structure on the subject site nor any other issues. Although normal standards of professional practice have been applied, the absence of any identified hazardous or toxic materials on the site(s) should not be interpreted as a guarantee that such materials or impacts do not exist.

This report is based on information provided by the Client or third parties (including regulatory agencies). All conclusions and recommendations made in the report are the professional opinions of the ERM personnel involved. Whilst normal checking of data accuracy was undertaken, except to the extent expressly set out in this report, ERM:

- Did not, nor was able to, make further enquiries to assess the reliability of the information or independently verify information provided by;
- Assumes no responsibility or liability for errors in data obtained from the Client, any third parties or external sources (including regulatory agencies).

Although the data that has been used in compiling this report is generally based on actual circumstances, if the report refers to hypothetical examples those examples may, or may not, represent actual existing circumstances.

Only the environmental conditions specifically referred to in this report have been considered. To the extent permitted by law and except as is specifically stated in this report, ERM makes no warranty or representation about:

- The suitability of the site(s) for any purpose or the permissibility of any use;
- The presence, absence or otherwise of any environmental conditions or contaminants at the site(s) or elsewhere; or
- The presence, absence or otherwise of asbestos, asbestos containing materials or any hazardous materials on the site(s).

Use of the site for any purpose may require planning and other approvals and, in some cases, environmental regulator and accredited site auditor approvals. ERM offers no opinion as to the likelihood of obtaining any such approvals, or the conditions and obligations which such approvals may impose, which may include the requirement for additional environment works.

The ongoing use of the site or use of the site for a different purpose may require the management of or remediation of site conditions, such as contamination and other conditions, including but not limited to conditions referred to in this report.

This report should be read in full and no excerpts are to be taken as representative of the whole report. No responsibility or liability is accepted by ERM for use of any part of this report in any other context.

Except to the extent that ERM has agreed otherwise with the Client in the Scope of Work or the Contract, this report:

- Has been prepared and is intended only for the exclusive use of the Client;
- Must not to be relied upon or used by any other party;
- Has not been prepared nor is intended for the purpose of advertising, sales, promoting or endorsing any Client interests including raising investment capital, recommending investment decisions, or other publicity purposes;
- Does not purport to recommend or induce a decision to make (or not make) any purchase, disposal, investment, divestment, financial commitment or otherwise in or in relation to the site(s); and
- Does not purport to provide, nor should be construed as, legal advice.

APPENDIX A AHIMS SEARCH RESULTS

AHIMS Web Services (AWS)
Search Result

Your Ref/PO Number : Kerabury Microgrid Lot68

Client Service ID : 722891

Environmental Resources Management - Melbourne

Date: 17 October 2022

Level 6 99 King Street
Melbourne Victoria 3000

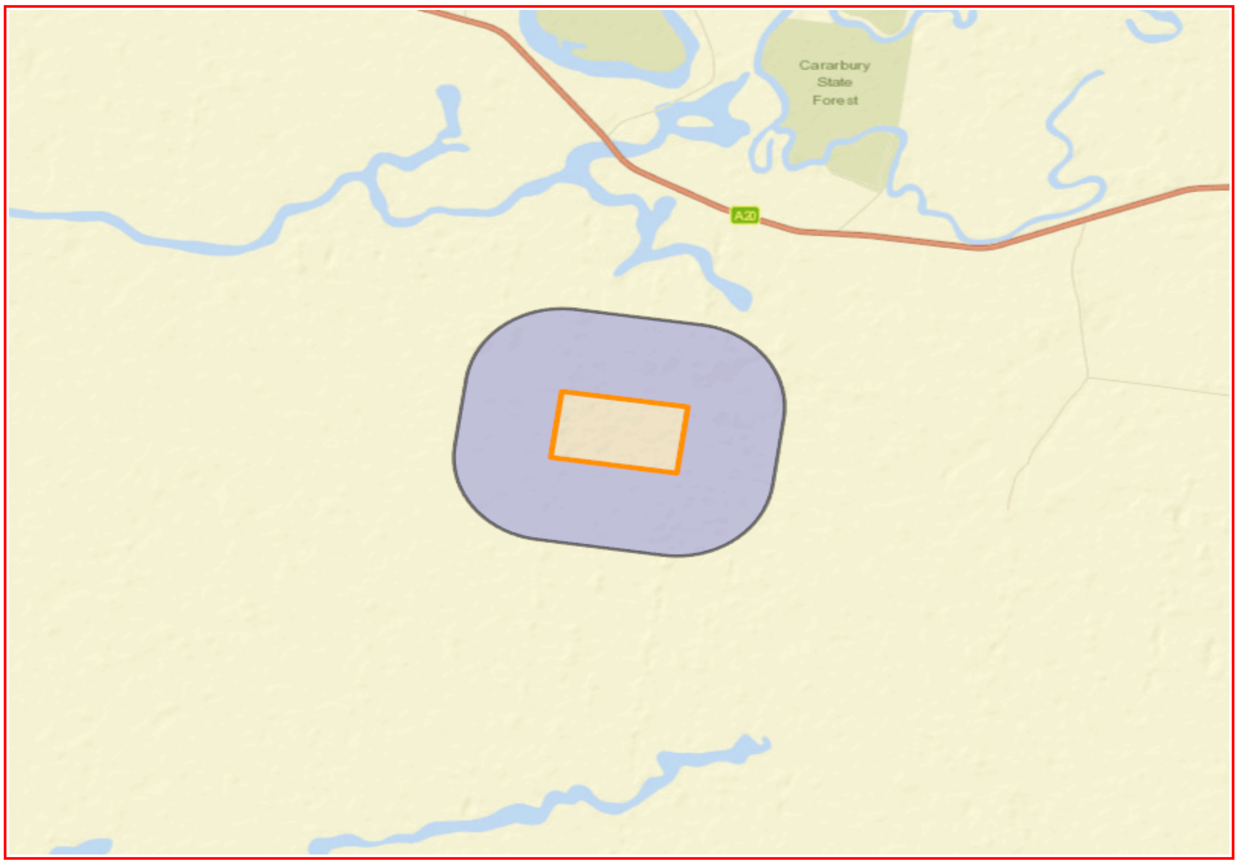
Attention: Elspeth Mackenzie

Email: elspeth.mackenzie@erm.com

Dear Sir or Madam:

AHIMS Web Service search for the following area at Lot : 68, DP:DP750877, Section : - with a Buffer of 1000 meters, conducted by Elspeth Mackenzie on 17 October 2022.

The context area of your search is shown in the map below. Please note that the map does not accurately display the exact boundaries of the search as defined in the paragraph above. The map is to be used for general reference purposes only.



A search of Heritage NSW AHIMS Web Services (Aboriginal Heritage Information Management System) has shown that:

0	**Aboriginal sites are recorded in or near the above location.**
0	**Aboriginal places have been declared in or near the above location. ***

If your search shows Aboriginal sites or places what should you do?

- You must do an extensive search if AHIMS has shown that there are Aboriginal sites or places recorded in the search area.
- If you are checking AHIMS as a part of your due diligence, refer to the next steps of the Due Diligence Code of practice.
- You can get further information about Aboriginal places by looking at the gazettal notice that declared it. Aboriginal places gazetted after 2001 are available on the NSW Government Gazette (https://www.legislation.nsw.gov.au/gazette) website. Gazettal notices published prior to 2001 can be obtained from Heritage NSW upon request

Important information about your AHIMS search

- The information derived from the AHIMS search is only to be used for the purpose for which it was requested. It is not be made available to the public.
- AHIMS records information about Aboriginal sites that have been provided to Heritage NSW and Aboriginal places that have been declared by the Minister;
- Information recorded on AHIMS may vary in its accuracy and may not be up to date. Location details are recorded as grid references and it is important to note that there may be errors or omissions in these recordings,
- Some parts of New South Wales have not been investigated in detail and there may be fewer records of Aboriginal sites in those areas. These areas may contain Aboriginal sites which are not recorded on AHIMS.
- Aboriginal objects are protected under the National Parks and Wildlife Act 1974 even if they are not recorded as a site on AHIMS.
- This search can form part of your due diligence and remains valid for 12 months.

AHIMS Web Services (AWS)
Search Result

Your Ref/PO Number : Kerabury Microgrid Lot69

Client Service ID : 722894

Environmental Resources Management - Melbourne

Level 6 99 King Street
Melbourne Victoria 3000

Attention: Elspeth Mackenzie

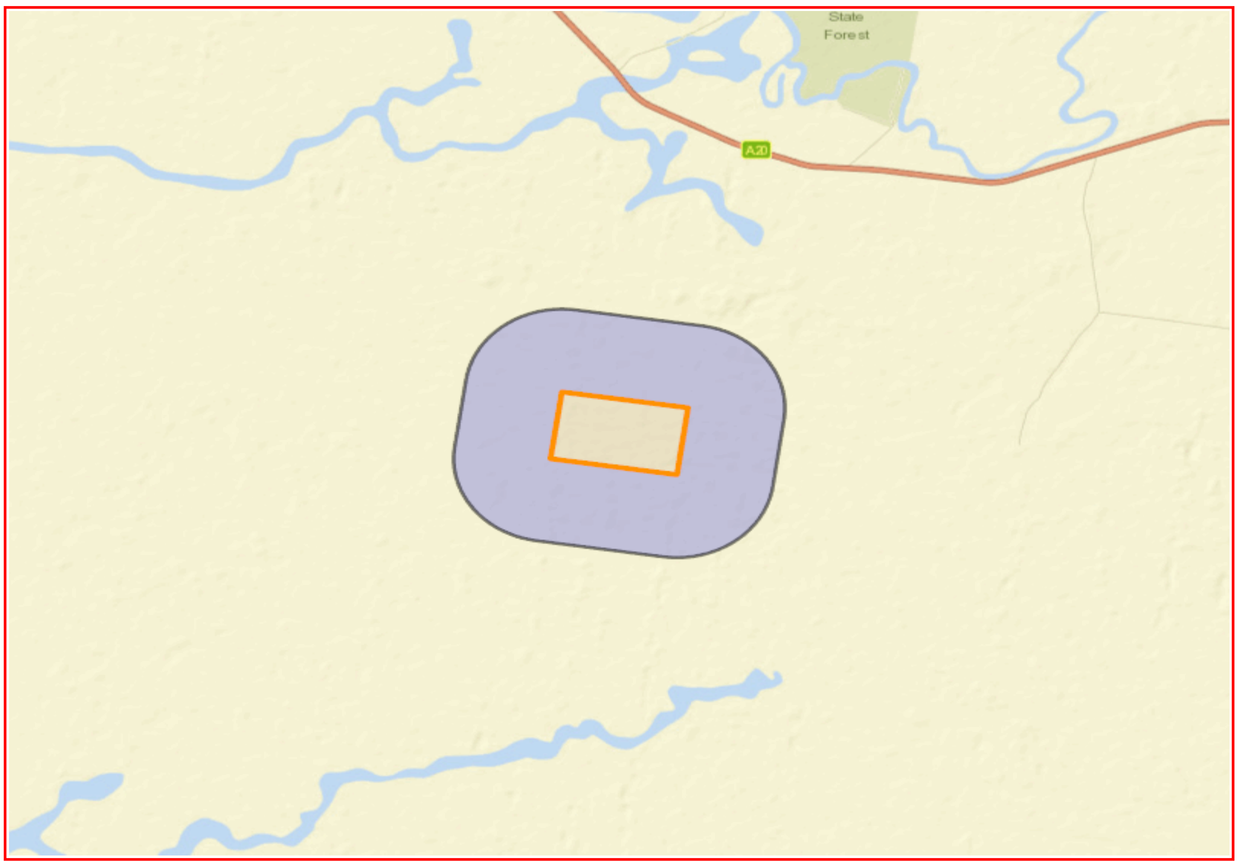
Email: elspeth.mackenzie@erm.com

Date: 17 October 2022

Dear Sir or Madam:

AHIMS Web Service search for the following area at Lot : 69, DP:DP750877, Section : - with a Buffer of 1000 meters, conducted by Elspeth Mackenzie on 17 October 2022.

The context area of your search is shown in the map below. Please note that the map does not accurately display the exact boundaries of the search as defined in the paragraph above. The map is to be used for general reference purposes only.



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- Aboriginal objects are protected under the National Parks and Wildlife Act 1974 even if they are not recorded as a site on AHIMS.
- This search can form part of your due diligence and remains valid for 12 months.

APPENDIX E CIV REPORT

Project Cost Summary for CIV assessment	
Project Name	Olam Kerarbury (Darlington Point)
Category	**Cost (AUD$)**
SOLAR MODULES	$ 2,586,217.85
INVERTERS & OPTIMISERS	$ 602,230.77
BATTERIES	$ 1,919,123.08
MOUNTING	$ 1,162,502.51
BALANCE OF SYSTEM	$ 339,851.12
SUBCONTRACT WORKS	$ 3,707,868.64
Subcontractors Solar Works	*$ 2,605,000.00*
Subcontractors Battery Works	*$ 451,868.00*
Subcontractors HV Works	*$ 615,000.00*
Subcontractors Other	*$ 36,000.00*
APPLICATIONS	$ 923,119.00
Engineering Certification	*$ 238,000.00*
Council & Utility Application	*$ 685,119.00*
OTHER	$ 363,093.00
Freight-out Cost	*$ 90,055.80*
Project Travel - Other Travel	*$ 60,037.20*
Referral Fees	*$ 213,000.00*
TOTAL SYSTEM COST (Ex. GST)	**$ 11,604,005.96**

APPENDIX F VISUAL IMPACT ASSESSMENT

Kerarbury Solar Farm

16705 Sturt Highway, Darling Point, NSW 2706

6MWp SOLAR PROJECT

GLARE ANALYSIS REPORT

Rev.1 19/10/2022

Contents

LIST OF FIGURES

LIST OF TABLES

LIST OF ABBREVIATIONS

	Abbreviation
Direct current	DC
Flight path	FP
Observation point	OP
Photovoltaic	PV
Runway	RWY
Federal Aviation Administration	FAA
Solar glare hazard analysis tool	SGHAT

1. INTRODUCTION

The Kerarbury Solar Farm Project Glare Assessment Report is prepared to evaluate the potential impact of glare of the 6MWp solar energy system on the environment around the installation, primarily the impact on drivers using the Sturt Highway. The solar farm is ground mounted, using a single axis tracker. There are no airports with air traffic control towers in the vicinity of the solar farm. The proposed project location is at Olam Orchards Almond Farm, 16705 Sturt Highway, Darling Point, NSW 2706 (-34.6139, 145.8834) . SBES ltd is responsible for the system design, installation, and application of the project.

Glare is defined as the difficulty seeing in the presence of continuous source of bright light, which is produced by indirect reflection of sunlight. Strong sources of glare can lead to “temporary loss of vision” or a “temporary visual interference effect that persists after the source of illumination has ceased”. Angle of the glare source and eye adaptation has significant impacts on the glare experience. (Tetra Tech EC, 2012).

Glare can be a resulting hazard of a solar power project in certain situations, hence when proposing solar power near highways and airports, the impact of glare should be carefully studied. The nature of the solar panel manufacturing technology is to absorb light as opposed to reflecting light, hence the reflection characteristics of solar panels is comparatively low compared with other sources that can be naturally found in the environment.

In absent of relevant Australian regulations/standards, the solar glare hazard analysis tool (SGHAT) developed by Sandia National Laboratories is adopted for this investigation. The use of the tool is required by the Federal Aviation Administration (FAA) for solar energy installations proposed at federally obligated airports (78 FR 63276).

SGHAT calculates the potential for glare resulted from solar panels by considering the sun path, observation point locations, panel reflectance, panel orientation, etc. It determines a) when and where the solar glare can occur and b) potential effects of the glare hazard on the human eye. If glare is found at a proposed location, the magnitude of the impact is calculated from retinal irradiance and subtended angle. The impact is categorised into 3 categories: low potential for after-image, potential for after-image, and potential for permanent eye damage (retinal burn). This investigation is conducted with the ForgeSolar Glare Gauge web application powered by SGHAT V3.0. SGHAT technical reference is available in Appendix D.

The potential of introducing sources of glare to the environment is evaluated in this report. The brief evaluation of the location’s natural solar resource, the design principle for this project and an introduction to the glare analysis tool is found in section 2; the inputs for the SGHAT software is detailed in section 3; summary of findings is provided in section 4.

2. PROJECT DESCRIPTION

In this section, a brief evaluation of the location's natural solar resource, the design principle for this project and an introduction to the glare analysis tool is provided.

An introduction of the site is provided in section 2.1, solar resource information is provided in section 2.2, introduction of the solar panel technology is provided in section 2.3, the glare hazard consequences are provided in section 2.4.

2.1. SITE DESCRIPTION

The solar project is proposed for 16705 Sturt Highway, Darling Point, NSW 2706 (-34.6139, 145.8834) . As illustrated in Figure 1, the site is approximately 4 kilometres south of the Sturt Highway.

Figure 1. Kerarbury solar farm project location

The proposed project converts sunlight into direct current (DC) through the adoption of Trina 545W monocrystalline photovoltaic (PV) panels. As shown in Figure 2, the proposed system consists of several arrays which have a total PV module front surface area of 28,783m^2. The panel front surface consists of the 3.2mm high transmission, anti-reflection coated tempered glass and silver anodized aluminium alloy frame. The specification sheet of the solar panel is provided in Appendix A.

The total capacity of the proposed solar energy system is 6 MWp, with 11,016 panels in total. These panels will be installed on an FTC ground mount racking system with Single Axis trackers.

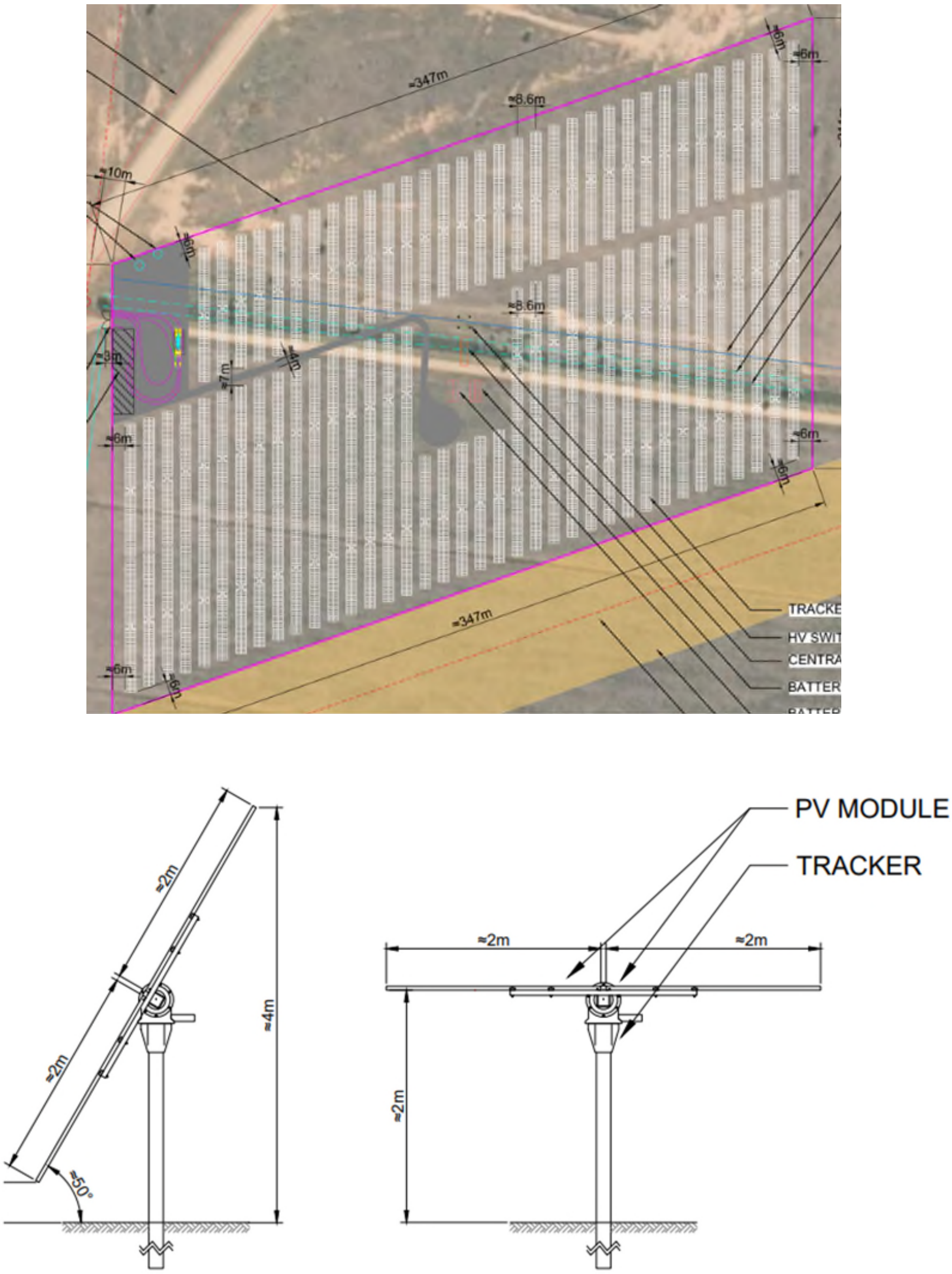

Figure 2. Kerarbury solar project layout

2.2. SOLAR RADIANCE

The motion of the sun dictates the occurrence and magnitude of the resulting glare - the main contributors are the incident angle and the solar radiation intensity.

The glare location depends heavily on the incident angle. Solar incident angle is a result of sun's motion, it changes along with local clock time (and solar time), and has significate seasonal variations. As shown in Figure 3, during summer, the sun is higher up in the sky, and has a longer day length; in winter, the sun is lower in the sky and has a shorter day length.

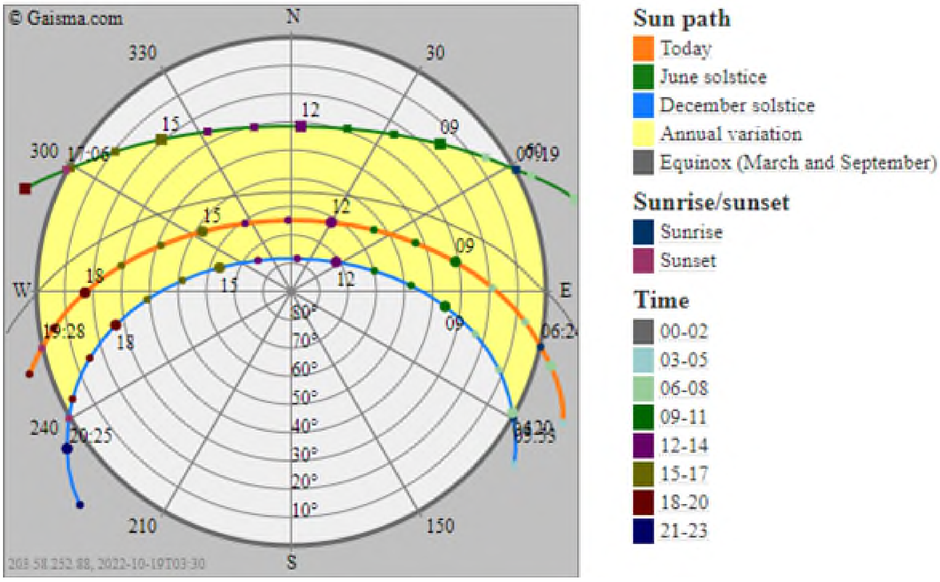

Figure 3. Wagga Wagga sun path chart

The magnitude of glare depends on the solar radiation intensity. The motion of the sun has the same impact on solar radiation, as the sun is higher up in the sky, the earth surface receives more energy as summer rays of light travel much shorter distance, hence solar radiance has a high intensity during summer; winter, on the other hand rays of light travel longer in distance, hence has a low intensity. Solar radiation intensity also changes along with the local time. On a clear day, the solar radiation intensity is low in the mornings and afternoons as the sun's rays strike the earth at low angles, but at solar noon, the sun strikes the earth at high angles hence has maximized radiation intensity. Other aspects also impact on the solar radiation intensity, for instance the presence of air molecules and dust particles, atmospheric conditions, etc.

Both the angle of attack and the solar radiation intensity are location specific. For this report, the location studied is Darling Point, NSW, Australia.

2.3. SOLAR PV TECHNOLOGY

Solar module glare can be a result of direct/indirect sunlight reflection from the PV modules and the corresponding balance of system. However, the glare impacts of solar modules are considerably low comparing with items commonly found in the environment. The panels are designed to collect incident light and convert it into electricity, hence technologies have been developed to ensure minimized reflection loss.

The reflectivity of the solar panel surfaces contributes greatly on the magnitude/likelihood of glare. The PV panels are designed to absorb sunlight to produce electricity. To maximize energy generation, the solar cells are chemically processed to achieve light trapping.

The reflectivity of a surface is measured by Albedo, or reflection coefficient. The albedo factor of the solar panel is 10%, the albedo factor of other surfaces commonly found in the area are shown in Figure 4. (Tetra Tech EC, 2012) The albedo of the PV modules is the same or even lower than the other surfaces commonly found in the environment.

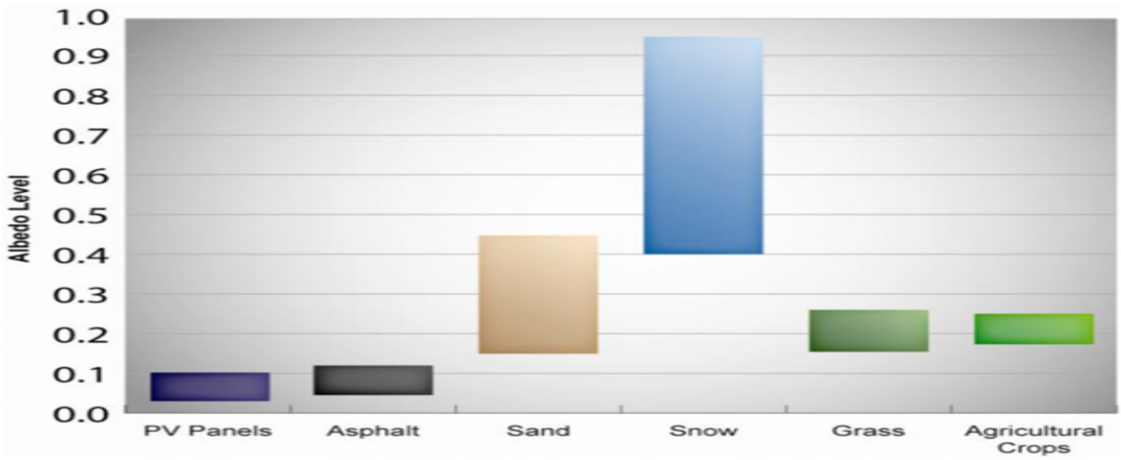

Figure 4. Albedo of Common Surfaces

Need to mention most common roofing materials have higher albedo than solar panels, as shown in Appendix B, *Low and High Solar Reflectance Options for Typical Roofing materials*.

2.4. GLARE HAZARDS

While glint is defined as a momentary flash of light, glare is most commonly recognized as a "more continuous source of excessive brightness relative to ambient lighting". For this research, the main objective is to study the likelihood and severity of hazardous glare resulted from the installation of solar panels.

Two types of glare can occur, direct glare and indirect glare. Direct glare happens when the viewer is located directly on the glare light path, and is a lot stronger in intensity. Direct glare is usually experienced momentarily, as the source of light - the sun and the receiver, the aircraft, are constantly moving. Indirect glare happens when the viewer is exposed to the reflection of the brightness of the sun, opposite to the reflection of the sun itself. Indirect glare can last longer than direct glare, although it has a much lower intensity.

Low-angle reflections that occur during mornings and afternoon are more likely to be observed by low-flying aircrafts during landing or departing. In these situations, as the sun is low, the aircraft operators are more likely to be looking into the sun, which brightness would overpower any resulting glare produced by the PV panels.

Hazards result from glint and glare are categorised into three categories, "potential for permanent eye injury (e.g., retinal burn), temporary disability or distractions (e.g., after-image)." To determine the severity of the glint and glare hazards, the measured and/or calculated irradiances can be compared against the compiled safety metrics, developed by Sandia national laboratories. (Ho, et al., 2011) The Ocular safety metrics determine the severity of the glint/glare based on two variables – the retinal irradiance and the subtended angle (size) of the glare source. The retinal irradiance is calculated from the total power entering the pupil and the retinal image area; the subtended angle is calculated based on the relative location of the sauce of the glare and glint and the receiver.

Figure 5 summarizes the potential impact of different retinal irradiances as a function of subtended source angle for short-term exposures. Same as the hazardous consequences of glare and glint, three regions are defined in the glare hazard plot: potential for permanent eye damage (retinal burn), potential for temporary after-image (flash blindness) and low potential for temporary after image. As shown in the figure 5, as the subtended source angle increases, the safe retinal irradiance threshold decreases. For a given retinal irradiance, a larger subtended source angle leads to larger retinal image area and delivers a greater power to the retinal hence yields more harmful results.

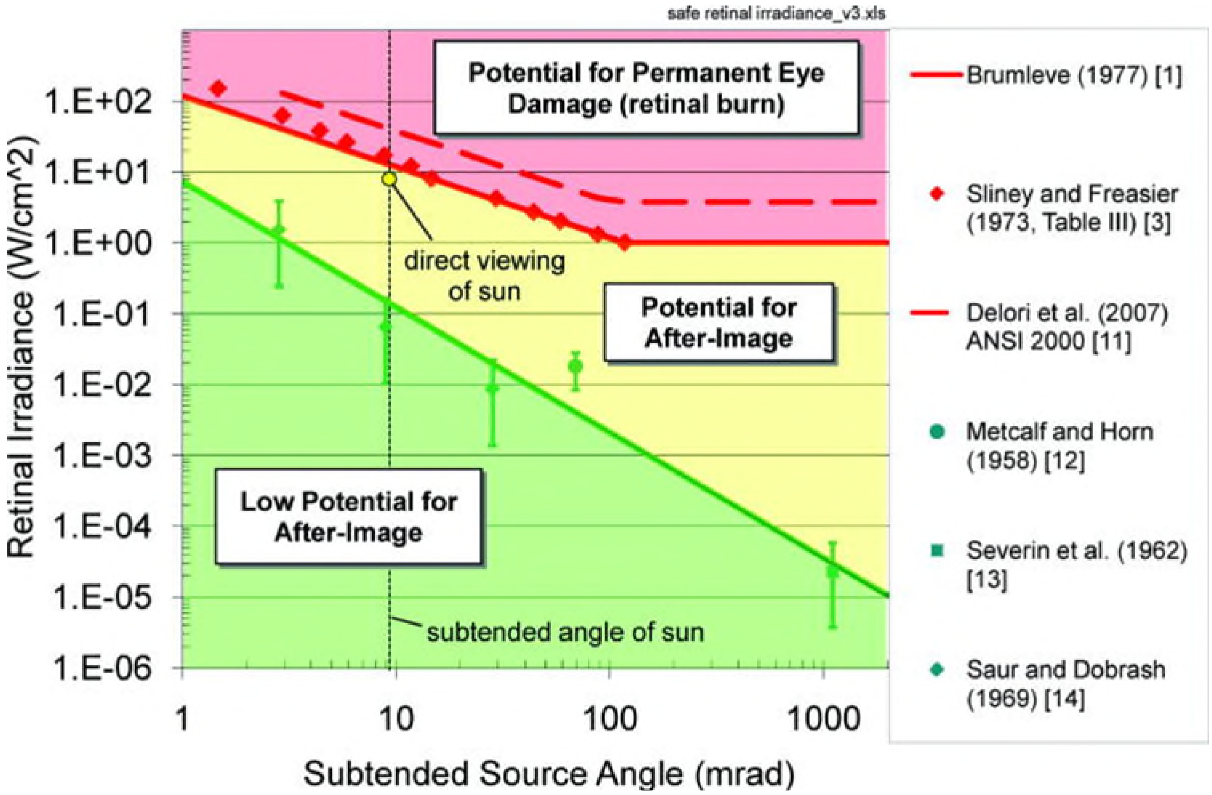

Figure 5. Sample of solar glare hazard plot (Ho, et al., 2011)

Glare and glint may lead to temporary after-image appears in the visual field, as a result, the receiver may experience flash blindness - the size and impact of the after-image in the field of view depend on the size of the subtended source angle and the level of retinal irradiance. (Ho, et al., 2011).

3. SOLAR GLARE HAZARD ANALYSIS

The method for calculating glare hazard is described in this section, including the justification of the design choices and the crucial numerical inputs.

The glare occurrence throughout the year is calculated by the SGHAT developed by Sandia National Laboratories, the algorism has since been licenced to various applications. Through various inputs, the user is able to specify the detailed PV array design and the location of the observation points. The potential ocular impact for the solar glare can be calculated. This investigation is conducted using ForgeSolar Glare Gauge web application, the simulation is powered by SGHAT V3.0.

The direct normal irradiance is defined in section 3.1; the solar arrays are defined in section 3.2; the observation point is defined in section 3.3; the flight path is defined in section 3.4.

3.1. DIRECT NORMAL IRRADIANCE

In the SGHAT, the direct normal irradiance shall be specified to reflect the level of solar irradiance received by the solar array - The direct normal irradiation (DNI) is the amount of solar radiation received per unit area by a surface that is perpendicular to the rays of light. It is adopted to quantify the magnitude of solar radiation at a given location/time.

As illustrated in Figure 6, in SGHAT the DNI is calculated with accordance to the standard solar profile as a function of local time, 2 seasonal variations can be defined for the DNI – winter season and summer season. The peak DNI specified as the absolute maximum DNI of any given day, which usually occurs during solar noon. At any given time of a day, the peak DNI is scaled down based on a normalized time relative to sunrise, solar noon and sunset - The algorithm returns peak DNI at solar noon, lower DNI in the mornings and afternoons.

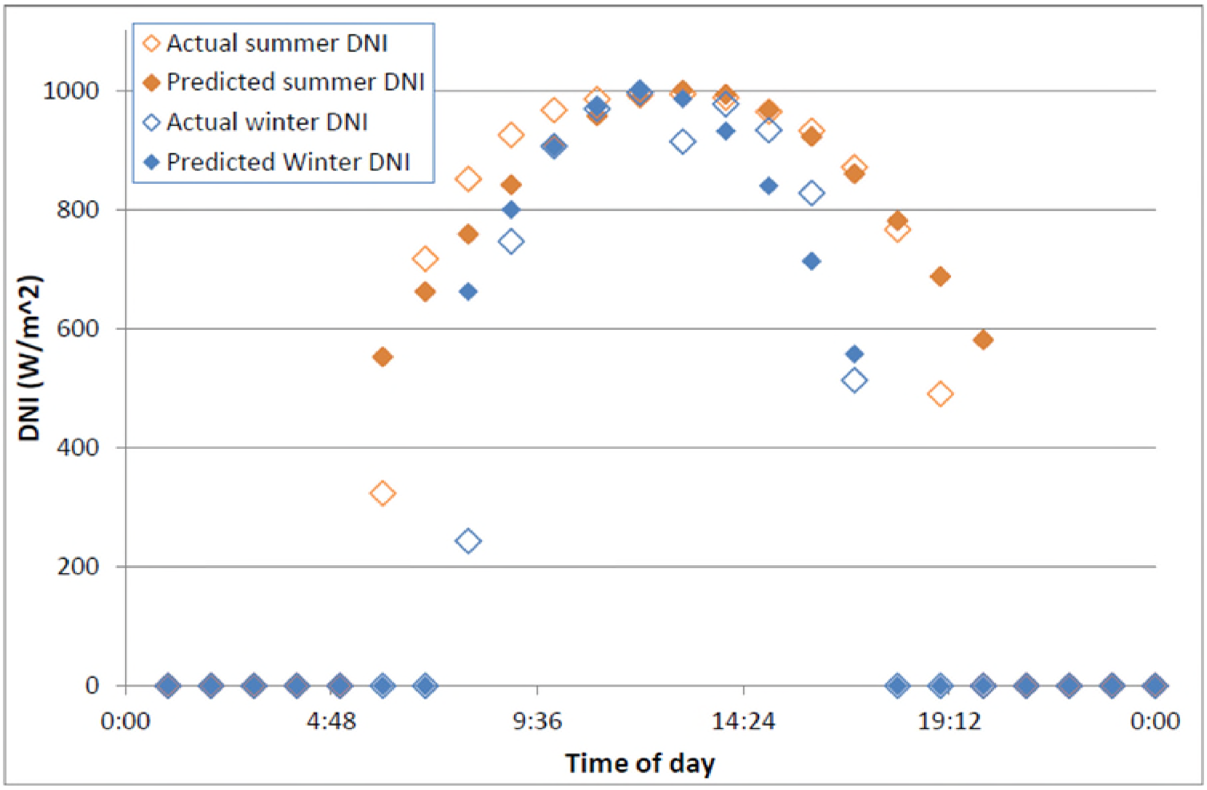

Figure 6. Fit functions modelling normalized DNI vs. Hour

Due to the lack of direct irradiance data available for Darling point, the standard DNI is utilized for this simulation.

3.2. SOLAR ARRAY

The proposed solar array layout is provided in this section, and the numerical inputs adopted for the simulation is listed.

As discussed in section 2.1, the PV array consists of 11,016 panels, the total capacity of the proposed system is 6MWp. The PV energy system constructed in SGHAT is illustrated in Figure 7.

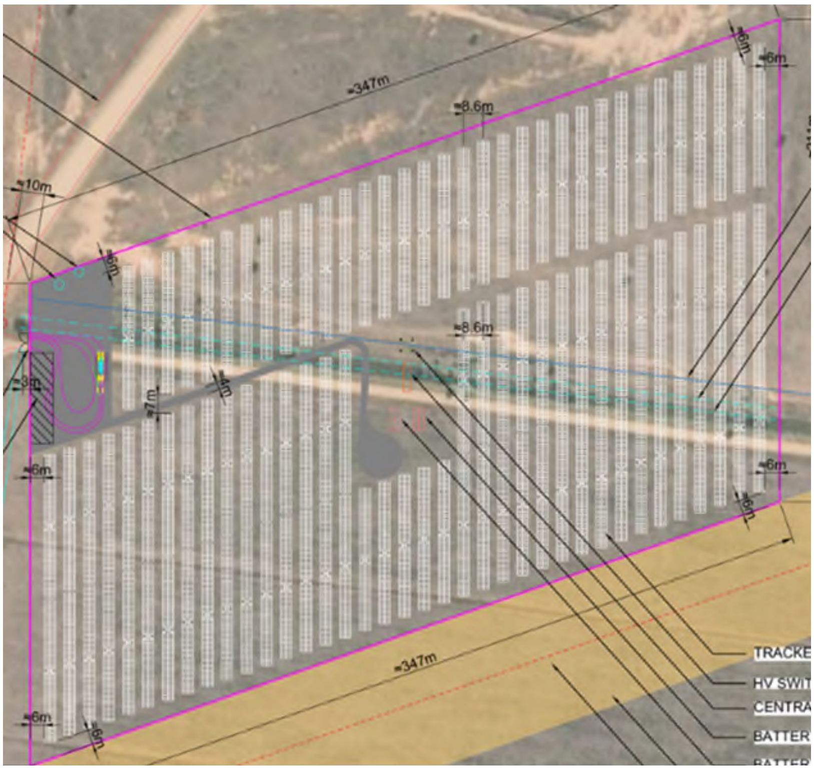

Figure 7. SGHAT proposed PV array layout

The single axis tracker, orientation, capacity, height above ground, latitude and longitude are defined in the model. As suggested in the Trina specification sheet, the module surface material is smooth glass, for the full specification information refer to Appendix A. TSM-DEG19C.20-545 monocrystalline solar module specification sheet.

The panel reflectivity is calculated dynamically based on the panel surface material and the incidence angle of the rays of light.

As shown in Figure 8, the racking system is ground mounted, with a single axis tracker. The panels can rotate from 50° pitch East through to 50° West.

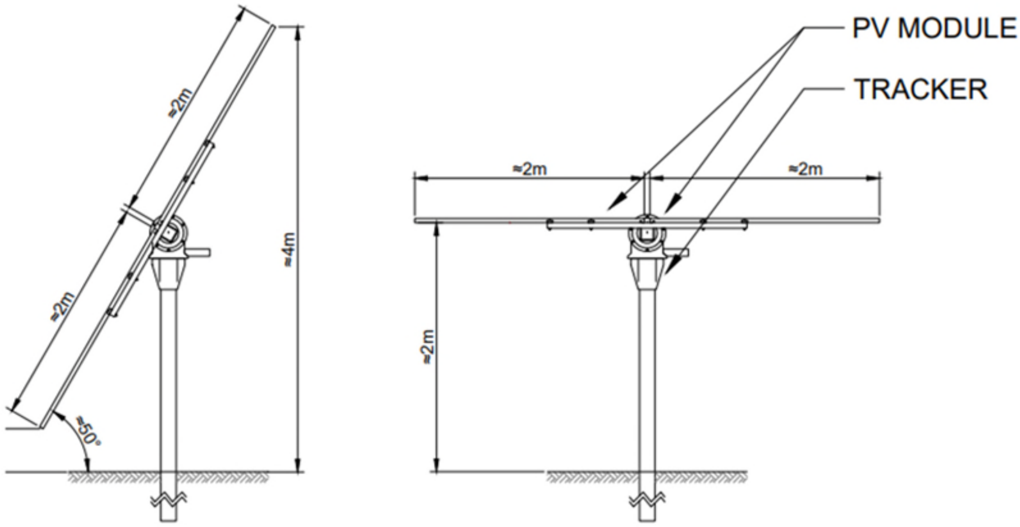

Figure 8. Elevation view

The SGHAT inputs for the PV array is listed in table 1. The latitude; longitude and ground elevation are the data obtained from Forge Solar.

Name: PV array 1
Description: 6MWp Single Axis Tracker
Axis tracking: Single-axis rotation
Backtracking: Shade-slope
Tracking axis orientation: 0.0°
Max tracking angle: 50.0°
Resting angle: 0.0°
Ground Coverage Ratio: 0.5
Rated power: 6000.0 kW
Panel material: Smooth glass with AR coating
Reflectivity: Vary with sun
Slope error: correlate with material

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-34.627463	145.817551	119.72	2.00	121.72
2	-34.625501	145.817717	118.57	2.00	120.57
3	-34.624454	145.821036	119.12	2.00	121.12
4	-34.626398	145.821072	118.44	2.00	120.44

Table 1. PV array 1 SGHAT inputs

It is important to acknowledge that for current version of the software the impact of the detailed geometry of the PV arrays (pathways, gaps between the panels, slight orientation mismatch) is not realized.

3.3. ROUTE RECEPTORS

The routes studied for glare impact are listed in this section.

In SGHAT, the user defined route consists of the section of the Sturt Highway with a 5km radius of the Kerarbury Solar Farm. Elevations of the road are taken from Forge Solar, and traffic is considered in both directions.

The Sturt Highway Route path runs North West to South East as indicated in Figure 9.

Figure 9. Sturt Highway Under Study

The detailed SGHAT inputs are listed in Table 2.

Route Receptors

Name: Sturt Highway
Path type: Two-way
Observer view angle: 50.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-34.601564	145.870157	124.51	0.00	124.51
2	-34.602500	145.866971	122.66	0.00	122.66
3	-34.602651	145.866113	122.18	0.00	122.18
4	-34.602748	145.865405	121.19	0.00	121.19
5	-34.602748	145.864836	121.19	0.00	121.19
6	-34.602712	145.864053	120.53	0.00	120.53
7	-34.602447	145.861832	120.36	0.00	120.36
8	-34.601937	145.857375	120.68	0.00	120.68
9	-34.601505	145.853802	118.98	0.00	118.98
10	-34.601381	145.852493	117.09	0.00	117.09
11	-34.601134	145.847901	119.18	0.00	119.18
12	-34.600991	145.845070	120.72	0.00	120.72
13	-34.600872	145.844244	119.30	0.00	119.30
14	-34.600519	145.842978	117.68	0.00	117.68
15	-34.600066	145.841433	120.02	0.00	120.02
16	-34.599335	145.838970	120.00	0.00	120.00
17	-34.598675	145.836652	120.00	0.00	120.00
18	-34.598486	145.836056	120.25	0.00	120.25
19	-34.597828	145.834538	120.00	0.00	120.00
20	-34.594910	145.827742	119.51	0.00	119.51
21	-34.594035	145.825971	119.36	0.00	119.36
22	-34.593581	145.825241	118.85	0.00	118.85
23	-34.593032	145.824611	118.86	0.00	118.86
24	-34.592476	145.824127	120.21	0.00	120.21
25	-34.583003	145.815113	118.05	0.00	118.05
26	-34.580281	145.812270	121.17	0.00	121.17
27	-34.579623	145.811572	122.02	0.00	122.02

Table 2. Sturt Highway SGHAT inputs

The results for the SGHAT simulation are listed in section 4.

4. SIMULATION RESULTS

The results for the SGHAT simulation for the potential impact of the proposed solar energy system on traffic operation are listed in this section.

To avoid confusion, SGHAT notation is adopted for this report. “No Glare” denotes no glare impact on the observation points; glare denotes low potential for after image; glare denotes potential to cause temporary after-image; glare denotes potential to cause retinal burn (permanent eye damage).

The glare impact analysis is provided in section 5. For the detailed glare simulation report refer to Appendix C.

4.1. SIMULATION RESULTS

The severity of glare impact for each observation point/flight path is listed in Table 8.

Observation points	
Route Receptors	
Sturt Highway	glare

Table 3. Potential glare impact of photovoltaicarrayson the Sturt Highway observation points

The number of glare instances resulted from combined PV arrays are listed in Table 5.

PV array	Green Glare (Min)	Yellow Glare (Min)	Red Glare (Min)
PV array 1	138	0	0

Table 4. Detailed glare impact summary

4.2. KEY MODELING ASPECTS AND ASSUMPTIONS

Various assumptions used for this investigation are summarized in the following section.

1. The local geometry (terrain) is defined to our best ability, in the case when no data is available, the height of the coordinates outlined by google maps are utilised
2. The analysis is based on the solar irradiance of a clear day - environmental factors such as cloud coverage, atmospheric attenuation, presence of air particles, etc are not considered, which may impact on the result of the simulation
3. Other factors such as dirt build up on the panels, partial shading, and human/animal factors are not considered
4. The DNI data does not reflect on the actual solar irradiance at all given times.
5. The analysis assumes constant viewing from the specified observation points/ route
6. The minimum time interval for the software is 1 minute, please note direct glare is experienced momentarily as the viewer passes through the direct angle of reflection. (Jason A. ROgers, 2015)
7. Time associated with glare are demoted in standard time. For daylight savings, add one hour
8. Glare analyses do not account for physical obstructions between reflectors and receptors. This includes buildings, tree cover and geographic obstructions
9. The glare hazard determination relies on several approximations including observer eyes characteristics, angle of view, and typical blink response time. Actual values may differ

10. Hazard zone boundaries shown in the Glare Hazard Plot are an approximation and visual aid. Actual ocular outcomes encompass a continuous, not discrete, spectrum.
11. Ocular transmission coefficient of 0.5
12. Pupil diameter 0.002m
13. Eye Focal Length 0.017meters
14. Sun Subtended angle 9.3 milliradians

4.3. SIMULATION RESULT SUMMARY

The three levels of ocular hazards are established based on retinal irradiance and subtended source angle. (Clifford K. Ho, 2015) The retinal irradiance determines the amount of energy received by the retina of the observer; and the subtended source angle determines the direction of the glare path. While lower retinal irradiance indicates lower impact at low source angle, it can result in high intensity of glare at large source angle. For each route receptor specified, the project must produce a low potential for a temporary after-image or no glare to be considered safe for traffic operation.

As illustrated in Table 4, green glare with low potential for after image is present for a very short period of time.

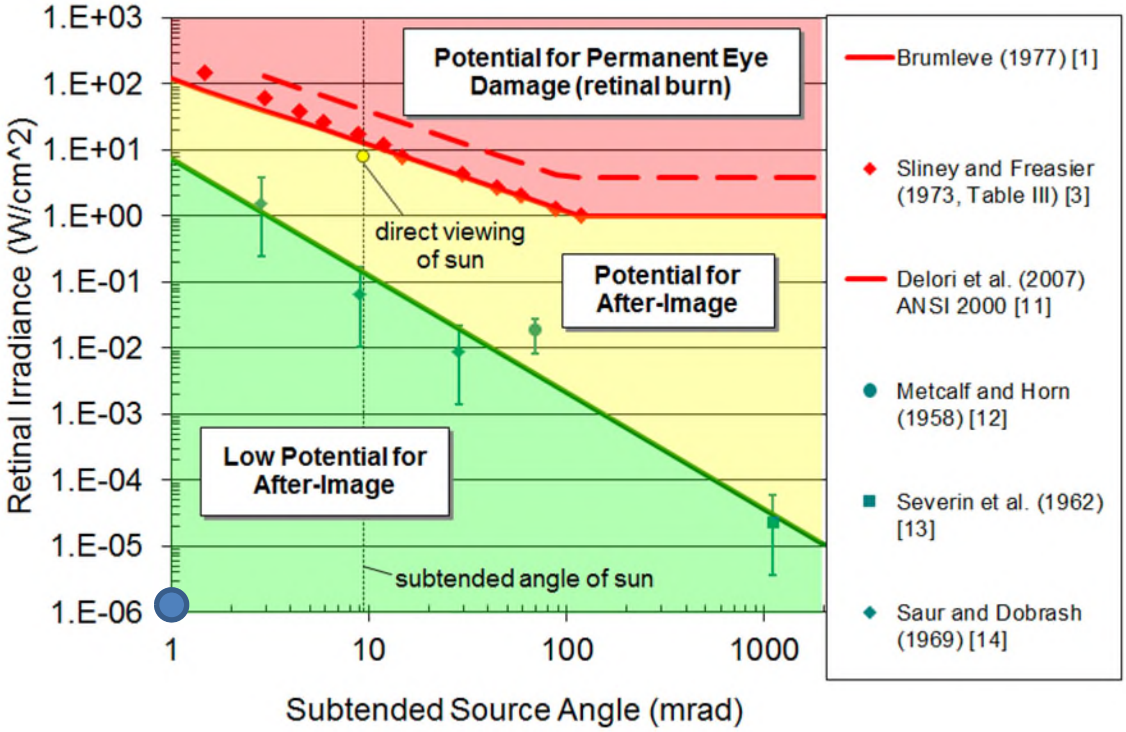

Figure 10. Glare hazard plot showing the plot of simulated glare result

To summarize:

- Green glare (low potential for after image) is present for short duration.
- As can be seen from Figures 11 this green glare occurs for short durations, only during the months of January and December.
- As can be seen in figure 12, the green glare only occurs on a very limited section of the route under study.
- Short durations of green glare over a limited number of months will have negligible impact on users of the Sturt Highway.

All glares resulted from the solar panels installation belong to the category low potential for after image, hence the proposed PV array is deemed suitable for operation in the current location. The methodology & consequences of the potential glare is investigated in detail in section 5.

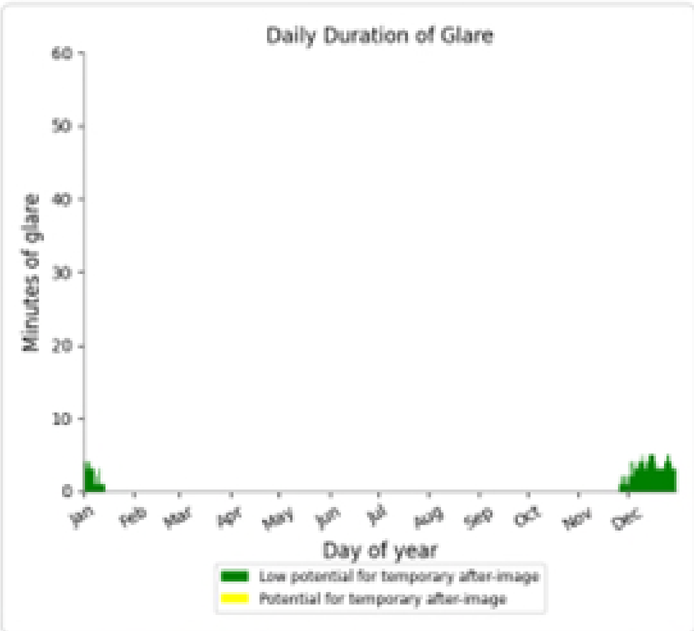

Figure 11. Daily Duration of Glare

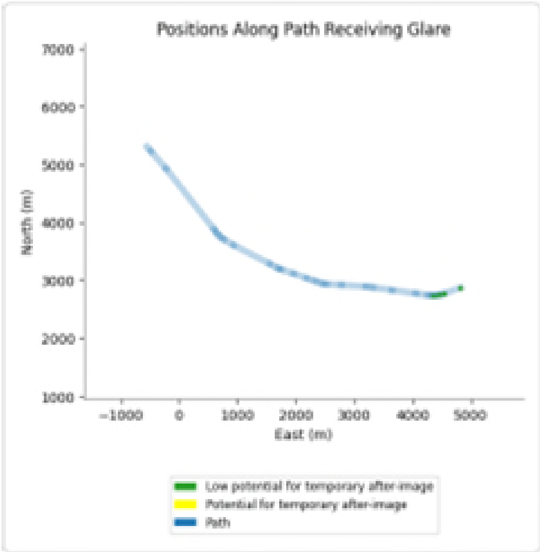

Figure 12. Positions Along Path Receiving Glare

5. CONCLUSION

The PV panels are designed to absorb light hence the reflectivity of the surface have very low reflectivity. Comparing with the reflectivity of common objects found in the environment, the reflectivity of the panels is considerably low.

The Solar Glare Hazard Analysis Tool is utilised to determine the potential for glare occurrence and the resulting glare intensity. The glare receivers investigated by this research include the users of the Sturt Highway. All inputs are detailed and documented in this report.

This investigation has demonstrated the proposed solar energy system will not produce harmful glare impact that would be deemed distracting or harmful to road users, and the glare that will result from the installation of the proposed PV modules and its impact to the road users operations are considered minimal.

6. REFERENCE

Barrett, S., 2013. *Glare Factor: Solar Installations and Airports,* 0: Solar Industry Mag.

Clifford K. Ho, C. A. S. J. Y. E. B., 2015. *Solar glare hazard analysis tool (SGHAT) technical reference manual,* s.l.: Sandia National Laboratories.

Ho, C. K., Ghanbari, C. M. & Diver, R. B., 2011. Methodology to Assess Potential Glint and Glare Hazards From Concentrating Solar Power Plants: Analytical Models and Experimental Validation. *Journal of Solar Energy Engineering,* 133(031021), pp. 1-9.

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Available at: http://www.bom.gov.au/jsp/ncc/climate_averages/solar-exposure/index.jsp?period=an#maps
[Accessed 05 09 2017].

Tetra Tech EC, I., 2012. *Imperial valley solar company soalr photovoltaic project report,* Irvine, CA: Tetra Tecfh EC, Inc.

Melbourne Airport Master Plan 2018

APPENDIX A. SOLAR PANEL SPEC SHEET – TSM-DE19c.20-545W MONOCRYSTALLINE SOLAR MODULE

APPENDIX B. LOW AND HIGH SOLAR REFLECTANCE OPTIONS FOR TYPICAL ROOFING MATERIALS

APPENDIX C. FORGESOLAR SGHAT REPORT

APPENDIX D. SGHAT TECHNICAL REFERENCE

APPENDIX A. SOLAR PANEL SPEC SHEET – TSM-450 DE17M(II) MONOCRYSTALLINE SOLAR MODULE

Vertex

BIFACIAL DUAL GLASS MONOCRYSTALLINE MODULE

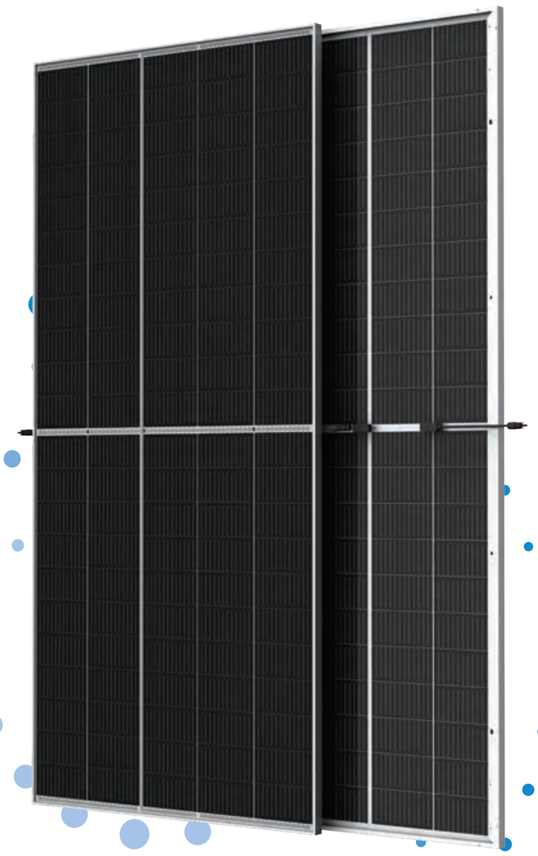
PRODUCT: TSM-DEG19C.20

PRODUCT RANGE: 530-555W

555W
MAXIMUM POWER OUTPUT

0~+5W
POSITIVE POWER TOLERANCE

21.2%
MAXIMUM EFFICIENCY



High customer value

- Lower LCOE (Levelized Cost Of Energy), reduced BOS (Balance of System) cost, shorter payback time
- Lowest guaranteed first year and annual degradation;
- Designed for compatibility with existing mainstream system components
- Higher return on Investment

High power up to 555W

- Up to 21.2% module efficiency with high density interconnect technology
- Multi-busbar technology for better light trapping effect, lower series resistance and improved current collection

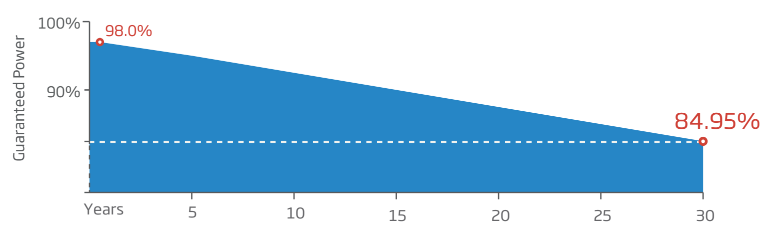
High reliability

- Minimized micro-cracks with innovative non-destructive cutting technology
- Ensured PID resistance through cell process and module material control
- Resistant to harsh environments such as salt, ammonia, sand, high temperature and high humidity areas
- Mechanical performance up to 5400 Pa positive load and 2400 Pa negative load

High energy yield

- Excellent IAM (Incident Angle Modifier) and low irradiation performance, validated by 3rd party certifications
- The unique design provides optimized energy production under inter-row shading conditions
- Lower temperature coefficient (-0.34%) and operating temperature
- Up to 25% additional power gain from back side depending on albedo

Trina Solar's Vertex Bifacial Dual Glass Performance Warranty



Comprehensive Products and System Certificates

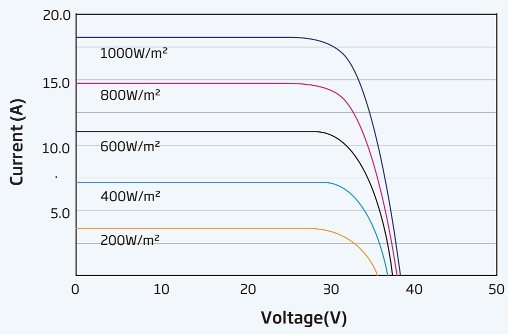
IEC61215/IEC61730/IEC61701/IEC62716/UL61730
ISO 9001: Quality Management System
ISO 14001: Environmental Management System
ISO14064: Greenhouse Gases Emissions Verification
ISO45001: Occupational Health and Safety Management System

Trinasolar

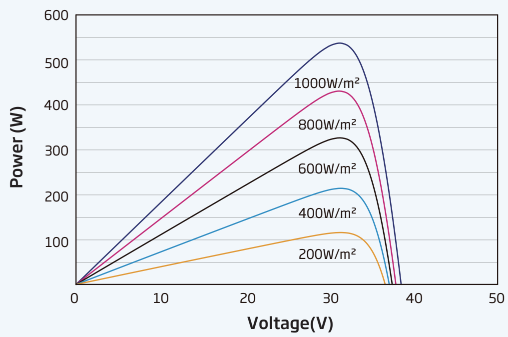
Vertex BIFACIAL DUAL GLASS MONOCRYSTALLINE MODULE

DIMENSIONS OF PV MODULE(mm)

I-V CURVES OF PV MODULE(540 W)



P-V CURVES OF PV MODULE(540 W)



ELECTRICAL DATA (STC)

Peak Power Watts-PMAX (Wp)*	530	535	540	545	550	555
Power Tolerance-PMAX (W)	0 ~ +5					
Maximum Power Voltage-VMPP (V)	31.0	31.2	31.4	31.6	31.8	32.0
Maximum Power Current-IMPP (A)	17.11	17.16	17.21	17.24	17.29	17.35
Open Circuit Voltage-VOC (V)	37.3	37.5	37.7	37.9	38.1	38.3
Short Circuit Current-ISC (A)	18.19	18.24	18.30	18.35	18.39	18.43
Module Efficiency η m (%)	20.3	20.5	20.7	20.9	21.0	21.2

STC: Irrdiance 1000W/m2, Cell Temperature 25°C, Air Mass AM1.5. *Measuring tolerance: ±3%.

Electrical characteristics with different power bin (reference to 10% Irradiance ratio)

Total Equivalent power -PMAX (Wp)	567	573	578	583	589	594
Maximum Power Voltage-VMPP (V)	31.0	31.2	31.4	31.6	31.8	32.0
Maximum Power Current-IMPP (A)	18.31	18.36	18.41	18.45	18.50	18.56
Open Circuit Voltage-VOC (V)	37.3	37.5	37.7	37.9	38.1	38.3
Short Circuit Current-ISC (A)	19.46	19.52	19.58	19.63	19.68	19.72
Irradiance ratio (rear/front)	10%					

Power Bifaciality:70±5%.

ELECTRICAL DATA (NOCT)

Maximum Power-PMAX (Wp)	401	405	409	413	416	420
Maximum Power Voltage-VMPP (V)	28.8	29.0	29.2	29.4	29.5	29.7
Maximum Power Current-IMPP (A)	13.93	13.97	14.02	14.08	14.10	14.14
Open Circuit Voltage-VOC (V)	35.1	35.3	35.5	35.7	35.9	36.1
Short Circuit Current-ISC (A)	14.66	14.70	14.75	14.79	14.82	14.85

NOCT: Irradiance at 800W/m², Ambient Temperature 20°C, Wind Speed 1m/s.

MECHANICAL DATA

Solar Cells	Monocrystalline
No. of cells	110 cells
Module Dimensions	2384×1096×30 mm (93.86×43.15×1.18 inches)
Weight	32.3 kg (71.2 lb)
Front Glass	2.0 mm (0.08 inches), High Transmission, AR Coated Heat Strengthened Glass
Encapsulant material	EVA/POE
Back Glass	2.0 mm (0.08 inches), Heat Strengthened Glass (White Grid Glass)
Frame	30mm(1.18 inches) Anodized Aluminium Alloy
J-Box	IP 68 rated
Cables	Photovoltaic Technology Cable 4.0mm² (0.006 inches²), Portrait: 280/280 mm(11.02/11.02 inches) Length can be customized
Connector	MC4 EVO2 / TS4*

*Please refer to regional datasheet for specified connector.

TEMPERATURE RATINGS

NOCT(Nominal Operating Cell Temperature)	43°C (±2°C)
Temperature Coefficient of PMAX	- 0.34%/°C
Temperature Coefficient of VOC	- 0.25%/°C
Temperature Coefficient of ISC	0.04%/°C

MAXIMUMRATINGS

Operational Temperature	-40~+85°C
Maximum System Voltage	1500V DC (IEC)
	1500V DC (UL)
Max Series Fuse Rating	35A

WARRANTY

12 year Product Workmanship Warranty

30 year Power Warranty

2% first year degradation

0.45% Annual Power Attenuation

(Please refer to product warranty for details)

PACKAGING CONFIGUREATION

Modules per box: 36 pieces

Modules per 40' container: 720 pieces

Trinasolar

CAUTION: READ SAFETY AND INSTALLATION INSTRUCTIONS BEFORE USING THE PRODUCT.

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Version number: TSM_EN_2022_A

www.trinasolar.com

APPENDIX B. LOW AND HIGH SOLAR REFLECTANCE OPTIONS FOR TYPICAL ROOFING MATERIALS

Low and High Solar-Reflectance Options for Typical Roofing Materials

Low Solar-Reflectance Option			**High Solar-Reflectance Option**		
Description	**Albedo (%)**	**Average Cost[1] ($/ft^2)**	**Description**	**Albedo (%)**	**Additional Cost[2] (% of avg. cost in column 2)**
Sloped roofs					
dark composite asphalt shingle; dark fiberglass asphalt shingle; dark organic asphalt shingle	5-15	0.95 - 1.92	white asphalt shingle with "premium" white granules; not presently soldoption of high reflectance white	35 55	0 - 1% more
clay tile	25-35	7.22 - 9.55	white clay tile	70-80	0-35% more
concrete tile	10-30	3.17 - 4.80	white concrete tile	70-80	0-20% more
fiber-cement shingle (dark)	10-30	2.84	white fiber-cement shingle	60-80	0
unpainted metal (steel, aluminum) shingle;	60-70 [3]	3.49 - 6.0	white painted metal shingle	55-80	0
Flat or low-slope roofs					
built-up roof with dark gravel; built-up with mineral-surface cap sheet; built-up or coal tar roof with smooth asphalt surface; built-up roof with aluminum coating	5-10 10-20 5-10 30-55[3]	1.25 - 2.13	built-up roof with white gravel; built-up roof with gravel and cementitious coating; built-up roof with white cementitious coating over a mineral surface cap sheet; smooth surface built-up roof with white roof coating	40 60 65 70-80	0 0-20% more 0-20% more 0- 30% more
black single-ply membrane (EPDM, CPE, CPSE)	5-10	1.06-2.01	Stevens Roofing “Cool-Black” white single-ply membrane (EPDM, CPE, CPSE); white coating on a black single-ply membrane	50 70-80 70-80	? 0-20% more 0-30% more
modified bitumen roof with mineral-surface cap sheet	10-20	1.44-1.84	white cementitious coating over a mineral surface cap sheet	65	0-20% more
unpainted metal roof	70[3]	1.72-3.74	white painted metal roof	55-80	0-20% more

1 Average installed cost, including materials and labor. Sources: for all roofs except concrete tile: R.S. Means, *Assemblies Cost Data 1996,* R.S. Means Company, Kingston, MA, 1995. For concrete roof we used a supplier's estimate of material cost and R.S. Means estimate of installing a clay tile roof.
2 Additional costs are rough estimates of the additional installed cost, based on calls to manufacturers.
3 Unpainted metal and aluminum coatings exhibit low emissivity, resulting in higher surface temperatures in sunlight than their albedo would suggest.

APPENDIX C. FORGESOLAR SGHAT REPORT

FORGESOLAR GLARE ANALYSIS

Project: **Kerarbury**

6MWp Solar Farm and 4.58MWh Battery located at Olam Orchards Farm near Darling Point, NSW

Site configuration: **Kerarbury Solar Farm-temp-0**

Site description: 6MWp Solar Farm on single axis tracker

Created 19 Oct, 2022
Updated 19 Oct, 2022
Time-step 1 minute
Timezone offset UTC-8
Site ID 77890.13790
Category 5 MW to 10 MW
DNI peaks at 1,000.0 W/m^2
Ocular transmission coefficient 0.5
Pupil diameter 0.002 m
Eye focal length 0.017 m
Sun subtended angle 9.3 mrad
Methodology V2

Summary of Results

Glare with low potential for temporary after-image predicted

PV Array	Tilt	Orient	Annual Green Glare		Annual Yellow Glare		Energy
	°	°	min	hr	min	hr	kWh
PV array 1	SA tracking	SA tracking	138	2.3	0	0.0	16,170,000.0

Total annual glare received by each receptor; may include duplicate times of glare from multiple reflective surfaces.

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Sturt Highway	138	2.3	0	0.0

Component Data

PV Arrays

Name: PV array 1
Description: 6MWp Single Axis Tracker
Axis tracking: Single-axis rotation
Backtracking: Shade-slope
Tracking axis orientation: 0.0°
Max tracking angle: 50.0°
Resting angle: 0.0°
Ground Coverage Ratio: 0.5
Rated power: 6000.0 kW
Panel material: Smooth glass with AR coating
Reflectivity: Vary with sun
Slope error: correlate with material

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-34.627463	145.817551	119.72	2.00	121.72
2	-34.625501	145.817717	118.57	2.00	120.57
3	-34.624454	145.821036	119.12	2.00	121.12
4	-34.626398	145.821072	118.44	2.00	120.44

Route Receptors

Name: Sturt Highway
Path type: Two-way
Observer view angle: 50.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-34.601564	145.870157	124.51	0.00	124.51
2	-34.602500	145.866971	122.66	0.00	122.66
3	-34.602651	145.866113	122.18	0.00	122.18
4	-34.602748	145.865405	121.19	0.00	121.19
5	-34.602748	145.864836	121.19	0.00	121.19
6	-34.602712	145.864053	120.53	0.00	120.53
7	-34.602447	145.861832	120.36	0.00	120.36
8	-34.601937	145.857375	120.68	0.00	120.68
9	-34.601505	145.853802	118.98	0.00	118.98
10	-34.601381	145.852493	117.09	0.00	117.09
11	-34.601134	145.847901	119.18	0.00	119.18
12	-34.600991	145.845070	120.72	0.00	120.72
13	-34.600872	145.844244	119.30	0.00	119.30
14	-34.600519	145.842978	117.68	0.00	117.68
15	-34.600066	145.841433	120.02	0.00	120.02
16	-34.599335	145.838970	120.00	0.00	120.00
17	-34.598675	145.836652	120.00	0.00	120.00
18	-34.598486	145.836056	120.25	0.00	120.25
19	-34.597828	145.834538	120.00	0.00	120.00
20	-34.594910	145.827742	119.51	0.00	119.51
21	-34.594035	145.825971	119.36	0.00	119.36
22	-34.593581	145.825241	118.85	0.00	118.85
23	-34.593032	145.824611	118.86	0.00	118.86
24	-34.592476	145.824127	120.21	0.00	120.21
25	-34.583003	145.815113	118.05	0.00	118.05
26	-34.580281	145.812270	121.17	0.00	121.17
27	-34.579623	145.811572	122.02	0.00	122.02

Glare Analysis Results

Summary of Results Glare with low potential for temporary after-image predicted

PV Array	Tilt	Orient	Annual Green Glare		Annual Yellow Glare		Energy
	°	°	min	hr	min	hr	kWh
PV array 1	SA tracking	SA tracking	138	2.3	0	0.0	16,170,000.0

Total annual glare received by each receptor; may include duplicate times of glare from multiple reflective surfaces.

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Sturt Highway	138	2.3	0	0.0

PV: PV array 1 low potential for temporary after-image

Receptor results ordered by category of glare

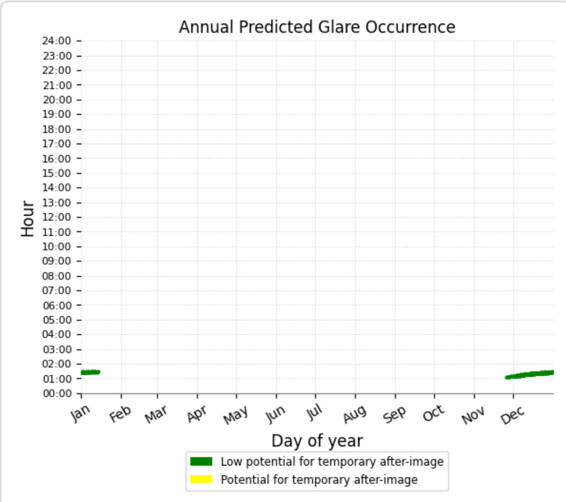
Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Sturt Highway	138	2.3	0	0.0

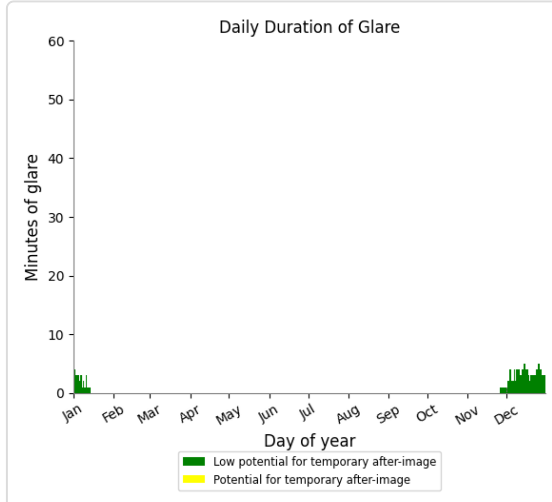
PV array 1 and Sturt Highway

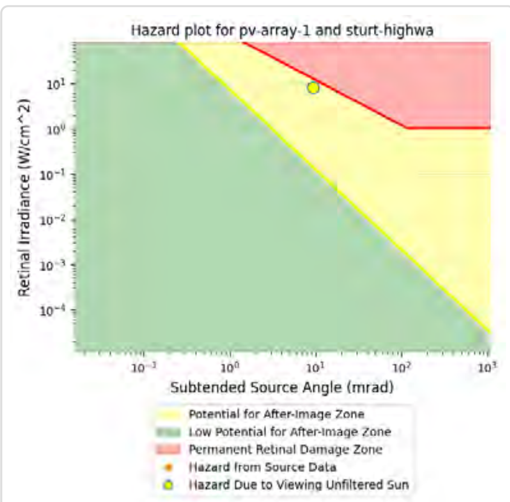
Receptor type: Route

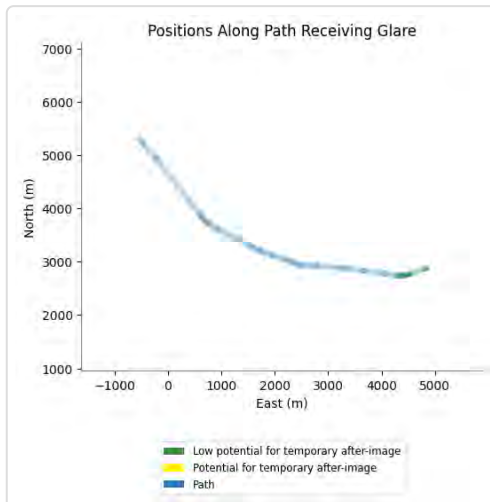
0 minutes of yellow glare

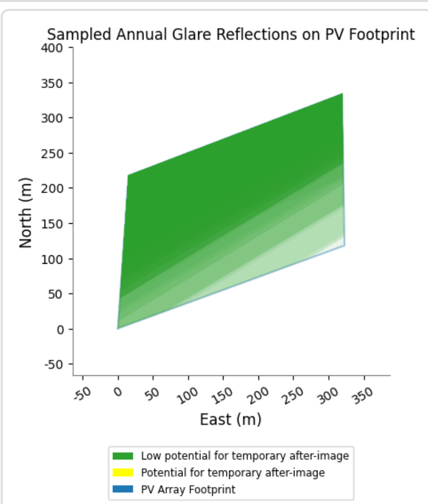
138 minutes of green glare











Assumptions

"Green" glare is glare with low potential to cause an after-image (flash blindness) when observed prior to a typical blink response time.
"Yellow" glare is glare with potential to cause an after-image (flash blindness) when observed prior to a typical blink response time.
Times associated with glare are denoted in Standard time. For Daylight Savings, add one hour.
The algorithm does not rigorously represent the detailed geometry of a system; detailed features such as gaps between modules, variable height of the PV array, and support structures may impact actual glare results. However, we have validated our models against several systems, including a PV array causing glare to the air-traffic control tower at Manchester-Boston Regional Airport and several sites in Albuquerque, and the tool accurately predicted the occurrence and intensity of glare at different times and days of the year.
Several V1 calculations utilize the PV array centroid, rather than the actual glare spot location, due to algorithm limitations. This may affect results for large PV footprints. Additional analyses of array sub-sections can provide additional information on expected glare. This primarily affects V1 analyses of path receptors.
Random number computations are utilized by various steps of the annual hazard analysis algorithm. Predicted minutes of glare can vary between runs as a result. This limitation primarily affects analyses of Observation Point receptors, including ATCTs. Note that the SGHAT/ForgeSolar methodology has always relied on an analytical, qualitative approach to accurately determine the overall hazard (i.e. green vs. yellow) of expected glare on an annual basis.
The analysis does not automatically consider obstacles (either man-made or natural) between the observation points and the prescribed solar installation that may obstruct observed glare, such as trees, hills, buildings, etc.
The subtended source angle (glare spot size) is constrained by the PV array footprint size. Partitioning large arrays into smaller sections will reduce the maximum potential subtended angle, potentially impacting results if actual glare spots are larger than the sub-array size. Additional analyses of the combined area of adjacent sub-arrays can provide more information on potential glare hazards. (See previous point on related limitations.)
The variable direct normal irradiance (DNI) feature (if selected) scales the user-prescribed peak DNI using a typical clear-day irradiance profile. This profile has a lower DNI in the mornings and evenings and a maximum at solar noon. The scaling uses a clear-day irradiance profile based on a normalized time relative to sunrise, solar noon, and sunset, which are prescribed by a sun-position algorithm and the latitude and longitude obtained from Google maps. The actual DNI on any given day can be affected by cloud cover, atmospheric attenuation, and other environmental factors.
The ocular hazard predicted by the tool depends on a number of environmental, optical, and human factors, which can be uncertain. We provide input fields and typical ranges of values for these factors so that the user can vary these parameters to see if they have an impact on the results. The speed of SGHAT allows expedited sensitivity and parametric analyses.
The system output calculation is a DNI-based approximation that assumes clear, sunny skies year-round. It should not be used in place of more rigorous modeling methods.
Hazard zone boundaries shown in the Glare Hazard plot are an approximation and visual aid based on aggregated research data. Actual ocular impact outcomes encompass a continuous, not discrete, spectrum.
Glare locations displayed on receptor plots are approximate. Actual glare-spot locations may differ.
Refer to the Help page at **www.forgesolar.com/help/** for assumptions and limitations not listed here.

Default glare analysis parameters and observer eye characteristics (for reference only):

- Analysis time interval: 1 minute
- Ocular transmission coefficient: 0.5
- Pupil diameter: 0.002 meters
- Eye focal length: 0.017 meters
- Sun subtended angle: 9.3 milliradians

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APPENDIX D. SGHAT TECHNICAL REFERENCE

Solar Glare Hazard Analysis Tool (SGHAT) Technical Reference Manual

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SAND2014-18360 O
March 2015

Contents

1. Requirements

- Use of this software requires the latest version of one of the following free web browsers: Mozilla Firefox or Google Chrome.
- The Solar Glare Hazard Analysis Tool (SGHAT) can be accessed by registering at www.sandia.gov/glare.

2. Introduction

With growing numbers of solar energy installations throughout the United States, glare from photovoltaic (PV) arrays and concentrating solar systems has received increased attention as a real hazard for pilots, air-traffic control personnel, motorists, and others. Sandia has developed a web-based interactive tool that provides a quantified assessment of (1) when and where glare will occur throughout the year for a prescribed solar installation, (2) potential effects on the human eye at locations where glare occurs, and (3) an estimate of the maximum annual energy production.

The Solar Glare Hazard Analysis Tool (SGHAT) employs an interactive Google map where the user can quickly locate a site, draw an outline of the proposed PV array, and specify observer locations or paths. Latitude, longitude, and elevation are automatically recorded through the Google interface, providing necessary information for sun position and vector calculations. Additional information regarding the orientation and tilt of the PV panels, reflectance, environment, and ocular factors are entered by the user.

If glare is found, the tool calculates the retinal irradiance and subtended angle (size/distance) of the glare source to predict potential ocular hazards ranging from temporary after-image to retinal burn. The results are presented in a simple, easy-to-interpret plot that specifies when glare will occur throughout the year, with color codes indicating the potential ocular hazard. The tool can also predict relative energy production while evaluating alternative designs, layouts, and locations to identify configurations that maximize energy production while mitigating the impacts of glare.

This Technical Reference Manual describes the theory and models used in SGHAT.

3. Assumptions and Limitations

Below is a list of assumptions and limitations of the models and methods used in SGHAT:

- The software currently only applies to flat reflective surfaces. For curved surfaces (e.g., focused mirrors such as parabolic troughs or dishes used in concentrating solar power systems), methods and models derived by Ho et al. (2011) [1] can be used and are currently being evaluated for implementation into future versions SGHAT.
- When enabled, PV array single- or dual-axis tracking does not account for backtracking or the effects of panel shading and blocking.

- SGHAT does not rigorously represent the detailed geometry of a system; detailed features such as gaps between modules, variable height of the PV array, and support structures may impact actual glare results. However, we have validated our models against several systems, including a PV array causing glare to the air-traffic control tower at Manchester-Boston Regional Airport and several sites in Albuquerque, and the tool accurately predicted the occurrence and intensity of glare at different times and days of the year.
- SGHAT assumes that the PV array is aligned with a plane defined by the total heights of the coordinates outlined in the Google map. For more accuracy, the user should perform runs using minimum and maximum values for the vertex heights to bound the height of the plane containing the solar array. Doing so will expand the range of observed solar glare when compared to results using a single height value.
- SGHAT does not consider obstacles (either man-made or natural) between the observation points and the prescribed solar installation that may obstruct observed glare, such as trees, hills, buildings, etc.
- The variable direct normal irradiance (DNI) feature (if selected) scales the user-prescribed peak DNI using a typical clear-day irradiance profile. This profile has a lower DNI in the mornings and evenings and a maximum at solar noon. The scaling uses a clear-day irradiance profile based on a normalized time relative to sunrise, solar noon, and sunset, which are prescribed by a sun-position algorithm [2] and the latitude and longitude obtained from Google maps. The actual DNI on any given day can be affected by cloud cover, atmospheric attenuation, and other environmental factors.
- The ocular hazard predicted by the tool depends on a number of environmental, optical, and human factors, which can be uncertain. We provide input fields and typical ranges of values for these factors so that the user can vary these parameters to see if they have an impact on the results. The speed of SGHAT allows expedited sensitivity and parametric analyses.

4. Determination of Glare Occurrence

Determination of glare occurrence requires knowledge of the following: sun position, observer location, and the tilt, orientation, location, extent, and optical properties of the modules in the solar array. Vector algebra is then used to determine if glare is visible from the prescribed observation points.

4.1 Sun Position

The sun position algorithm[2] calculates the sun position in two forms: first as a unit vector extending from the Cartesian origin toward the sun, and second as azimuthal and altitudinal angles. The algorithm relies on the latitude, longitude and time zone offset from UTC in order to determine the position of the sun at every time step throughout the year.

First, we calculate the solar time:

$$t_{solar} = 4(L_{st} - L_{loc}) + E + t_{standard}$$

Where:

$$L_{st} = tz_{offset} * 15$$

$$E = 229.2(0.000075 + 0.001868 * \cos B - 0.0320077 * \sin B - 0.014615 * \cos 2B - 0.04089 * \sin 2B)$$

L_{st} is the local standard meridian, L_{loc} is the given longitude and E is the equation of time, in minutes.

The solar time can then be used to calculate the Hour angle, ω:

$$\omega = \Delta t_{noon} * 15$$

Where $\Delta t_{noon}$is the difference between solar time and solar noon.

Once the declination,δ is known, the solar zenith and azimuthal angle of the sun can be found:

$$\delta = 23.45 * \sin\left(360 * \frac{284 + n}{365}\right)$$

$$\theta_z = \cos^{-1}(\cos\varphi * \cos\delta * \cos\omega + \sin\varphi * \sin\delta)$$

$$\gamma_s = sign(\omega)\left|\cos^{-1}\left(\frac{\cos\theta_z \sin\phi - \sin\delta}{\sin\theta_z \cos\phi}\right)\right|$$

Where:

- n is the day of the year (1 to 365)
- θ_z is the sun zenith angle (subtract from 90 to get the altitude angle, θ_a)
- φ is the given latitude
- γ_s is the sun azimuthal angle

The sun altitude and azimuth can be converted to unit vector components as follows:

$$\vec{s_i} = \cos\theta_a * \sin\gamma_s$$

$$\vec{s_j} = \cos\theta_a * \cos\gamma_s$$

$$\vec{s_k} = \sin\theta_a$$

4.2 Reflected Sun Vector

Once the sun position is known for each time interval a simple vector reflection equation [4] can determine the reflected sun vector, based on the normal vector of the PV array panels:

$$x_1' - x_0 = \boldsymbol{v} - 2(\boldsymbol{v} \cdot \hat{\boldsymbol{n}})\,\hat{\boldsymbol{n}}$$

Figure 1 illustrates this vector reflection graphically.

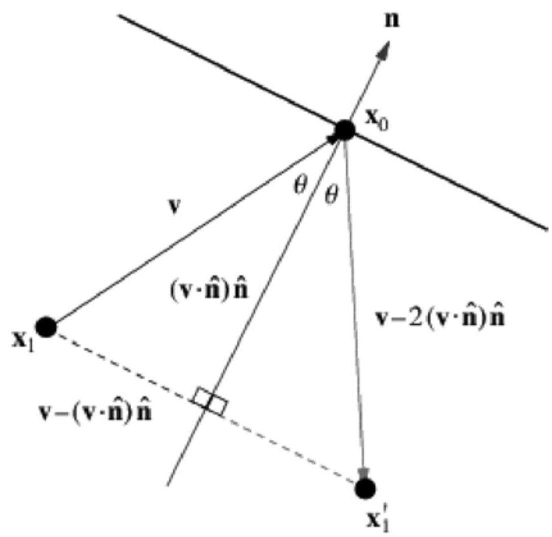

Figure 1 - Vector reflection over normal vector of plane. Source: mathworld.wolfram.com/Reflection.html

4.3 Scattering and Subtended Beam Angle

The reflected sun vector defines the axis of a conical beam representing the actual beam of sunlight. This sunbeam is translated to extend from the OP toward the PV array. The aperture of this conical sun beam is equivalent to β, the subtended beam angle, which is the sum of the sun shape and the scattering caused by slope error:

$$\beta = 2 * \left(\frac{\theta_{sun\ angle}}{2} + 2 * 3 * \theta_{slope\ error}\right)$$

4.4 Beam Projection onto PV Array Plane

The beam is projected onto the PV array in several steps: first, points lying on the edge of the beam in a conical section orthogonal to the axis are calculated. This conical section is arbitrarily defined to be 1 meter from the cone apex (the OP).

These 30 points are calculated by randomly generating two coordinates and solving for the third using the following equation:

$$v_{axis} \cdot v_{radius} = 0$$

This equation states that the cone axis is orthogonal to the radius vectors of the conical section upon which the 30 conical points lie.

Next, conical edge vectors are defined by subtracting the cone apex (the OP) from the cone points. This collection of vectors extends from the OP toward the PV array plane. These vectors define the conical sun beam. At their center, or the axis of the cone, is the reflected sun vector calculated in 4.2.

These conical vectors are then intersected with the PV array plane. This cone-plane intersection will be an elliptical conical section defined by 30 co-planar points.

These intersection points are calculated using line-plane intersection equations [5]:

$$d = \frac{(\boldsymbol{p_0} - \boldsymbol{I_0}) \cdot \vec{\boldsymbol{n}}}{\boldsymbol{I} \cdot \vec{\boldsymbol{n}}}$$

$$(x, y, z) = d\mathbf{I} + \boldsymbol{I_0}$$

Where:

- $\vec{\boldsymbol{n}}$ is the PV array panel normal vector
- $\mathbf{I}$ is one of the vectors extending from the OP to the PV array plane, which define the conical sun beam.
- $\mathbf{I_0}$ is a point on the vector (the OP)
- $\mathbf{p_0}$ is a point on the PV array plane
- d is the distance from the OP to the intersection point, and
- (x, y, z) define the intersection point for this vector.

The n intersection points found using the above equations define the elliptical conical section of the sun beam cone as it intersects the PV array plane.

Glare is present and viewable from the OP if any of the PV array vertices lie within this co-planar ellipse. This is determined using an optimized points-in-polygon algorithm from matplotlib [6].

4.5 PV Single-Axis Tracking

Single-axis tracking allows for the PV panels to rotate over one dimension in order to track the apparent movement of the sun over time. This rotation is modeled using the normal vector of the PV array panels, $\vec{\boldsymbol{n}}$. The components of $\vec{\boldsymbol{n}}$ are calculated using the following:

- β_t – Tracking axis tilt where 0º is parallel with flat ground and 90º is perpendicular to the ground, facing the horizon.
- μ – Panel offset from the tracking axis.
- ρ – Tracking, or rotation, angle designating the rotation of the panel at a given time. Clockwise and counter-clockwise over the tracking axis (see below).
- γ – Orientation of the tracking axis. Clockwise from due south (0º).

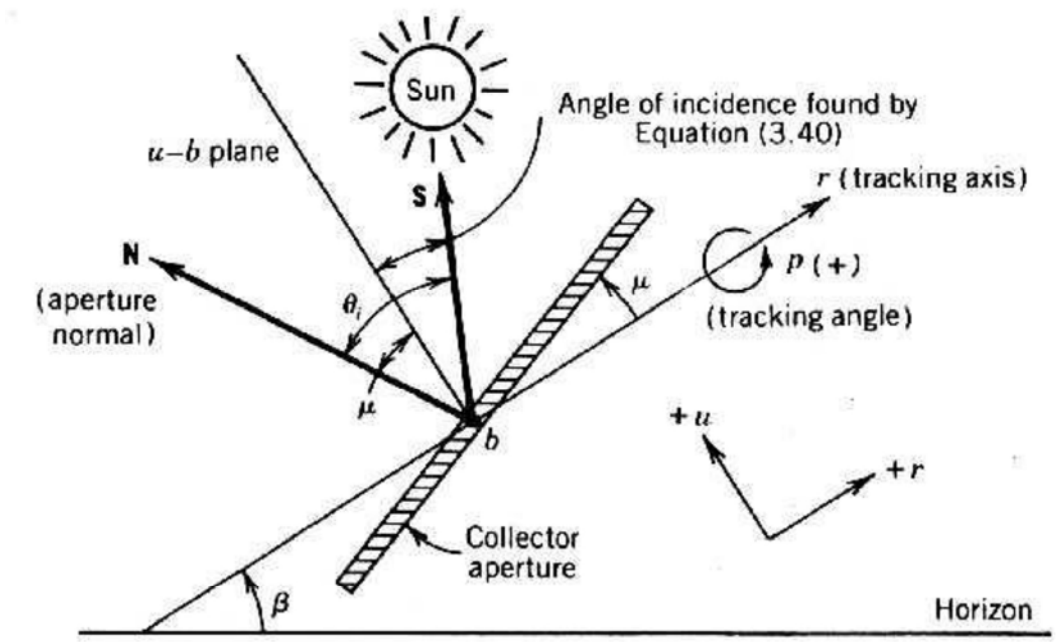

Figure 2 - PV panel with single-axis tracking. The panel normal is displayed as N. Source: http://www.powerfromthesun.net/Book/chapter04/chapter04.html

The components of $\vec{\boldsymbol{n}}$ are first calculated in a Cartesian coordinate system of (*b, r, u*) where *r* aligns with the tracking axis, *b* is perpendicular to it and extends to the horizon, and *u* is perpendicular to *r* vertically (see Figure 2). Note that β_t, μ, γ are all inputs provided by the user.

$$\rho = \tan^{-1}\left\{\frac{\cos(\theta_a)\sin(\gamma_s - \gamma)}{\sin(\theta_a - \beta_t) + [1 - \cos(\gamma_s - \gamma)]\sin(\beta_t)\cos(\theta_a)}\right\}$$

$$\vec{\boldsymbol{n}}_b = \sin\rho$$

$$\vec{\boldsymbol{n}}_r = \sin\mu$$

$$\vec{\boldsymbol{n}}_u = \cos\rho$$

These components are converted back to the standard Cartesian system:

$$\vec{\boldsymbol{n}}_z = \vec{\boldsymbol{n}}_u \cos\beta_t + \vec{\boldsymbol{n}}_r \sin\beta_t$$

$$\vec{\boldsymbol{n}}_e = -\vec{\boldsymbol{n}}_u \sin(\gamma)\sin(\beta_t) + \vec{\boldsymbol{n}}_b \cos(\gamma) + \vec{\boldsymbol{n}}_r \sin(\gamma)\cos(\beta_t)$$

$$\vec{\boldsymbol{n}}_n = -\vec{\boldsymbol{n}}_u \cos(\gamma)\sin(\beta_t) - \vec{\boldsymbol{n}}_b \sin(\gamma) + \vec{\boldsymbol{n}}_r \cos(\gamma)\cos(\beta_t)$$

Vector components are calculated for the panels at each time step.

4.6 PV Dual-Axis Tracking

Dual-axis tracking implies the PV panels face "toward" the sun at every time step. Again, the panel normal varies every minute. Because the variance occurs in two dimensions, the sun vector (extending from the origin toward the sun) can be used as the panel normal:

$$\vec{\boldsymbol{n}} = \vec{\boldsymbol{s}}$$

5. Determination of Ocular Impact

Determination of the ocular impact requires knowledge of the direct normal irradiance, PV module reflectance, size and orientation of the array, optical properties of the PV module, and ocular parameters. These values are used to determine the retinal irradiance and subtended source angle used in the ocular hazard plot [1, 3].

5.1 Ocular Hazard Plot

The ocular impact of viewed glare can be classified into three levels based on the retinal irradiance and subtended source angle: low potential for after-image, potential for after-image, and potential for permanent eye damage [1, 3]. The following log-log plot illustrates these three areas of glare intensity:

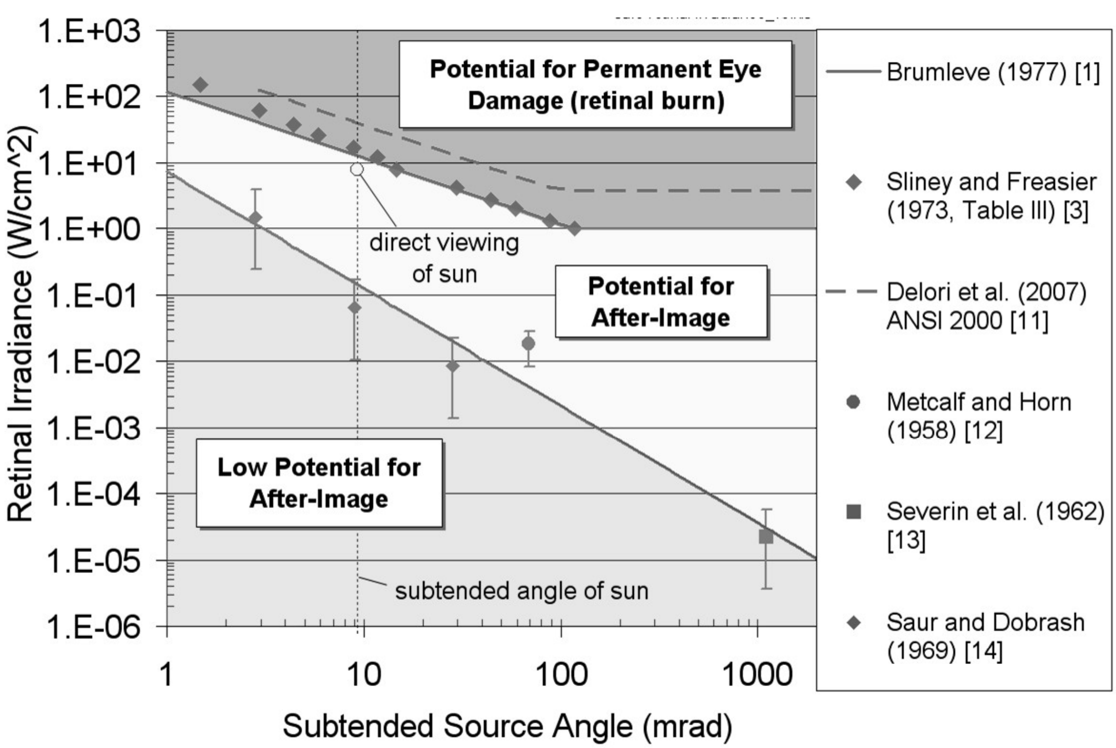

Figure 3 - Glare hazard plot illustrating the ocular impact as a function of retinal irradiance and subtended source angle [1, 3].

The subtended source angle represents the size of the glare viewed by an observer, while the retinal irradiance determines the amount of energy impacting the retina of the observer. Larger source angles can result in glare of high intensity, even if the retinal irradiance is low.

The boundary between the "yellow" and "red" regions, signifying glare that transitions from causing an after-image to causing permanent eye damage, can be quantified with the following equations:

$$E_{r,burn} = \frac{0.118}{\omega} \quad \text{for} \quad \omega < 0.118 \text{ rad}$$

$$E_{r,burn} = 1 \quad \text{for} \quad \omega \geq 0.118 \text{ rad}$$

The second boundary, between the low potential for after-image (green) and potential for after-image (yellow) areas, adheres to the following equation:

$$E_{r,flash} = \frac{3.59 \times 10^{-5}}{\omega^{1.77}}$$

5.2 Direct Normal Irradiance (DNI)

The variable direct normal irradiance (DNI) feature (if selected) scales the user-prescribed peak DNI using a typical clear-day irradiance profile. This profile has a lower DNI in the mornings and evenings and a maximum at solar noon. The scaling uses a clear-day irradiance profile based on a normalized time relative to sunrise, solar noon, and sunset, which are prescribed by a sun-position algorithm [2] and the latitude and longitude obtained from Google maps.

$$DNI = \cos(1 - t_s)$$

Here t_s represents the normalized time relative to solar noon. Normalization is based on the amount of time between sunrise or sunset and solar noon.

The DNI scaling profile was determined by fitting empirical DNI data to the cosine function, as illustrated in Figure 4. Note that DNI on any given day can be affected by cloud cover, atmospheric attenuation, and other environmental factors.

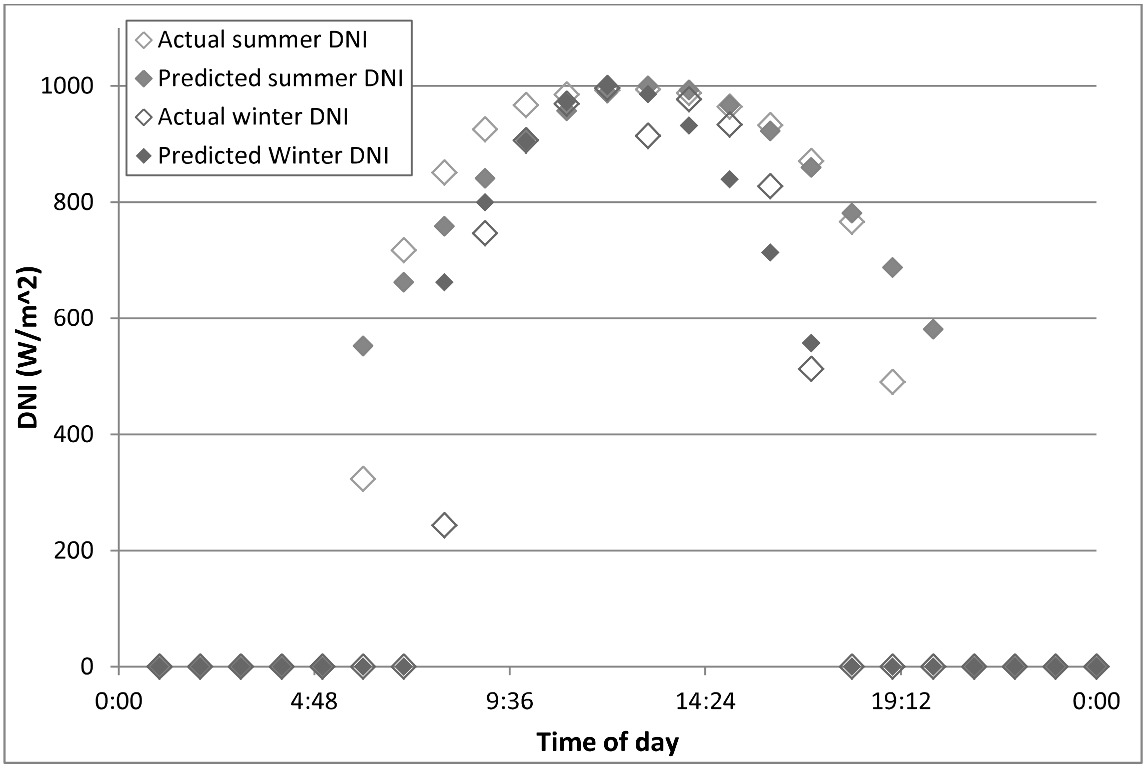

Figure 4 - Fit functions modeling normalized DNI vs. hour. Cosine was chosen to profile empirical data.

5.3 Reflectance

Panel reflectivity can be varied for each time step to account for the position of the sun relative to the array. Smooth glass and light textured glass with and without Anti-Reflection coating, along with deeply textured glass were analyzed to derive accurate functions for computing reflectivity based on sun incidence angle [7].

Table 1 contains the fit functions for panel reflectivity.

Table 1 - Reflectance fit functions for PV cover types.

PV Glass Cover Type	Fit Function Defined over 0° ≤ θ ≤ 60°	Fit Function Defined over 60° < θ < 90°
Smooth Glass without Anti-Reflection Coating	$y = 1.1977E\text{-}5\ x^2 - 9.5728E\text{-}4\ x + 4.410E\text{-}2$	$y = 6.2952E\text{-}5\ e^{0.1019x}$
Smooth Glass with Anti-Reflection Coating	$y = 1.473E\text{-}5\ x^2 - 9.6416E\text{-}4\ x + 3.2395E\text{-}2$	$y = 4.7464E\text{-}5\ e^{0.1051x}$
Light Textured Glass without Anti-Reflection Coating	$y = 1.5272E\text{-}5\ x^2 - 1.1304E\text{-}3\ x + 4.305E\text{-}2$	$y = 7.3804E\text{-}5\ e^{0.0994x}$
Light Textured Glass with Anti-Reflection Coating	$y = 1.4188E\text{-}5\ x^2 - 1.0326E\text{-}3\ x + 3.9016E\text{-}2$	$y = 7.0179E\text{-}5\ e^{0.0994x}$
Deeply Textured Glass	$y = 6.8750E\text{-}6\ x^2 - 6.5250E\text{-}4\ x + 2.10E\text{-}2$	$y = 4.1793E\text{-}5\ e^{0.0834x}$

5.4 Slope Error

The slope error can be automatically correlated with the selected surface type by checking ***correlate slope error with module surface type***. If unchecked, the slope error can be entered manually. If checked, the following table is referenced for determining the appropriate slope error and corresponding value of β, the subtended beam angle:

Table 2. Slope error and beam spread vs. surface type

PV Glass Cover Type	Average RMS Slope Error (mrad)	Average Beam Spread (mrad)	Standard deviation of slope error	Standard deviation of beam error
Smooth Glass without Anti-Reflection Coating	6.55	87.9	4.43	53.3
Smooth Glass with Anti-Reflection Coating	8.43	110	2.58	30.9
Light Textured Glass without Anti-Reflection Coating	9.70	126	2.78	33.3
Light Textured Glass with Anti-Reflection Coating	9.16	119	3.17	38.0
Deeply Textured Glass	82.6	1000	N/A	N/A

5.5 Subtended Beam Angle

The glare analysis must account for the actual visible area of the PV array when viewed from the observation point. For example, less viewable area will be apparent when viewing an array with panel tilt of 0 degrees on a flat surface from the side than when viewing it from above in an aircraft.

To account for this, the analysis replaces the solar beam angle computed in Section **Error! Reference source not found.** with an array-limiting beam angle if the latter is a smaller value. This represents the physical situation where the sun beam "overflows" the PV array from the viewer's perspective, and thus less glare is possible.

$$\theta = \frac{1}{d}\sqrt{\frac{4 * A * \left|\cos\theta_{ref-pva}\right|}{\pi}}$$

where:

- A is area of PV array
- d is distance between observer and array
- $\theta_{ref-pva}$ is angle between reflected sun vector and PV array normal

6. Annual Energy Production

SGHAT can also predict the annual energy produced by a PV array based on its capacity and configuration. First the rated capacity is scaled at each time step based on the angle between the panel normal and the position of the sun. E.g. when the sun vector is perpendicular to the panel normal, the power produced will be the rated capacity.

$$P = P_{rated} * \cos\theta_{inc}$$

Next, this power is multiplied by the scaled time increment to get the energy produced in that time interval (kWh).

$$E_t = P * \frac{t}{60}$$

Finally, the energy produced over the year is summed to get the maximum annual energy produced by the array, assuming clear sunny skies each day.

$$E_{max} = \sum E_t$$

7. Other Formulations

7.1 Flight Path Calculations

The flight path OP coordinates are computed based on the latitude and longitude of the selected threshold, and the specified direction of the flight path.

First, the distance covered by one degree of longitude is calculated, based on the latitude.

$$d = radius_{earth} * \cos(lat_{thres})$$

Next, the distance between each point in terms of latitude and longitude is computed based on the direction and distance, in meters, of a degree of latitude or longitude. This is the Δlatitude and Δlongitude between each OP.

$$\Delta lat = \frac{402.3 * \cos\theta}{111325}$$

$$\Delta lng = \frac{402.3 * \sin\theta}{d}$$

Here d is the distance covered by one degree of longitude, 402.3 is ¼ mile in meters, and θ is the flight path direction.

Finally, compute each OP position by augmenting the coordinates of the previous OP by Δlat and Δlng.

The flight path heights of each OP are calculated based on the threshold height above ground, glide slope and threshold elevation. The tangent of the glide slope, multiplied by the distance from the threshold yields the height above the threshold of the given OP. Since each OP elevation is queried automatically from Google, this height value is augmented by the elevation difference between the OP and the threshold elevation.

$$height = distance * \tan(\varphi) + height_{thres} + (elevation_{thres} - elevation_{OP})$$

where φ is the glide slope.

8. Acknowledgments

Sandia National Laboratories is a multi-program laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.

9. References

[1] Ho, C.K., C.M. Ghanbari, and R.B. Diver, 2011, Methodology to Assess Potential Glint and Glare Hazards From Concentrating Solar Power Plants: Analytical Models and Experimental Validation, *Journal of Solar Energy Engineering-Transactions of the Asme*, **133**(3).

[2] Duffie, J.A. and W.A. Beckman, 1991, *Solar engineering of thermal processes*, 2nd ed., Wiley, New York, xxiii, 919 p.

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[7] Yellowhair, J. *Reflectance Measurements on the Photovoltaic Sample Panels*, October 7, 2013.

[8] Stine, W. B. and Geyer, M, 2001, *Power From the Sun*, http://www.powerfromthesun.net/book.html

Additional references can be found at www.sandia.gov/glare.

Lauren Brown

From: Kerie Innes
Sent: Thursday, 11 August 2022 2:36 PM
To: Lauren Brown
Subject: FW: Olam FW: Private air strips [SEC=OFFICIAL]

For you

Kerie Innes
Coordination Manager
Sustainable Business Energy Solutions

t: 07 3023 2407
m: 0436 005 081
e: KInnes@agl.com.au

Progress for life

From: Steven Parisotto <stevenp@murrumbidgee.nsw.gov.au>
Sent: Thursday, 11 August 2022 3:02 PM
To: Kerie Innes <KInnes@agl.com.au>
Subject: RE: Olam FW: Private air strips [SEC=OFFICIAL]

Hi Kerie,

Yes, a visual impact study is not required.

Steven Parisotto
Senior Planner

T 1300 MRMBGE (676243) StevenP@murrumbidgee.nsw.gov.au
21 Carrington Street Darlington Point NSW 2706
PO Box 96 Jerilderie NSW 2716

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From: Kerie Innes <KInnes@agl.com.au>
Sent: Thursday, 11 August 2022 2:23 PM
To: Steven Parisotto <stevenp@murrumbidgee.nsw.gov.au>
Subject: FW: Olam FW: Private air strips [SEC=OFFICIAL]

Thanks for the reply, Stephen. So, I'm assuming with the below, we won't be required to do a visual impact study?

From: Steven Parisotto <stevenp@murrumbidgee.nsw.gov.au>
Sent: Tuesday, 9 August 2022 1:54 PM
To: Kerie Innes <KInnes@agl.com.au>
Subject: RE: Olam FW: Private air strips [SEC=OFFICIAL]

Hi Kerie,

I think you have done all that needs to be. I would incorporate the response from CASA as part of the DA documents.

From: Kerie Innes <KInnes@agl.com.au>
Sent: Monday, 8 August 2022 1:57 PM
To: Steven Parisotto <stevenp@murrumbidgee.nsw.gov.au>
Subject: Olam FW: Private air strips [SEC=OFFICIAL]

Hi Steve,

Hope you're well.

I was wondering if you could assist me with a couple of questions I have?.

Question 1. When we had the Pre DA meeting, we came to the conclusion that a glint and glare study isn't required, but you raised the comment, that we needed to be mindful of what could be private airstrips in that local area. We have reached out to CASA and they have responded with the below. Can you confirm that you believe this should be sufficient for the council with regards to the private airstrips?

From: Windebank, Matthew <Matthew.Windebank@casa.gov.au>
Sent: Friday, 22 July 2022 8:47 AM
To: Kerie Innes <KInnes@agl.com.au>
Subject: RE: Private air strips [SEC=OFFICIAL]

OFFICIAL

Good morning Kerie,

CASA farms have proven to not be a hazard to aircraft operations unless they are in close proximity to an airport with a control tower. Glare to pilots is fleeting but can negatively impact an air traffic control tower for a few minutes until the sun has moved. There are no airports with a control tower in this area and therefore CASA has no objection to a solar farm anywhere in this area.

Regards

Matthew Windebank

Aerodrome Engineer | Aerodrome Developments and Airspace Protection
Air Navigation, Airspace & Aerodromes Branch
CASA\ Aviation Group
p: (02) 6217 1183
e:matthew.windebank@casa.gov.au

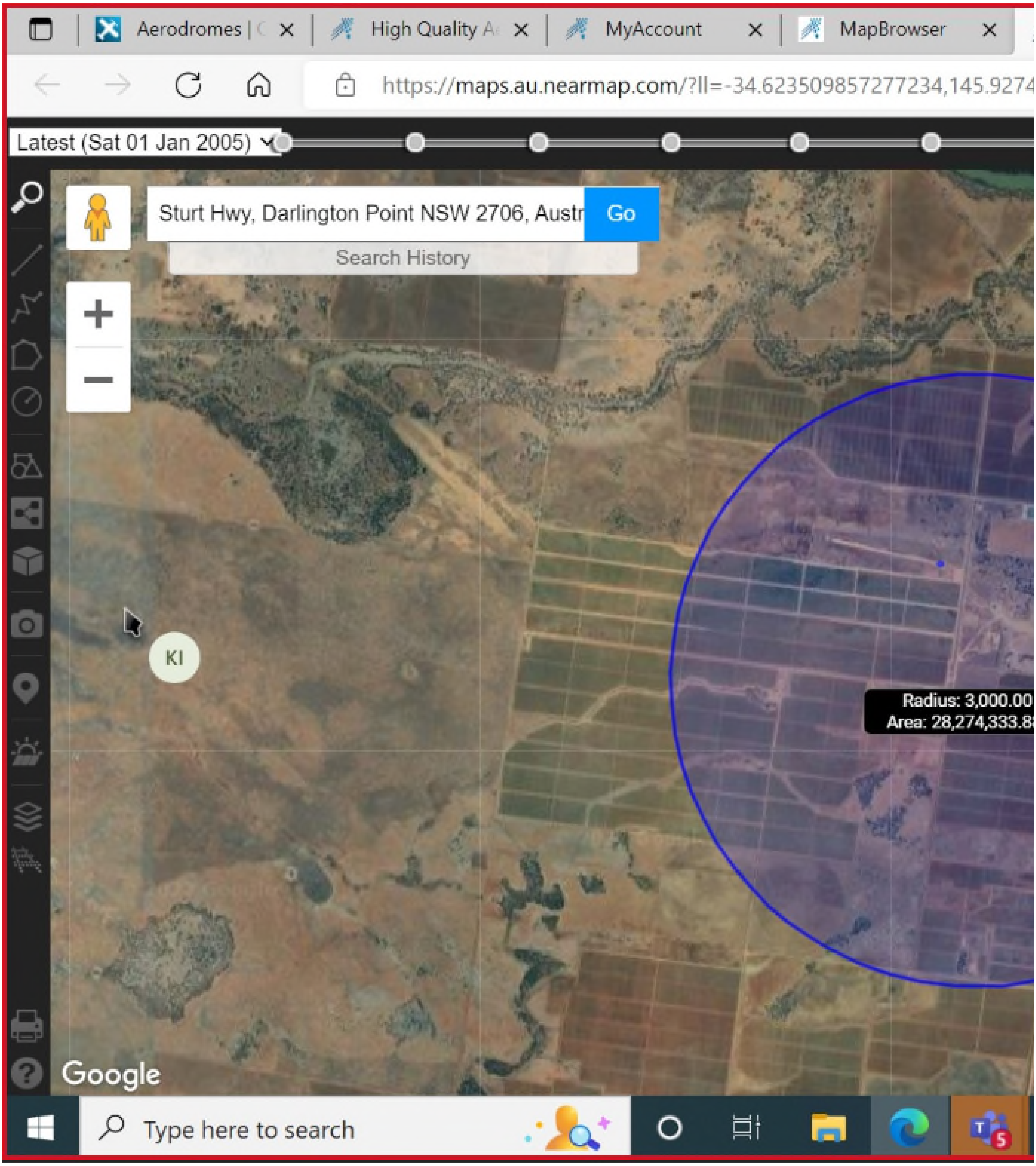
Question 2. Does Murrumbidgee have their own owners consent template? I have attached Tamworth councils as a reference. We just want to make sure we have the correct one to lodge with the DA on behalf of the client .

Kerie Innes
Coordination Manager
Sustainable Business Energy Solutions

t:07 3023 2407
m: 0436 005 081
e: KInnes@agl.com.au

agl

Progress for life



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APPENDIX G TRAFFIC AND TRANSPORT IMPACT ASSESSMENT

Kerarbury Solar Farm and BESS

Traffic and Transport Impact Assessment

Prepared for:

ERM

29 November 2022

The Transport Planning Partnership

Kerarbury Solar Farm and BESS

Traffic and Transport Impact Assessment

Client: ERM

Version: V02

Date: 29 November 2022

TTPP Reference: 22262

Quality Record

Version	Date	Prepared by	Reviewed by	Approved by	Signature
V01	17/11/22	Sokan Chhoun, Santi Botross	Santi Botross	Jason Rudd	Jason Rudd
V02	29/11/22	Sokan Chhoun, Santi Botross	Santi Botross	Jason Rudd	Jason Rudd

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APPENDICES

1 Introduction

AGL (the Proponent) is seeking development consent to develop a solar farm and battery energy storage system (BESS) at 16705 Sturt Highway, Darlington Point in Western NSW. The subject site is contained within Lots 68 and Lot 69 of DP750877. The proposed solar farm site area is approximately 7 hectares (ha) with the construction footprint proposed to be approximately 6.1 ha, including supporting infrastructure. The proposed solar farm site will be contained within the existing Kerarbury Almond Orchard.

The solar farm is expected to have a capacity for up to 4.95 megawatts (MW) and the BESS will have a capacity of up to 4.586 MW.

This traffic and transport impact assessment report has been prepared by the Transport Planning Partnership (TTPP) to accompany a Development Application (DA) to Murrumbidgee Council (Council). This report documents the existing conditions surrounding the subject site and assesses the traffic and parking implications for the construction and operation stages of the project. Where necessary, mitigation measures are proposed to minimise the impacts of the project on the surrounding road network.

2 Existing Conditions

2.1 Site Context

The subject site is located at 16705 Sturt Highway, Darington Point which is approximately 15km south-west of Darlington Point town centre and falls within the Murrumbidgee Council local government area.

The land zone classification of the site is 'RU1 primary production'. The site is surrounded by mainly agricultural land.

The solar farm site will be approximately 7 ha, located within the existing Kerarbury Almond Orchard. The seasonal peak of the orchard operation is during the harvest period which occurs annually between February and April. During the harvest period, the orchard's hours of operation are 6am-6pm.

2.2 Surrounding Road Network

Sturt Highway is a major highway which provides connectivity between Sydney and Adelaide. In the vicinity of the site, the highway has two travel lanes in both directions, is line marked and has road shoulders. In the vicinity of the site, Sturt Highway has a posted speed limit of 110 km/h. Sturt Highway forms the northern boundary of the broader site (Kerarbury Almond Orchard).

2.3 Public Transport Infrastructure

The closest bus stop is located in Darlington Point town centre on Sturt Highway, approximately 15 km (9-minute drive) from the site. Bus route 945 services this bus stop, which runs between Darlington Point and Griffith.

Leeton Station is the nearest train station to the site, located 65 km (47-minute drive) from the site. The Southern NSW train line services this train station, which provides connectivity between Griffith and Goulburn.

2.4 Pedestrian and Cyclist Facilities

Due to the remote nature of the site, there are no designated footpath or cycleway facilities in the vicinity of the site.

2.5 Existing Traffic Volumes

According to Average Annual Daily Traffic (AADT) online data provided by Transport for NSW (TfNSW), the road network peak periods are 10am-11am and 3pm-4pm. Traffic volumes (two-way) on Sturt Highway are in the order of 101 vehicles per hour (vph) in the AM peak and 316 vph in the PM peak period. Table 2.1 presents the peak hourly traffic volume data in the eastbound and westbound directions.

The data is representative of weekday traffic volumes in 2022 and has been recorded at a traffic counter located on Sturt Highway 50 km east from the site (counter ID: NNDSTC).

Table 2.1: 2022 AADT Average Traffic Volume

Direction	AM Peak (10:00 – 11:00)			PM Peak (15:00 – 16:00)		
	Light Vehicles	Heavy Vehicles	Combined	Light Vehicles	Heavy Vehicles	Combined
Eastbound	33	18	**51**	42	21	**165**
Westbound	31	19	**50**	35	16	**151**
Two-way Flow	**64**	**37**	**101**	**77**	**37**	**316**

The average daily traffic volume (weekday) is 744 vehicles in the eastbound direction and 740 vehicles in the westbound direction (or 1,484 two-way flow). Heavy vehicles comprise around 46% of the daily traffic volume.

2.5.1 Existing Site Traffic Generation

The seasonal peak of the orchard operation is during the harvest period which occurs annually between February and April. The Proponent has advised that the orchard generates up to 40 heavy vehicles per day during this period, of which 60% arrive before midday and the peak vehicle movements occurring before dawn.

During the off-peak season, the site's traffic generation is significantly less typically requiring less than one vehicle per week on average for ad-hoc and unplanned maintenance.

During the seasonal peak, the orchard has up to 50 site personnel for the harvesting operation. Workers travel to the site prior to the shift (before 6am) and leave the site following the shift (after 6pm). It is anticipated that there would be some car-pooling amongst workers who travel from similar areas. As such, there could be in the order of 40-50 cars generated by the existing operation on a daily basis.

2.6 Crash History

Historic crash data provided by TfNSW is available online for the most recent five-year period between 2017 and 2021. During this period, there have been no crashes within 500 m of the site access location. Therefore, there are no existing safety concerns surrounding the site access.

3 Proposal Description

The proposal involves the construction and the operation of a solar farm with a capacity up to 4.95 MW and a BESS facility with capacity up to 4.586 MW. The proposed solar farm site area is approximately 7 ha with the construction footprint proposed to be approximately 6.1 ha, including supporting infrastructure.

The proposed solar farm site will be contained within the existing Kerarbury Almond Orchard which is located at 16705 Sturt Highway, Darlington Point. The energy generated from the solar farm would be supplied to the Kerarbury Almond Orchard. The solar farm operation will occur simultaneously with the orchard operation.

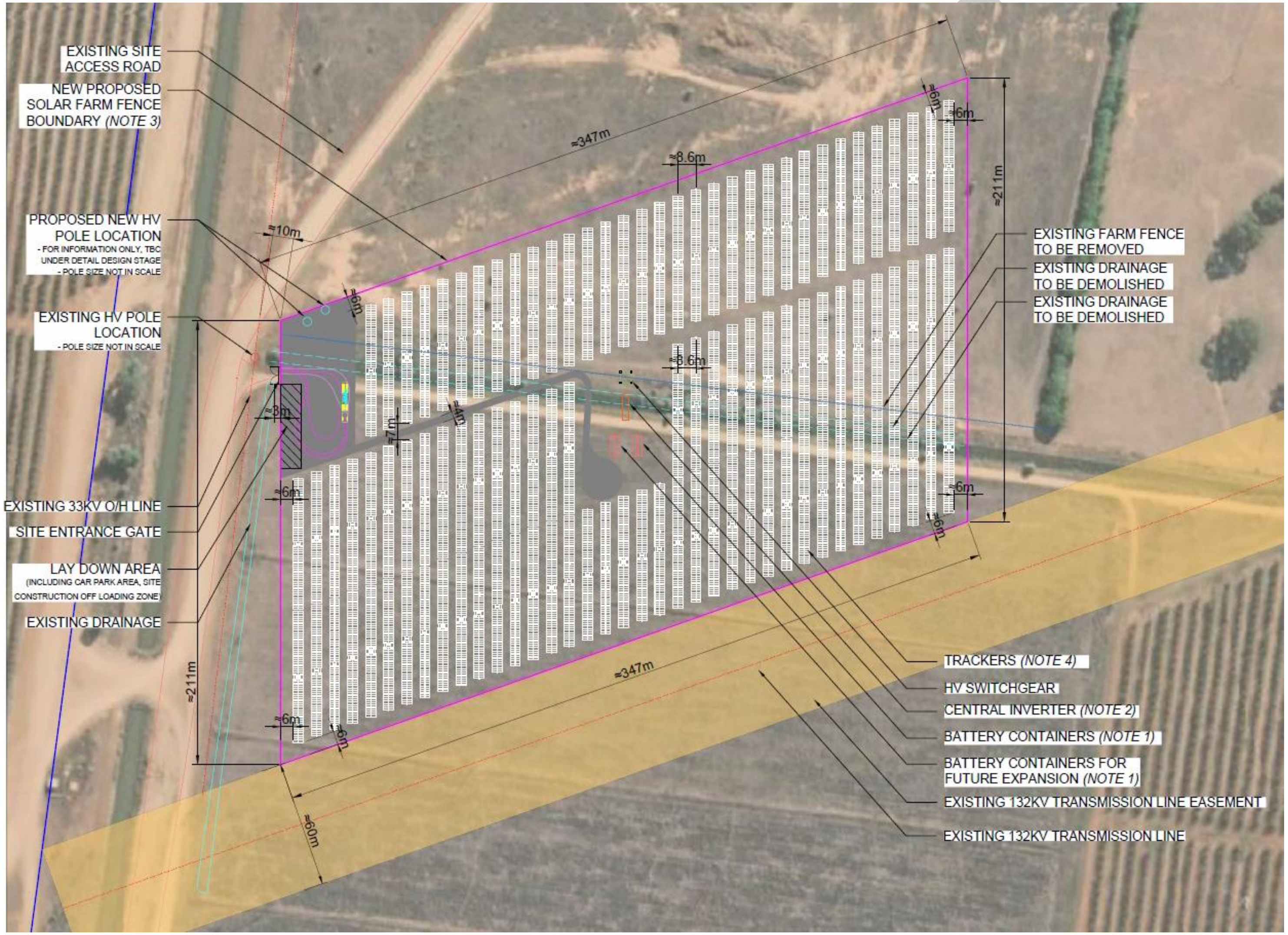
Regular operation of the orchard is anticipated during the construction phase and operation phase of the solar farm. Construction of the solar farm is expected to commence in March 2023, which would partially overlap with the seasonal peak of the orchard. Notwithstanding this, the majority of harvest vehicle movements would occur in the early hours of the day (before dawn). Therefore, there would be minimal overlap with the construction activities which would commence after 7am each day.

Key construction activities as part of the solar farm and BESS development would include the following:

- Site clearing within the proposed development boundary.
- Installation of fencing and gates for the proposed development compound.
- Stormwater and sediment control.
- Construction of internal access road (approx. 10 m in width) and associated hardstand area for laydown and car parking.
- Construction of a management hub, including demountable offices, amenities and equipment sheds.
- Installation of support columns (piling).
- Delivery and installation of PV solar panel arrays.
- Construction of electrical collection system, switch room and control rooms.
- Construction of connection infrastructure to a nearby substation.
- Construction of battery energy storage system and associated components.

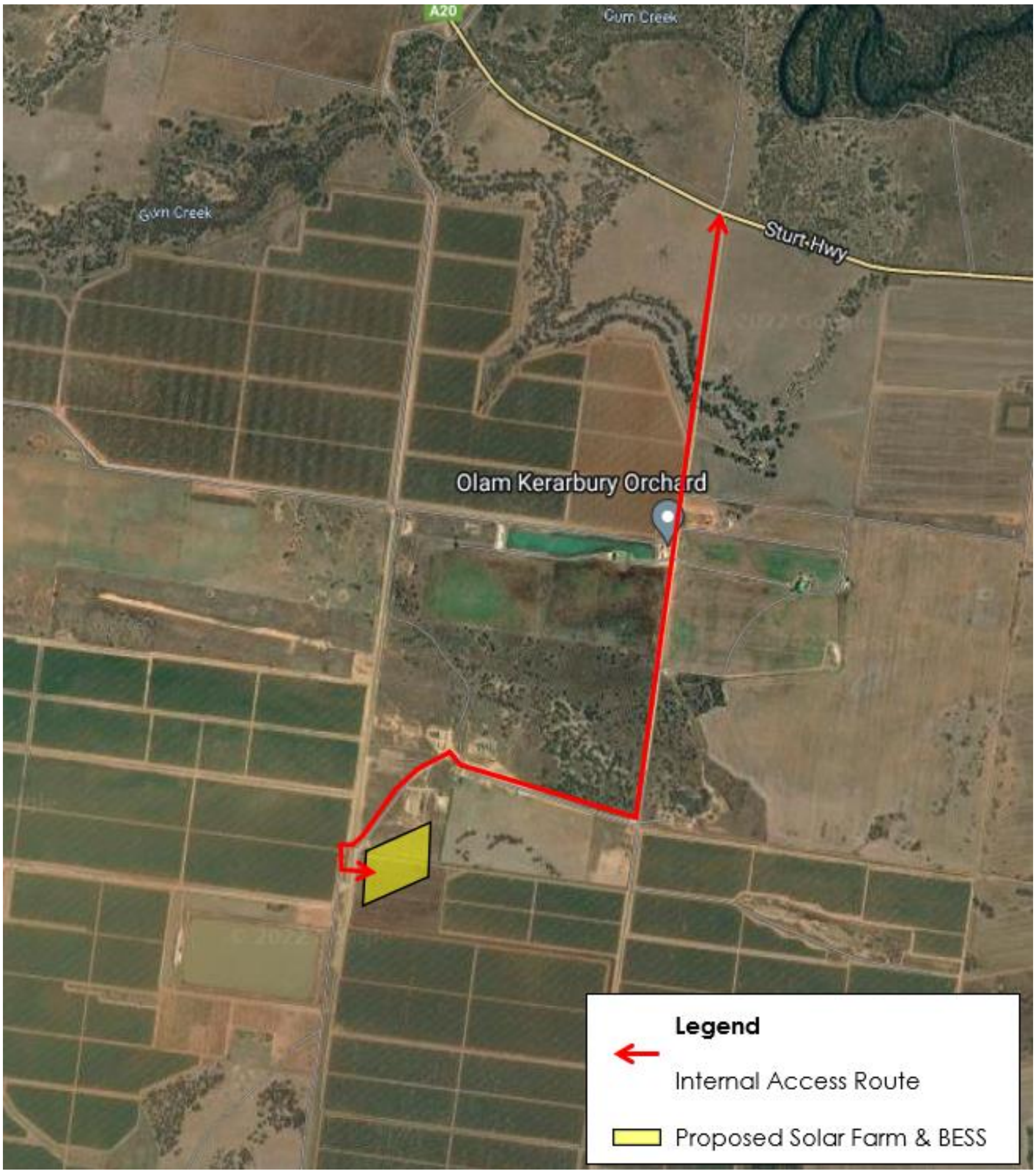
The layout of the proposed solar farm and BESS is shown in Figure 3.1while the site plans are contained in Appendix A.

Figure 3.1: The Proposal



The solar farm and the orchard will be separated by new fencing. The solar farm will be located centrally within the orchard, approximately 3 km south of Sturt Highway. The solar farm would be accessed via an internal road within the site as shown indicatively in Figure 3.2. Upon completion of the solar farm construction, the solar farm and the orchard will operate simultaneously using the same site access driveway off Sturt Highway.

Figure 3.2: Proposed Solar Farm Site Access and Egress



Basemap Source: Google Maps, last accessed on 25/10/2022

4 Traffic and Transport Assessment

4.1 Construction Phase

4.1.1 Staging and Timing

Construction works are expected to commence in March 2023 and run until September 2023. Table 4.1 shows the construction activities for the development and the expected duration for each stage of works.

Table 4.1: Construction Staging and Timing

Stage	Construction Activities	Duration	Start Date	End Date
1	Design and Procurement	6 months	July 2022	December 2022
2	Civil, mechanical and electrical works	5 months	March 2023	July 2023
3	Logistics and delivery	5 months	March 2023	July 2023
4	Testing and commissioning works	2 months	August 2023	September 2023
5	Post-commissioning tune-up and performance testing	2 months	August 2023	September 2023

4.1.2 Hours of Construction

The hours of construction will be 7am-6pm Monday to Friday, and 8am-1pm Saturday which is in-line with the Construction Management Plan for the development.

Any out of hours work must be approved by Council prior to the works being undertaken.

4.1.3 Construction Traffic Generation

On a typical day in the construction period, there would be approximately six (6) vehicles per day which would be equivalent to one (1) vehicle every two hours on average. During the peak of the construction works, there would be up to 20 heavy vehicles per day during the peak of construction activities. This would be equivalent to up to two (2) vehicles every hour (i.e. 2 inbound trips and 2 outbound trips) on average. This is considered minimal and would not result in any noticeable traffic impact on the surrounding road network.

On a typical day in the construction period, there would be approximately 12 site personnel on-site while the peak construction workforce is expected to be up to 50 site personnel. Naturally, there would be some car-pooling amongst workers who travel from similar areas. Adopting a vehicle occupancy rate of 1.5 workers per vehicle, there would be in the order of eight (8) vehicles on a typical day or 33 vehicles during the peak construction period (i.e. 33 inbound trips and 33 outbound trips). The construction workforce would arrive to work before 7am and leave after 6pm. The construction worker trips would occur outside of the surrounding road network peak periods (which occur at 10am and 3pm) and therefore would have a minor impact on the road network.

4.1.4 Construction Vehicle Types

The largest truck required during the construction phase will be a 19 m semi-trailer while the majority of deliveries would be undertaken using 19m truck-and-dogs.

The following vehicles would be required on-site to complete the construction activities:

- Telehandler
- Rug Terrain Crane
- Dozer
- Grader
- Smooth Drum Roller
- Skid Steer
- Water Truck
- Excavator
- Solar Piling Rig.

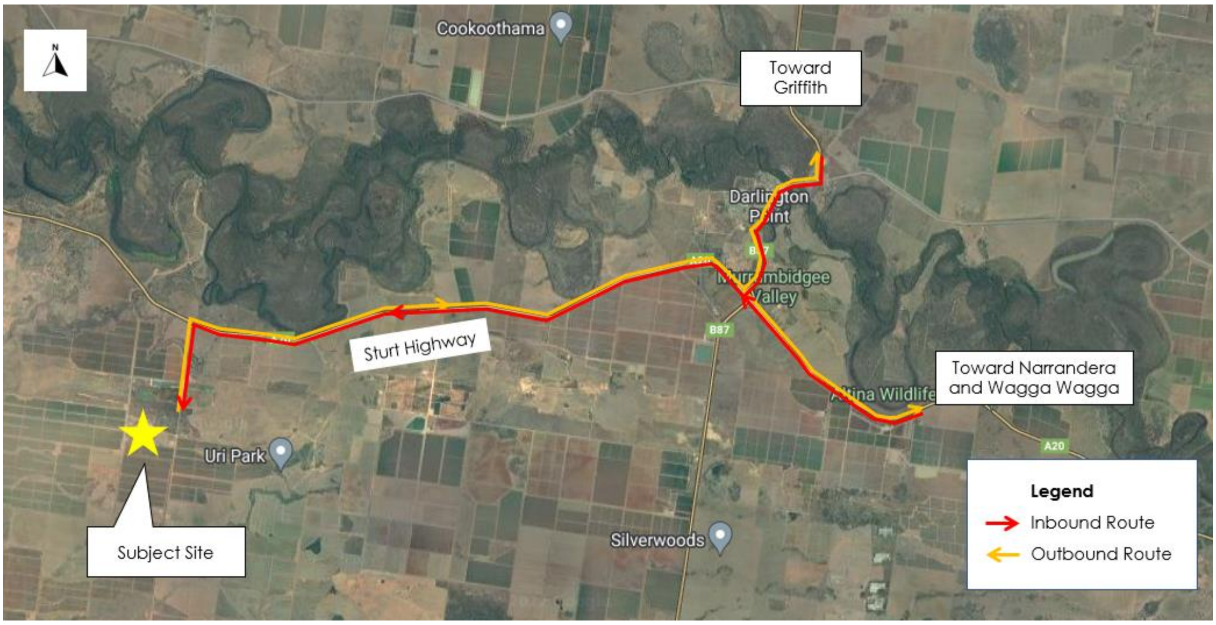
Oversize/ overmass (OSOM) vehicles are considered not to be required as part of the delivery of construction material and equipment. Should OSOM delivers be required, the relevant permits and approvals for OSOM vehicles on the road would be managed under a separate application through the National Heavy Vehicle Regulator (NHVR) permit portal prior to any OSOM deliveries taking place.

4.1.5 Construction Transport Routes

The majority of construction deliveries are expected to come from the east direction from surrounding regional areas such as Darlington Point, Narrandera, Wagga Wagga and Griffith.

The designated construction vehicle routes to/from the site are shown in Figure 4.1.

Figure 4.1: Transport Routes



Basemap Source: Google Street view, last accessed on 25/10/2022

Major deliveries would originate from the ports, such as Port Botany or Port of Newcastle in New South Wales and Port Geelong or Port of Melbourne in Victoria.

4.2 Operational Phase

4.2.1 Traffic Generation

For the solar farm, all operations would be performed remotely and there would be no permanent staffing on-site. There might be instances when maintenance and operation staff are required to attend the site to address urgent issues to do with maintenance, repairs, troubleshooting etc. This would require around two (2) operation staff, which would generate up to 2 inbound and 2 outbound trips in a day and would have no impact on the surrounding road network.

Routine inspections and maintenance would be required twice per year, which would require around two (2) operation staff. This work is also expected to result in minimal impact on the road network.

4.3 Development Site Access

The existing site access driveway is located off Sturt Highway and is currently used to access the Kerarbury Almond Orchard. The access driveway can accommodate ingress and egress movements.

An assessment of the turn treatments required for the site access to be used for the solar farm development has been undertaken in accordance with *Austroads Guide to Road Design (AGRD) Part 4* (2017 and 2021) and *Austroads Guide to Traffic Management (AGTM) Part 6 (2020)*. The turn treatment warrants are based on the major road traffic volumes on Sturt Highway, 'Q_M', and the volume of turning movements generated by the development, 'Q_R' and 'Q_L'.

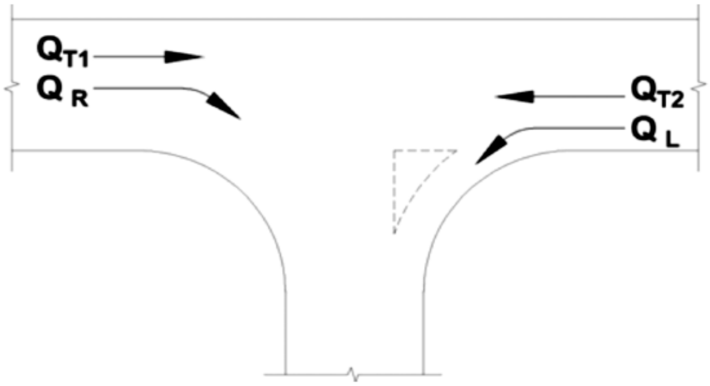
The Proponent expects that all construction deliveries and construction staff will arrive from the east direction, turning left-in and right-out of to the site via Sturt Highway. Therefore, the value for Q_R would be zero. Values for Q_L have been taken from the estimated trip distribution as summarised in Table 4.2.

Calculation of the major road traffic volume (Q_M) for a two-lane two-way road is shown in Figure 4.2 and summarised in in Table 4.3.

Table 4.2: Estimate for Q_R and Q_L

Activity	No. of Vehicle Entering the site (Q_L)		Comment
	AM Peak Hour	PM Peak Hour	
During March-April (overlap of Harvest Seasonal Peak and Constriction Phase)			
Orchard Transport Vehicles	2	2	60% of vehicles arriving before midday with majority (taken as 50%) arriving before dawn (20). The remaining 20 spread evenly throughout the day i.e. up to 2 trucks per hour entering the site.
Orchard Operation Staff	0	0	Orchard hours of operation: 6am-6pm. Staff arrive before 6am and depart after 6pm i.e. zero staff trips in peak hours.
Construction Vehicles	2	2	During peak construction, there would be approx. 2 trucks per hour entering the site.
Construction Staff	0	0	Hours of construction will be 7am-6pm Monday to Friday. Construction workers will arrive before 7am and depart after 6pm. i.e. zero construction staff trips in peak hours.
Total Vehicles per Peak Hour	**4**	**4**	-

Figure 4.2: Calculation of the Major Road Traffic Volume Parameter, Q_M



Road type	Turn type	Splitter island	Q_M (veh/h)
Two-lane two-way	Right	No	$= Q_{T1} + Q_{T2} + Q_L$
		Yes	$= Q_{T1} + Q_{T2}$
	Left	Yes or no	$= Q_{T2}$
Four-lane two-way	Right	No	$= 50\% \times Q_{T1} + Q_{T2} + Q_L$
		Yes	$= 50\% \times Q_{T1} + Q_{T2}$
	Left	Yes or no	$= 50\% \times Q_{T2}$
Six-lane two-way	Right	No	$= 33\% \times Q_{T1} + Q_{T2} + Q_L$
		Yes	$= 33\% \times Q_{T1} + Q_{T2}$
	Left	Yes or no	$= 33\% \times Q_{T2}$

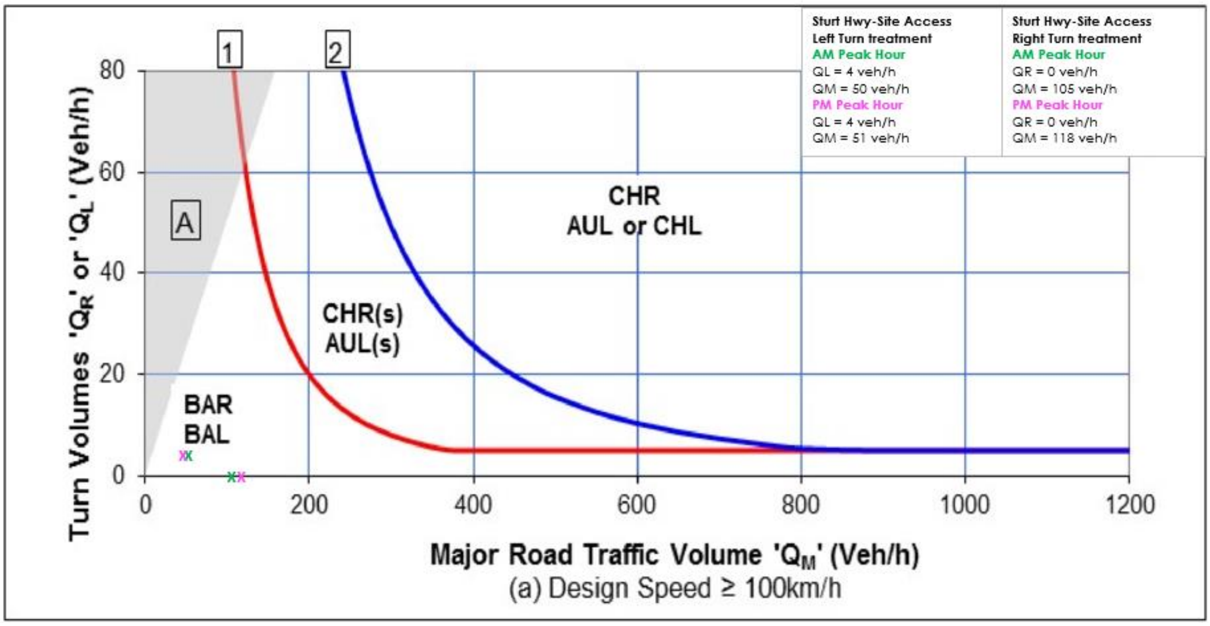
Source: Austroads Guide to Traffic Management Part 6, 2020

Table 4.3: Calculation of Q_M

Road Type	Peak Period	Turn Type	Splitter Island	Q_M (vph)	
Two-Lane Two-Way	AM	Right (Q_R) = 0	No	$Q_M = Q_{T1} + Q_{T2} + Q_L$	105 vph
		Left (Q_L) = 4	No	$Q_M = Q_{T2}$	50 vph
	PM	Right (Q_R) = 0	No	$Q_M = Q_{T1} + Q_{T2} + Q_L$	118 vph
		Left (Q_L) = 4	No	$Q_M = Q_{T2}$	51 vph

The turn treatment warrant assessment also considers the design speed of a road, which is typically taken as the posted speed limit plus 10 km/h; namely, the design speed for Sturt Highway is 120 km/h. Figure 4.3 shows an extract from AGTM Part 6 of the turn treatment warrants on major roads at unsignalised intersections with a design speed more than 100 km/h, which is applicable to Sturt Highway.

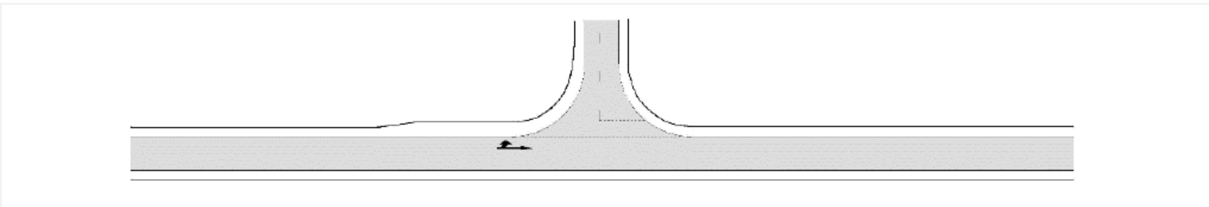
Figure 4.3: Warrants for Turn Treatments on Major Roads at Unsignalised Intersections



Source: Austroads Guide to Traffic Management Part 6, 2020

Based on values for Q_M, Q_L and Q_R in Table 4.3 and warrants for turn treatments in Figure 4.3, the turn treatments required at the future development site access off Sturt Highway include a basic left-turn (BAL). An indicative layout for a BAL treatment as per AGRD Part 4 is provided in Figure 4.4.

Figure 4.4: Basic Left Turn (BAL)



Source: Austroads Guide to Traffic Management Part 6, 2020

Currently, a BAL treatment in accordance with Austroads Guides is not provided at the site access off Sturt Highway as shown in Figure 4.5.

As presented in Table 4.2, two (2) construction vehicles would be expected to turn left-in to the site in each peak hour in addition to the existing two (2) harvest vehicles. The low number of additional vehicles, and a low number of vehicles entering the site overall, would be unlikely to result in operational or safety impacts at the site access.

Whilst the turn treatment assessment identifies that a BAL treatment is warranted at the site access, the future road network conditions are expected to be similar to existing conditions of which there are no reported crashes in the vicinity of the site access and would continue to be a low number of turning movements into the site.

Figure 4.5: Street View of Site Access

Source: Google Street View, imagery dated August 2022, accessed online on 25/10/2022

4.4 Mitigation Measures

In order to mitigate any potential traffic and access impacts, the following measures should be considered.

- If the Proposal traffic generation or Orchard traffic generation exceed the estimates in this TIA, the turn treatment warrant assessment must be reassessed for intersection operation and safety.
- A Construction Traffic Management Plan (CTMP) be prepared and approved by Murrumbidgee Council. The CTMP would outline details pertaining to construction activities proposed at the site and the associated traffic control measures to be implemented to manage the impacts. The CTMP also provide details on any oversize/overmass vehicles required for the construction works.
- A road dilapidation condition assessment of Sturt Highway to be undertaken prior to and following the completion of construction activities.

5 Parking Assessment

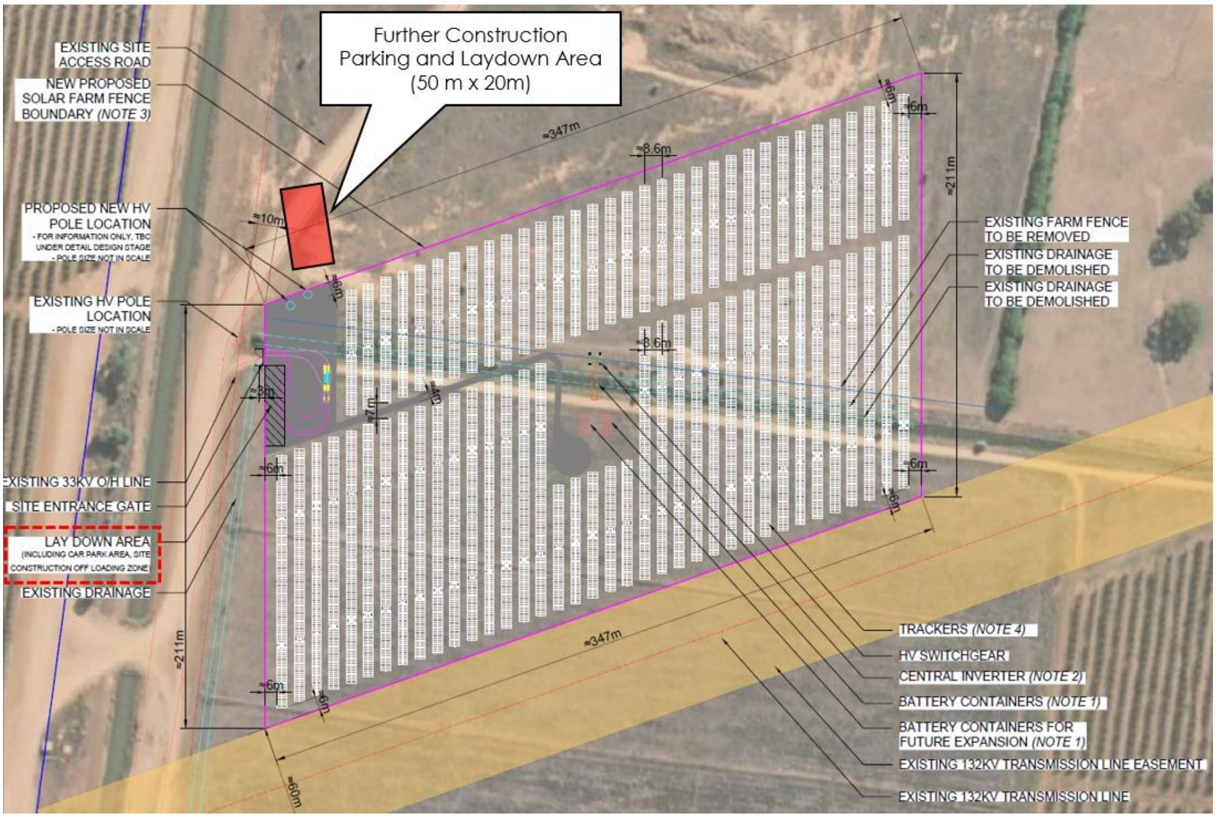
5.1 Construction Phase

It is proposed to provide a construction staff car parking and vehicle laydown area at the north-western corner of the site, adjacent to the proposed solar farm entrance. The proposed car parking and laydown facility will be approximately 50 m by 10 m as shown in Figure 5.1.

On-site car parking would be provided in-line with Class 1A parking in AS2890.1 which stipulates employee parking spaces to be provide as 2.4 m wide, 5.4 m long and with a 5.8 m aisle width (as a minimum). On this basis, the proposed car parking facility would be able to accommodate the construction workforce parking demand which is expected to be in the order of 8 car spaces on a typical day and construction vehicle laydown (1 vehicle every 2 hours) (see Section 4.1.3 for traffic generation estimates).

In the peak construction period, it is estimated that there would be around 33 staff vehicles per day and 2 construction vehicles every hour. Additional space immediately north of the solar farm site would be established to accommodate the further construction staff parking demand and construction vehicles in the laydown area. This area would measure approximately 50 m by 20 m and would be located on-site as shown in Figure 5.1 indicatively.

Figure 5.1: Construction Parking and Laydown Areas



5.2 Operational Phase

For the solar farm, all operations would be performed remotely and there would be no permanent staffing on-site. There may be instances when maintenance and operation staff are required to attend the site to address urgent issues to do with maintenance, repairs, troubleshooting etc. When such works are required, it would involve around two (2) operational and maintenance staff to travel to the site via private light vehicles. The associated car parking demand will be accommodated within the on-site car park.

Routine inspections and maintenance of the solar panels and associated infrastructure would occur two times per year. This would also require around two (2) operation and maintenance staff, which would be accessing the site via private light vehicles. The parking demand associated with such tasks would be accommodated within the on-site parking facility.

6 Sight Distance Assessment

A desktop review of driver sight distance has been undertaken in accordance with Australian Standards AS2890.1:2004 and *Austroads Guide to Road Design Part 4A: Unsignalised and Signalised Intersection*. The proposed development plans to utilise the existing site access driveway located off Sturt Highway to access the solar farm and BESS.

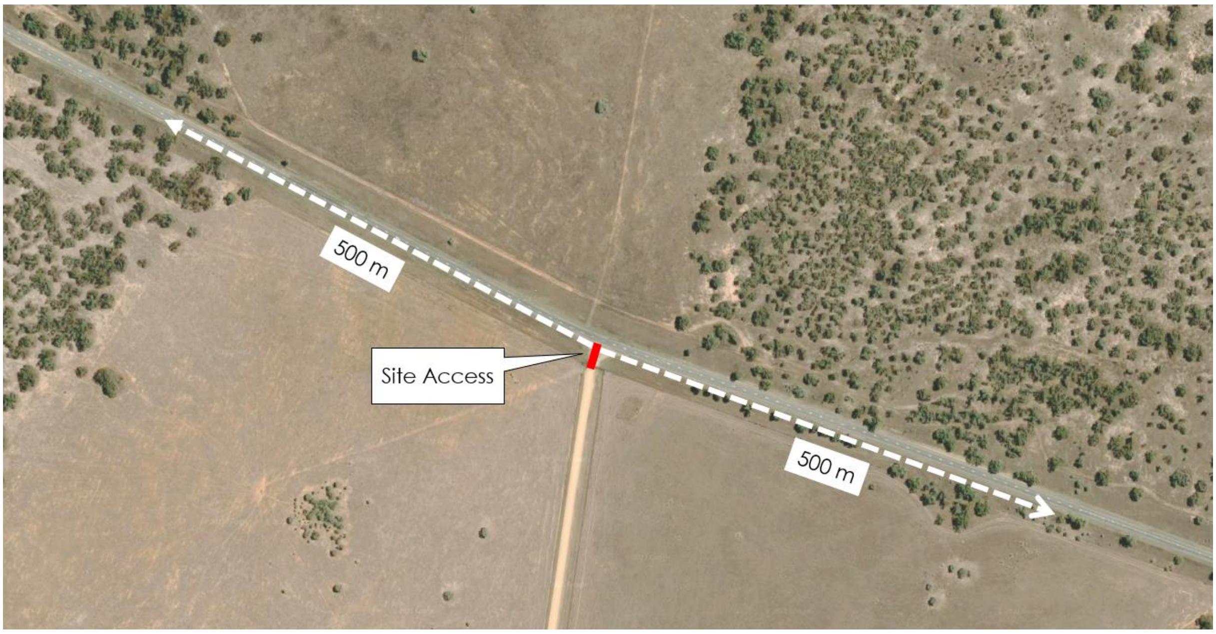
The sight distance requirement at the site access driveway has been based on Australian Standards AS2890.1. Access driveways need to be located and constructed so that there is adequate entering sight distance to traffic along the frontage road. The distance is relative to the posted speed limit of the frontage road.

Sturt Highway has a posted speed limit of 110 km/h which requires a minimum sight distance of 190 m and desirable sight distance (based on a five second gap) of 153 m.

Based on Google Street View and Nearmap aerial imagery, the available sight distance appears to exceed 500 m in each direction. This is a result of the flat terrain and reasonably straight alignment of the highway, as well as there being no vegetation surrounding the site access.

This is well above the sight distance requirements at the site access location. Figure 6.1 shows an aerial image of the site access while Figure 6.2 shows the east approach and west approach relative to the site access driveway.

Figure 6.1: Aerial View of Site Access



Source: Google Maps, accessed online on 25/10/2022

Figure 6.2: Sight Distance on Approaches

Source: Google Street View, imagery dated December 2019, accessed online on 25/10/2022

7 Conclusion

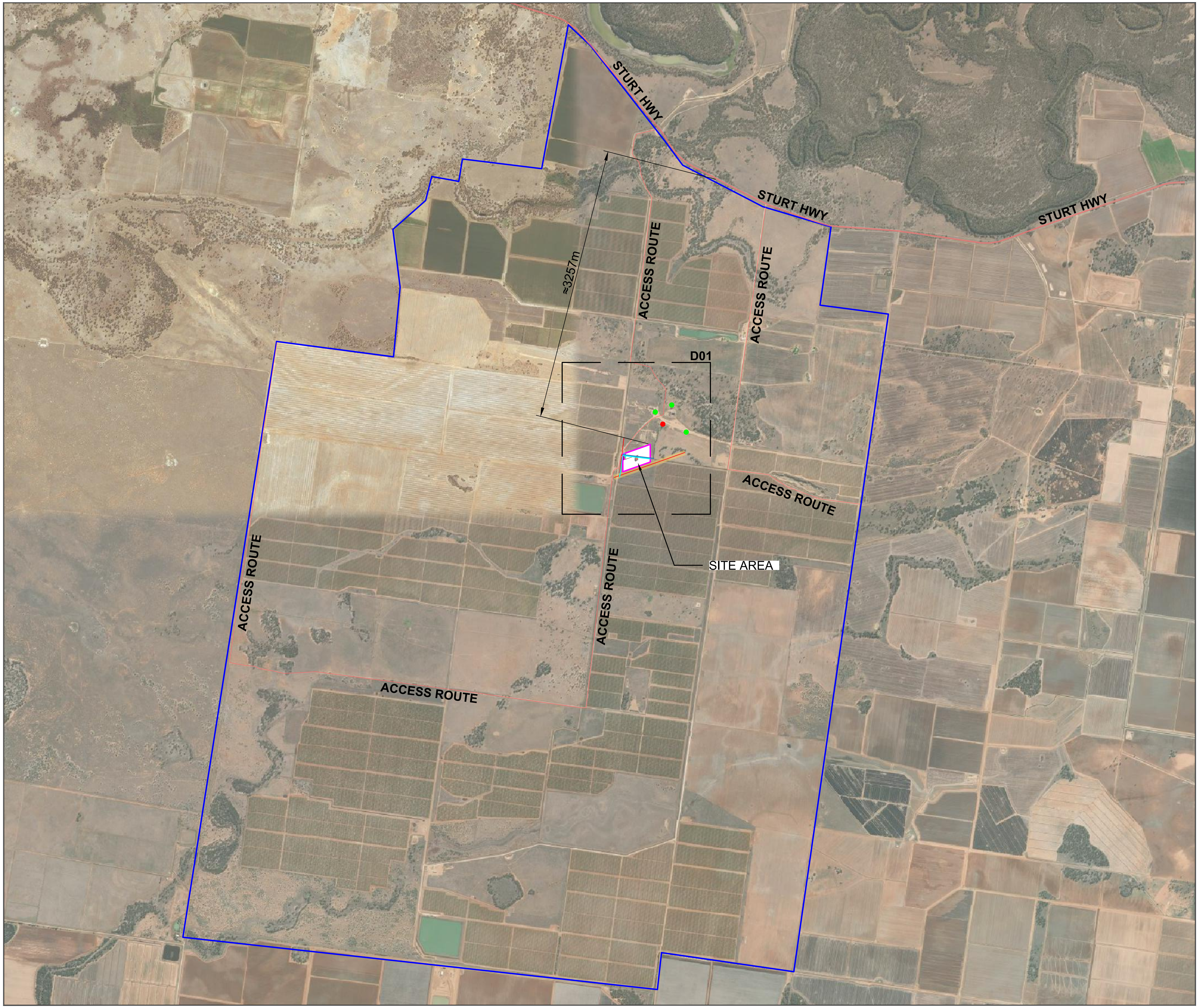
Based on the analysis presented with this Traffic and Transport Impact Assessment report, the following conclusions are made:

- The proposed solar farm and BESS will be contained within the existing Kerarbury Almond Orchard.
- The existing site traffic generation is associated with the seasonal peak of the Kerarbury Almond Orchard which occurs annually between February and April. In this period, there is 40 heavy vehicles per day with the majority of vehicle movements taking place before dawn. During the off-peak season, the site's traffic generation is significantly less typically requiring less than one vehicle per week on average.
- Historical crash data shows that there are no existing safety concerns in the vicinity of the site access.
- The future development traffic would utilise the existing site access off Sturt Highway, which would be acceptable.
- Site generated trips during the construction phase and operation phase of the development would result in minimal impact to the surrounding road network.
- The proposed development construction and operation will occur simultaneously with the orchard operation and would not result in any traffic and parking conflicts.
- There will be sufficient parking provided on-site during the construction phase and operation phase to accommodate the associated car parking demands.

Overall, the proposed development would not cause any adverse impacts to the traffic and transport networks surrounding the subject site in the Darlington Point vicinity.

Appendix A

Proposed Development Site Plans



GENERAL INFORMATION

SITE INFORMATION:

LAND AREA:	APPROX.7.0HA

PV MODULE:

MODULE PROVIDER:	TRINASOLAR
MODULE TYPE:	TSM-DEG19C.20-545W
MODULE POWER CLASS:	545W
NUMBER OF MODULES:	11016
SYSTEM DC CAPACITY:	6MWP

INVERTER:

INVERTER MODEL:	SG4950HV-MV
RATED AC CAPACITY:	4950KVA@50°C
NUMBER OF INVERTERS:	1
TOTAL AC CAPACITY:	4950KVA@50°C

BATTERY:

BATTERY PROVIDER:	SUNGROW
BATTERY MODEL:	SG2752UX
BATTERY QUANTITY:	4

TRACKER:

TRACKER PROVIDER:	FTCSOLAR
TRACKER TYPE:	VOYAGER
TRACKER QUANTITY:	102
TRACKER PITCH:	APPROX.8.6M

GENERAL NOTES:

1. DETAIL INFORMATION FOR BATTERY CONTAINER ELEVATION REFER TO "GE-50624P1_3.0_BATTERY CONTAINER ELEVATION"
2. DETAIL INFORMATION FOR CENTRAL INVERTER ELEVATION REFER TO "GE-50624P1_4.0_CENTRAL INVERTER ELEVATION"
3. DETAIL INFORMATION FOR SECURITY FENCE ELEVATION REFER TO "GE-50624P1_5.0_SECURITY FENCE ELEVATION"
4. DETAIL INFORMATION FOR TRACKER ELEVATION REFER TO "GE-50624P1_6.0_TRACKER ELEVATION"

LEGEND:

SITE ENTRANCE GATE AND ACCESS ROAD
SOLAR FARM SECURITY FENCE
SITE CAR PARK ZREA
HV O/H POLE / HV UG/OH POLE
ROAD / HIGHWAY
BATTERY CONTAINER
HV SWITCHBOARD PLATFORM
EXISTING IRRIGATION CHANNEL TO BE DEMOLISHED
CENTRAL INVERTER
SITE BOUNDARY
PV TRACKER
PROPOSED NEW HV POLE POSITION (FOR INFORMATION ONLY)
HV O/H LINE

Rev	Description	Date	Drwn.	Design.	Check.
B	DRAWING UPDATED AS PER AGL COMMENTS	09.09.22	X.T	X.T	R.Z
A	PRELIMINARY DESIGN	07.09.22	X.T	X.T	R.Z

PROJECT:

KERARBURY SOALR FARM

16705 STURT HWY, DARLINGTON POINT, NSW 2706
-34.6139, 145.8334
DP750877 LOT 68 & LOT 69

CLIENT:

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DRAWING TITLE:

GE_2.1_LOCALITY DIAGRAM 1 OF 2

NORTH DIRECTION

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SCALE: 1:42000

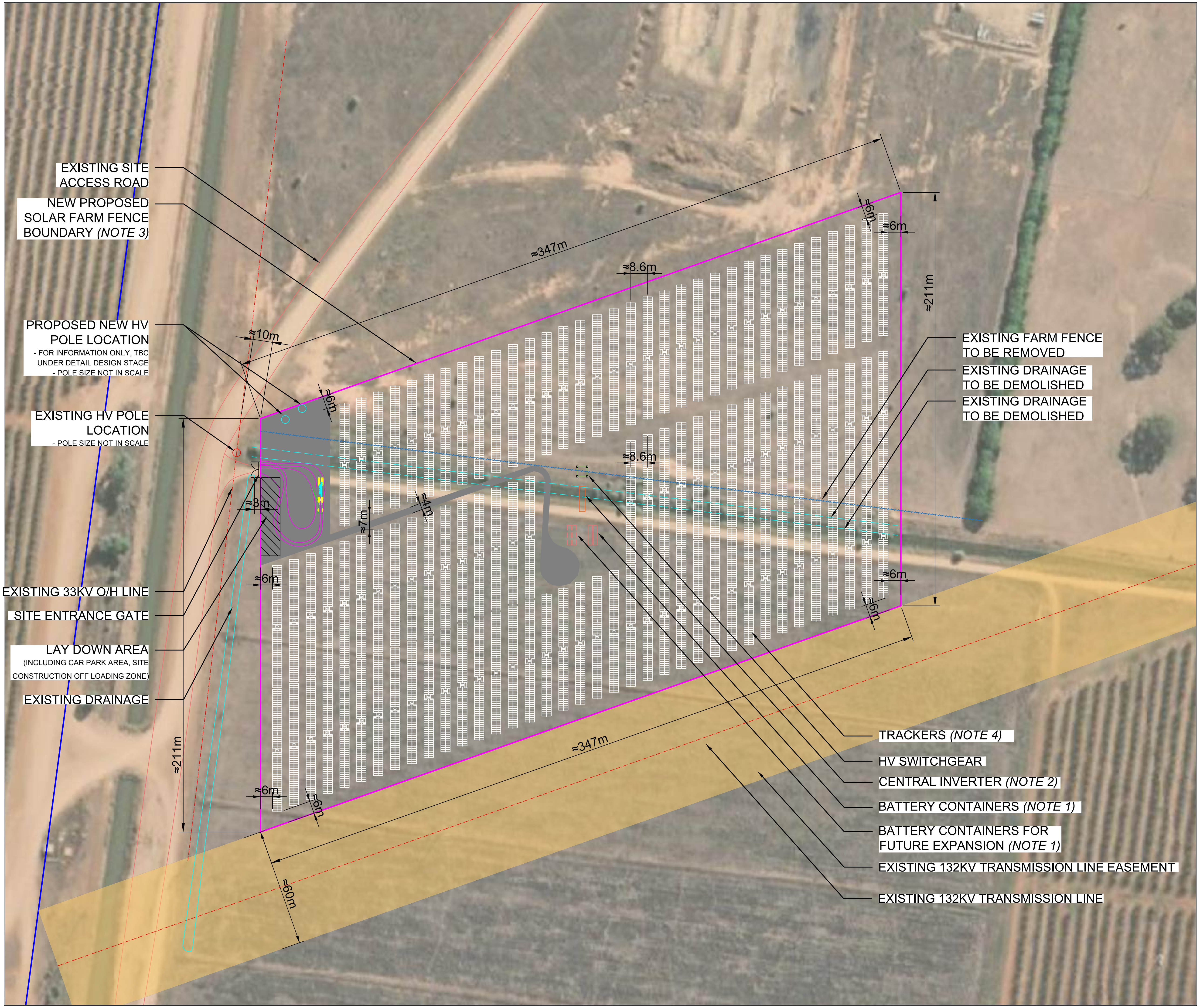
DRAWING ISSUE: PRELIMINARY

SIZE: A3

PROJECT No.: PRJ_50624P1

DRAWING No.: GE_2.1

Rev: REV_B



GENERAL INFORMATION

SITE INFORMATION:

LAND AREA:	APPROX.7.0HA

PV MODULE:

MODULE PROVIDER:	TRINASOLAR
MODULE TYPE:	TSM-DEG19C.20-545W
MODULE POWER CLASS:	545W
NUMBER OF MODULES:	11016
SYSTEM DC CAPACITY:	6MWP

INVERTER:

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BATTERY MODEL:	SG2752UX
BATTERY QUANTITY:	4

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TRACKER PROVIDER:	FTCSOLAR
TRACKER TYPE:	VOYAGER
TRACKER QUANTITY:	102
TRACKER PITCH:	APPROX.8.6M

GENERAL NOTES:

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LEGEND:

SITE ENTRANCE GATE AND ACCESS ROAD
SOLAR FARM SECURITY FENCE
SITE CAR PARK ZREA
HV O/H POLE / HV UG/OH POLE
ROAD / HIGHWAY
BATTERY CONTAINER
HV SWITCHBOARD PLATFORM
EXISTING IRRIGATION CHANNEL TO BE DEMOLISHED
CENTRAL INVERTER
SITE BOUNDARY
PV TRACKER
PROPOSED NEW HV POLE POSITION (FOR INFORMATION ONLY)
HV O/H LINE

Rev	Description	Date	Drwn.	Design.	Check.
E	TYPO AMENDED	14.09.22	X.T	X.T	R.Z
D	MINOR UPDATES AS PER AGL COMMENTS	09.09.22	X.T	X.T	R.Z
C	MINOR UPDATES AS PER AGL COMMENTS	07.09.22	X.T	X.T	R.Z
B	SITE PLAN UPDATED AS PER AGL COMMENTS	01.09.22	X.T	X.T	R.Z
A	PRELIMINARY DESIGN	30.08.22	X.T	X.T	R.Z

PROJECT:

KERARBURY SOLAR FARM

16705 STURT HWY, DARLINGTON POINT, NSW 2706
-34.6139, 145.8334
DP750877 LOT 68 & LOT 69

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DRAWING TITLE: GE_1.1_SITE PLAN

NORTH DIRECTION
North

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SCALE: 1:1800

DRAWING ISSUE: PRELIMINARY

SIZE: A3

PROJECT No.: PRJ_50624P1

DRAWING No.: GE_1.1

Rev: REV_E

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APPENDIX H FLOOD IMPACT ASSESSMENT

Report

ACLE services Solar Farms – Sturt Hwy, Darlington Point NSW

ACLE services Pty Ltd

28 September 2022

Document Status

Version	Doc type	Reviewed by	Approved by	Date issued
V01	Final report	Lachlan Inglis	Lachlan Inglis	28/09/2022

Project Details

Project Name	ACLE services Solar Farms – Sturt Hwy, Darlington Point NSW
Client	ACLE services Pty Ltd
Client Project Manager	Rodd Zhang
Water Technology Project Manager	Aram Manjikian
Water Technology Project Director	Ben Hughes
Authors	Chandi Dissanayake/Ben Hughes
Document Number	23010129_R01v1_S9

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ABN	60 093 377 283

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LIST OF TABLES

1 INTRODUCTION

This report details the findings of a flood study for a proposed solar farm at 16705 Sturt Hwy, Darlington Point, NSW. The study objective is to better understand the flooding mechanisms within the site, particularly across the location where the solar farm is proposed to be constructed. This site is referred to as 'the subject site' within this report. The report presents the flood modelling assumptions and results together with an investigation of the flood risks at the subject site.

1.1 Objectives

In order to provide ACLE services Pty Ltd with a better understanding of the flooding and drainage behaviour within the subject site, the following tasks were completed:

- Development of a 2D (Two-Dimensional) hydraulic flood model (using TUFLOW) Rain-on-Grid (RoG) methodology to assess flood risk from stormwater runoff.
- Assess the risk of inundation from the Murrumbidgee River.
- Provide high-level recommendations for any mitigation or design alterations which may be required to reduce the risk associated with flooding and drainage.

1.2 Site

The subject site is approximately 17.5 km south-west of the Darlington Point township in southern NSW, located at 16705 Sturt Hwy, Darlington Point, NSW 2706 (Figure 1-1).

The solar panels are proposed to be installed on generally flat terrain with an existing irrigation channel running in an east-west direction in the northern portion of the solar array. There is a limited catchment upstream of the site with significant irrigation and drainage network surrounding the site, impacting overland flows from both entering and leaving the site. Runoff from the site appear to be captured by these drains and diverted away from the site while upstream flows may pool against the embankment. The terrain levels across the site are very flat, varying from 118.9 m AHD to 119.0 m AHD. An existing irrigation channel runs through the site, which is the largest topographic feature. It is assumed this will be removed during the solar farm development. The topography surrounding the site is shown in Figure 1-2 while the broader area including the Murrumbidgee River topography is shown in Figure 1-3.

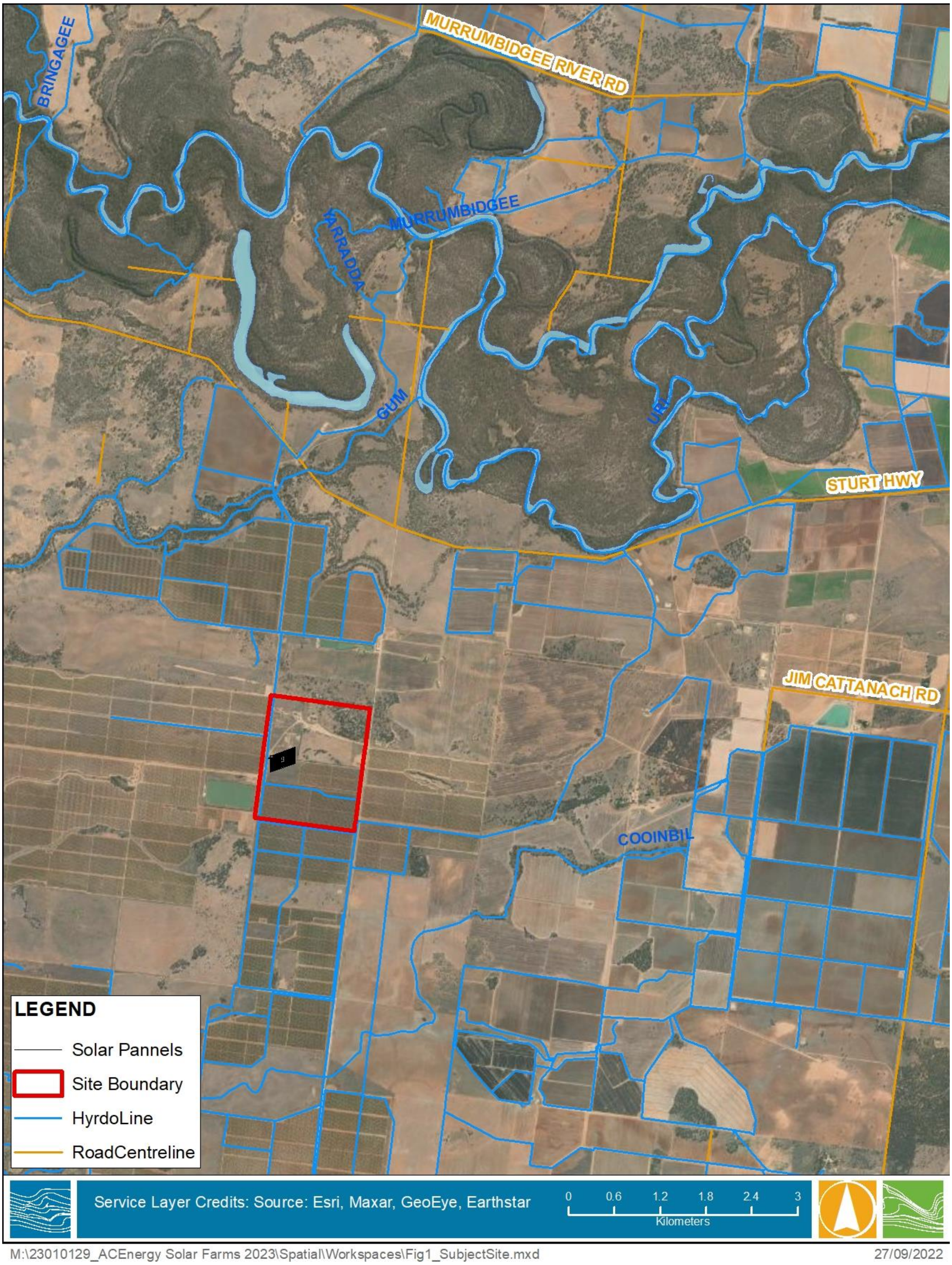

FIGURE 1-1 SUBJECT SITE

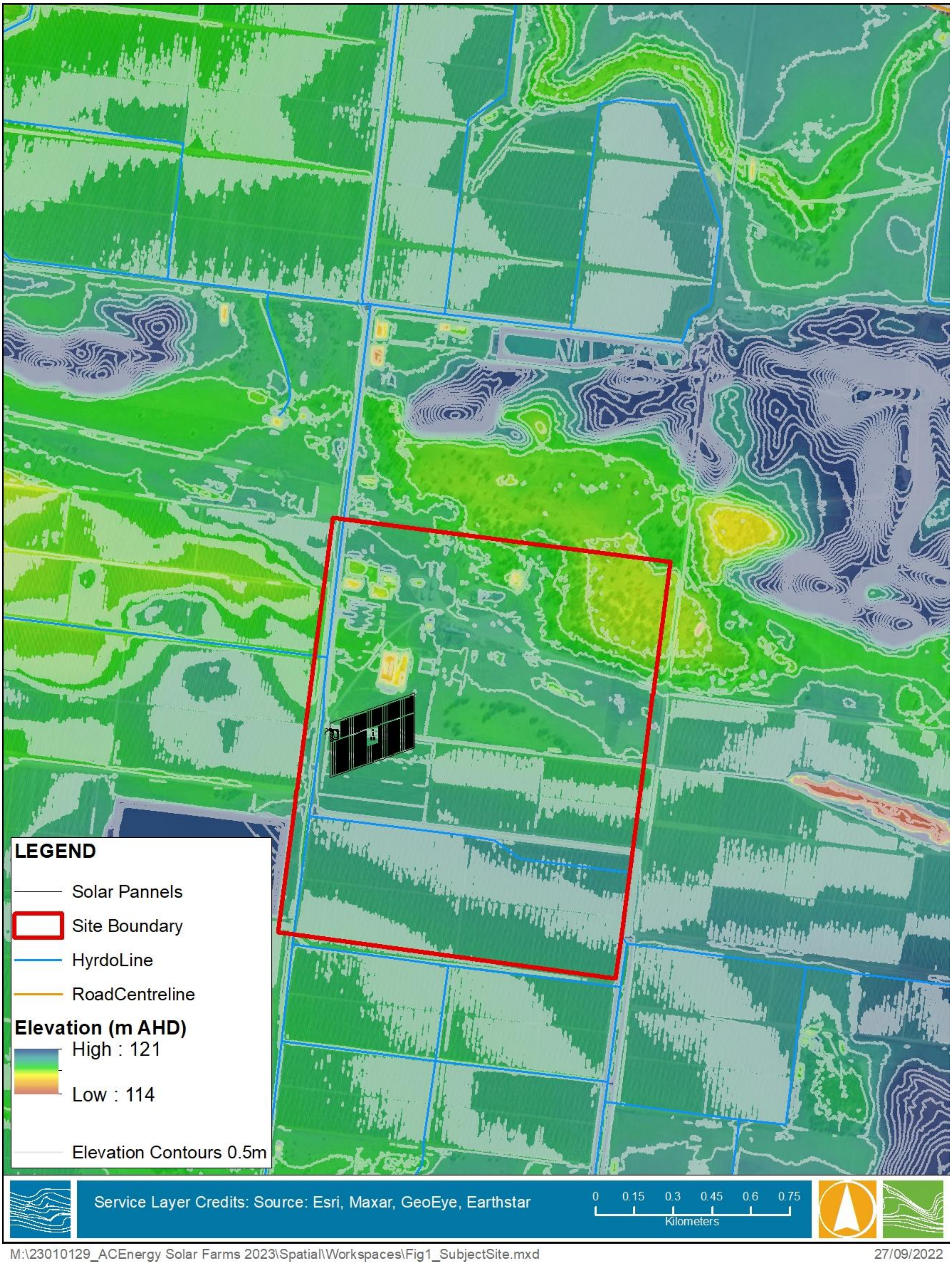

FIGURE 1-2 SUBJECT SITE TOPOGRAPHY

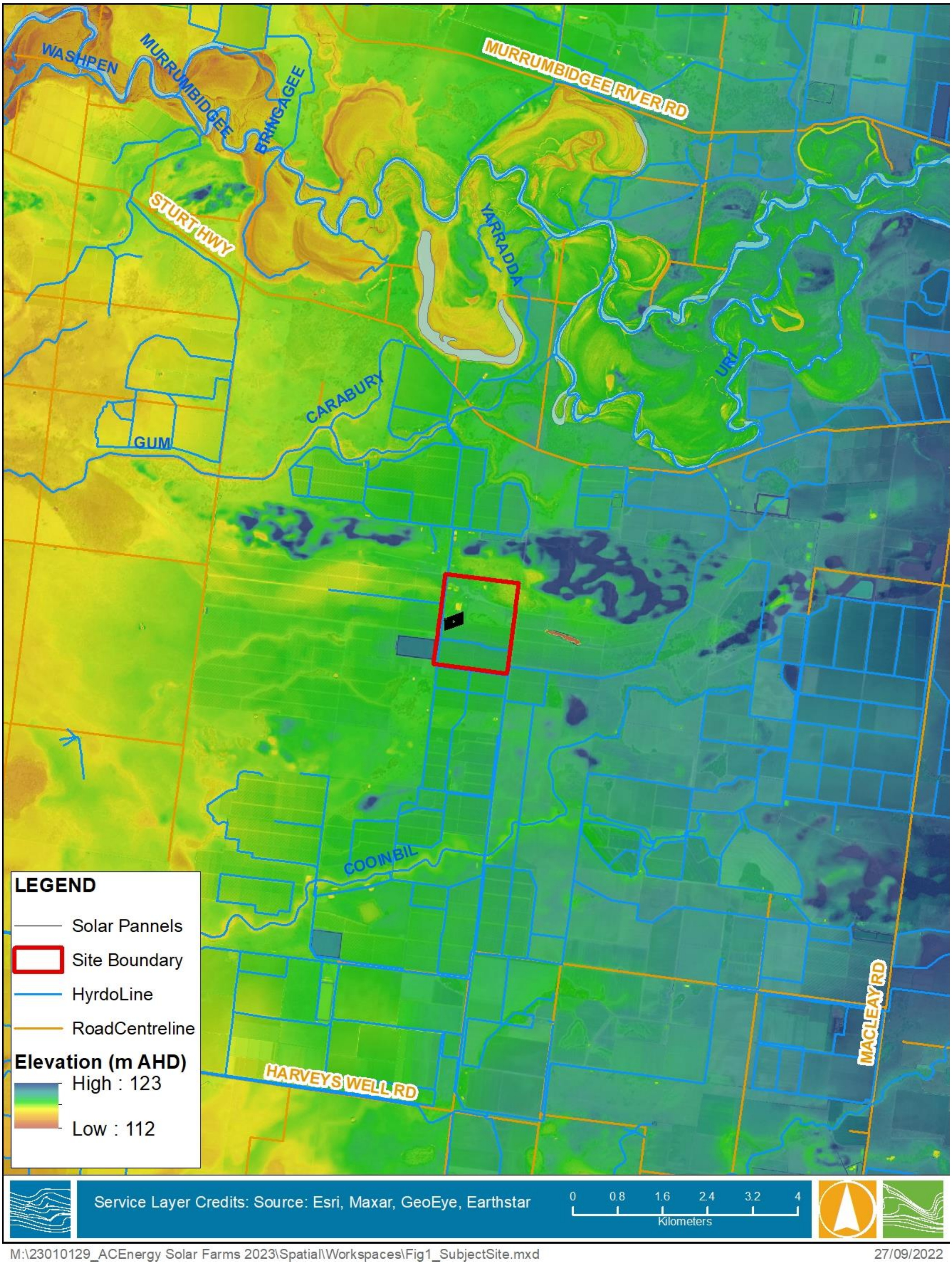

FIGURE 1-3 BROADER TOPOGRAPHY SURROUNDING SITE

2 HYDRAULIC MODELLING EXISTING CONDITIONS

2.1 Methodology

A two-dimensional Rain on Grid (RoG) hydraulic modelling approach was employed for this investigation using the Australian Rainfall and Runoff (ARR) 2019 guidelines and TUFLOW hydraulic flood modelling software. Simulations were completed using TUFLOW Build 2020-10-AD Single Precision with HPC (Highly Parallelised Computations) solution scheme on a GPU solver. Flows from the Murrumbidgee River where also modelled as a separate scenario to confirm potential riverine inundation.

No existing TUFLOW model exists for this catchment; hence, a new hydraulic model was constructed using land use, cadastral, topography and aerial photography datasets to identify different land uses which are represented from a hydrologic and hydraulic perspective as surface roughness and initial and continuing loss values.

To account for overland flows from upstream catchment and the impact of the surrounding irrigation network on overland flow behaviour, the wider area was modelled. The TUFLOW model set-up is presented in Figure 2-1 highlighting the model extent.

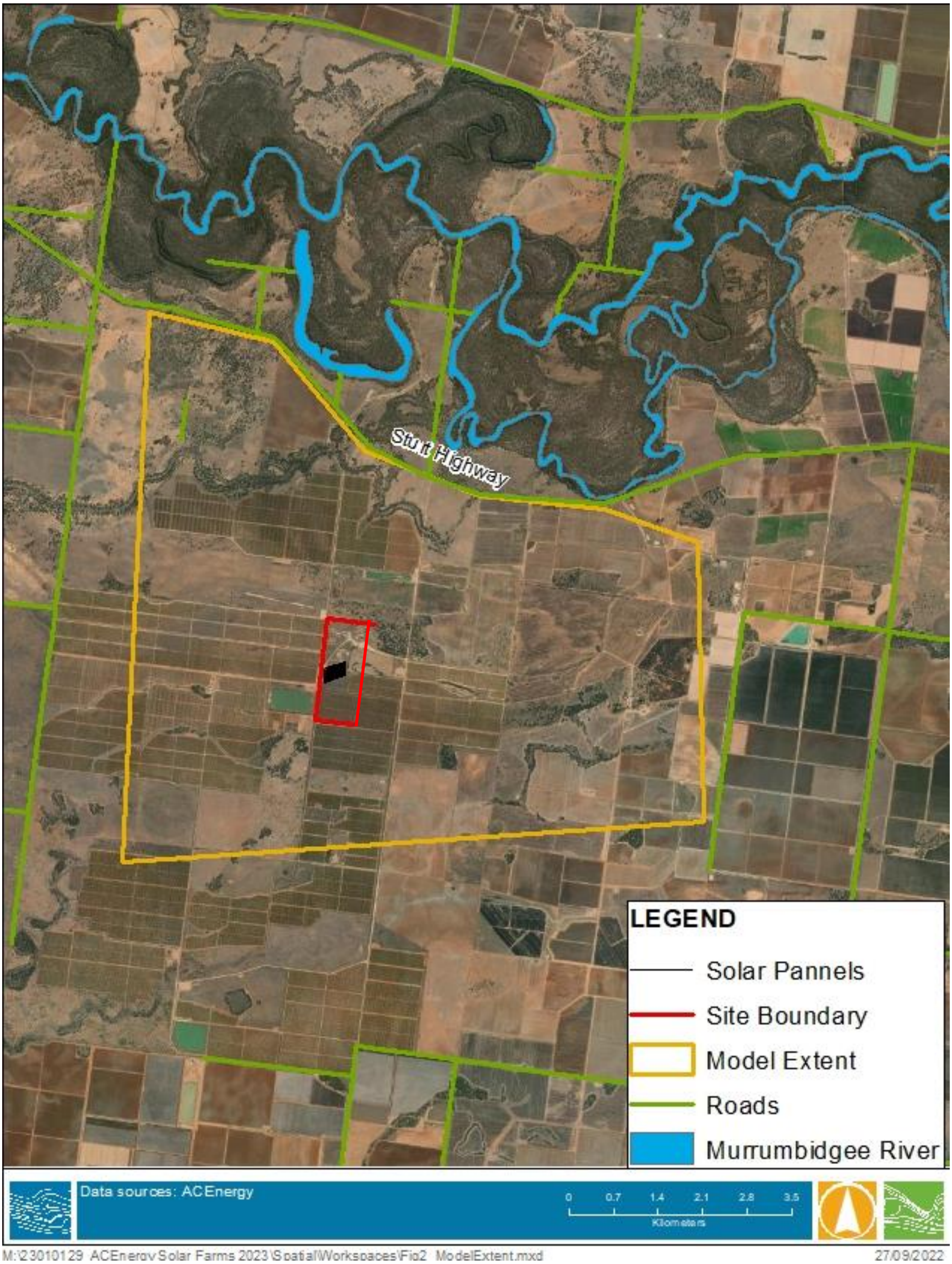

FIGURE 2-1 TUFLOW MODEL SETUP

2.1.1 Digital Elevation Model, Losses and Hydraulic Roughness

The Digital Elevation Model (DEM) was generated from 1 m resolution LiDAR, supplied by NSW Spatial Services via Geoscience Australia's Elevation Information System (ELVIS).

Given the site is largely within areas of active irrigation no infiltration losses were applied as a conservative assumption. A Manning's 'n' roughness coefficient of 0.06 was applied throughout the model.

2.1.2 Boundaries

A tailwater (2D TUFLOW 'HQ') boundary was set and extended around the downstream model boundary to allow overland flow to freely drain out of the model, with a constant slope of 1%. This is located downstream of the site and is not likely to impact on flood behaviour at the site.

2.1.3 Rainfall

The RoG methodology is extensively used for flood mapping of urban and rural areas. It allows for a comprehensive flood risk assessment by identifying overland flow paths based on the topography dataset as illustrated in the flow chart in Figure 2-2.

- The rainfall layer, which consists of one single rainfall polygon over the model extent was produced in a GIS package.
- Hyetograph (or rainfall depth timeseries in .csv format) were created for the standard range of rainfall AEP (Annual Exceedance Probability) events and durations using QGIS TUFLOW plugin and the 2016 BOM IFD at the centroid of the catchment. These were applied to the TUFLOW model to represent catchment rainfall under various durations for the 1% AEP design storm.

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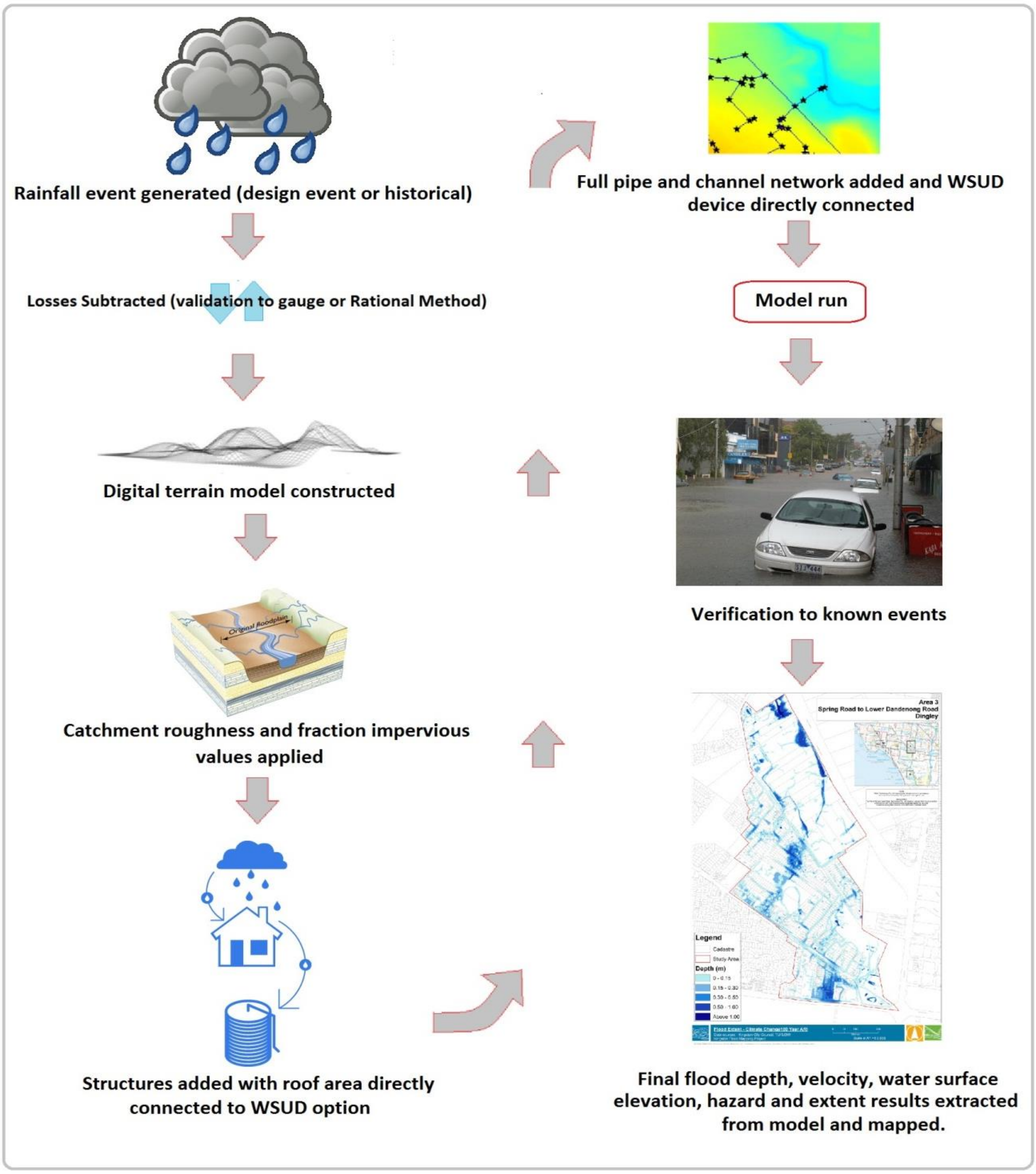

Figure 2-2 Rainfall on Grid Modelling Approach

2.1.4 TUFLOW Model Checks

- The following checks were undertaken on the TUFLOW model parameters and outputs;
  - 2D timestep: The adaptive 2D timestep drops to a minimum of 0.8 seconds. A 'Classic' TUFLOW model would be expected to have a timestep no less than ¼ of the grid size (5 m), i.e. 1.25 seconds, with a healthy HPC model no lower than a tenth of this figure. Hence the adopted timestep is within the recommended range.
  - Model mass errors: The mass errors for all models are no greater than 1% and are within the recommended range.
  - Errors and warning messages: No errors were found within the model and all warnings were reviewed and fixed, if required.

2.1.5 Critical Duration and Temporal Pattern Assessment

The model was run for the following 1% AEP design storm durations; 3, 6, 12, & 24 hours, using three ARR 2019 temporal patterns, representative of front, mid and back loaded storm events.

Results were processed to select the combination of durations and temporal patterns causing the most flooding throughout the catchment and covering the site. This is a conservative method of identifying areas prone to flooding in a 1% AEP event.

The modelled durations and temporal patterns are shown in Table 2-1.

TABLE 2-1 MODELLED DURATION AND TEMPORAL PATTERN

AEP Event	1%
Durations	3, 6, 12, & 24 hours
Temporal Pattern	TP04, TP05, TP09

2.2 Flood Hazard Classification

Floods can be hazardous, producing harm to people, damage to infrastructure and potentially loss of life. In examining potential flood hazard there are several factors to be considered, as outlined in ARR 2019 (Book 6 Chapter 7)[1]. An assessment of flood hazard should consider:

- Velocity of floodwater.
- Depth of floodwater.
- Combination of velocity and depth of floodwater.
- isolation during a flood.
- Effective warning time.
- Rate of rise of floodwater.

The flood hazard of the site was assessed in accordance with ARR2019, which defines six hazard categories. The combined flood hazard curves are presented in Figure 2-3 and vulnerability thresholds classifications are tabulated in Table 2-2.

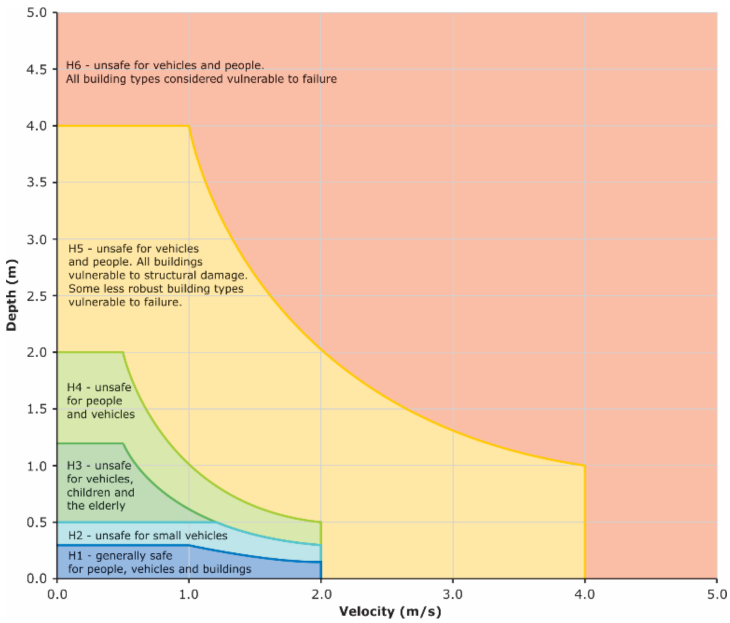

FIGURE 2-3 COMBINED FLOOD HAZARD CURVES

[1] http://book.arr.org.au.s3-website-ap-southeast-2.amazonaws.com/

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TABLE 2-2 HAZARD CLASSIFICATION (ARR, 2016)

Hazard Vulnerability Classification	Classification Limit (D and V in combination)	Limiting Still Water Depth (D)	Limiting Velocity (V)	Description
H1	D*V ≤ 0.3	0.3	2.0	Generally safe for vehicles, people and buildings.
H2	D*V ≤ 0.6	0.5	2.0	Unsafe for small vehicles.
H3	D*V ≤ 0.6	1.2	2.0	Unsafe for vehicles. children and the elderly.
H4	D*V ≤ 1.0	2.0	2.0	Unsafe for vehicles and people.
H5	D*V ≤ 4.0	4.0	4.0	Unsafe for vehicles and people. All buildings vulnerable to structural damage. Some less robust buildings subject to failure.
H6	D*V > 4.0	-	-	Unsafe for vehicles and people. All building types considered vulnerable to failure.

3 RESULTS

Detailed TUFLOW modelling was completed for the site for existing conditions and the results are discussed in the following section. The existing conditions 1% AEP depth, velocity and flood hazard results are shown from Figure 3-1 to Figure 3-3. It is noted that the flood depth map has been filtered for small depths below 0.02 m; however, this has not been performed for the other results.

The following observations can be made for the 1% AEP flood event:

- The maximum flood depth within the solar farm site is approximately 200 mm. Flood depths south of an irrigation channel splitting the site is relatively consistent at 150-200mm. This channel holds water to the south causing the water to pool (noting no details of the channel infrastructure were available or included in the hydraulic model). If this channel is removed (it is assumed it will be given there are panels located on top of the channel), these depths will decrease.
- North of the channel depths are generally below 100mm, with higher depths to the north east reaching up to 180mm.
- Modelled peak velocities within the proposed solar panel extent are very low, largely below 0.1 m/s with some isolated areas up to 0.15 m/s. This is due to the flat nature of the site.
- A flood hazard map was created from the product of both flood depth and velocity as described in the previous section. The entire site and surrounds are classified as H1: 'Generally safe for vehicles, people, and buildings'. This is to be expected of shallow still water, ponding across the site rather than traversing it.
- The site was assessed for flooding from the Murrumbidgee River located 6km north of the site. The edge of the Murrumbidgee River floodplain is located 4km north of the site. Flood modelling from the Darlington Point flood study undertaken by BMT WBM in 2018[2] shows the 1% AEP flood extent typically remained within the broader Murrumbidgee River floodplain. Design flows were extracted downstream of Darlington Point (upstream of the site) and simulated as a steady state flow in a broader flood model. The results showed the subject site is situated well above the 1% AEP design level within the Murrumbidgee River.

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[2] BMT WBM (2018), Murrumbidgee River at Darlington Point and Environs Flood Study 2018.

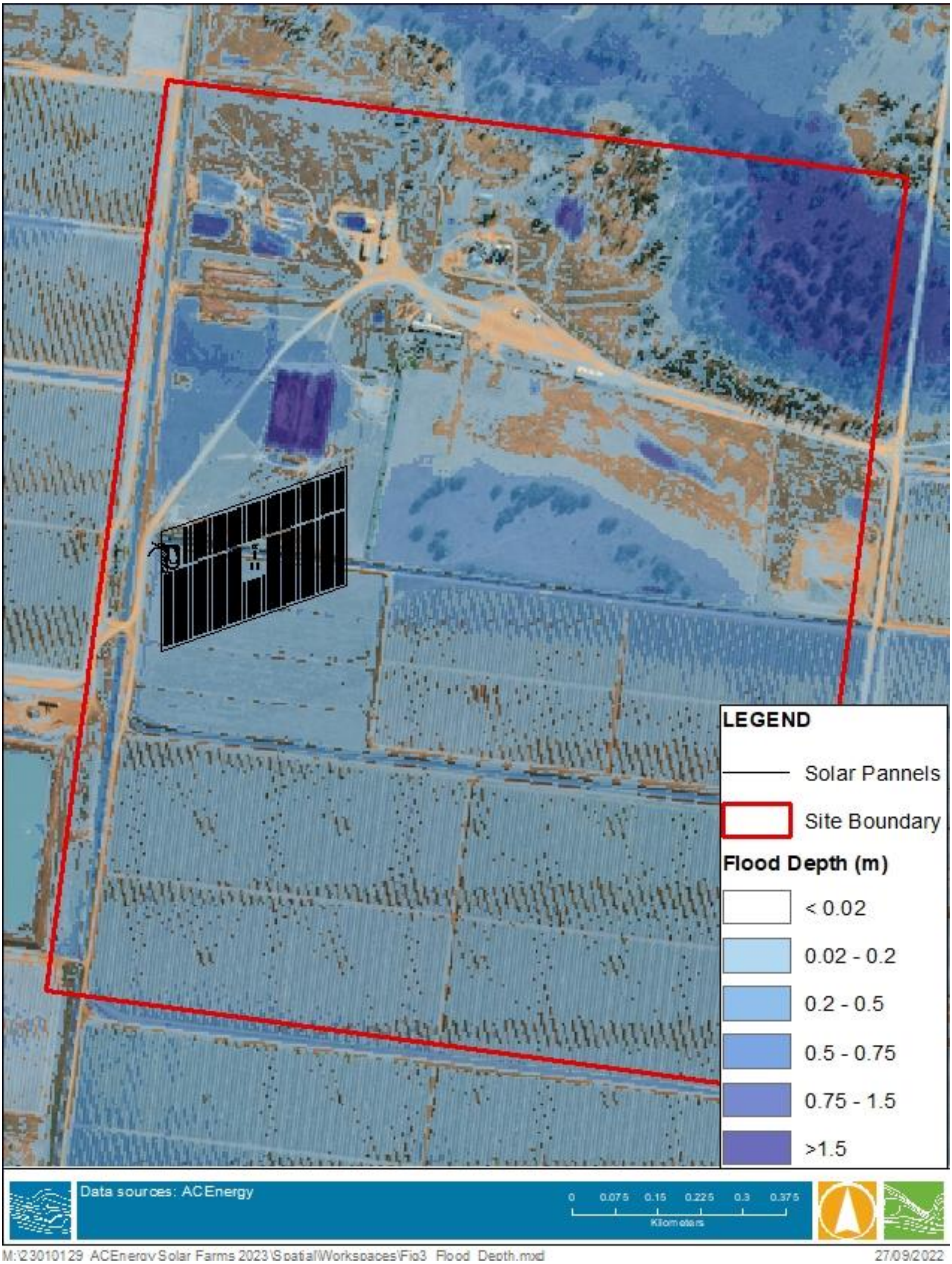

FIGURE 3-1 1% AEP MAXIMUM FLOOD DEPTH (DEPTHS BELOW 0.02 M NOT SHOWN)

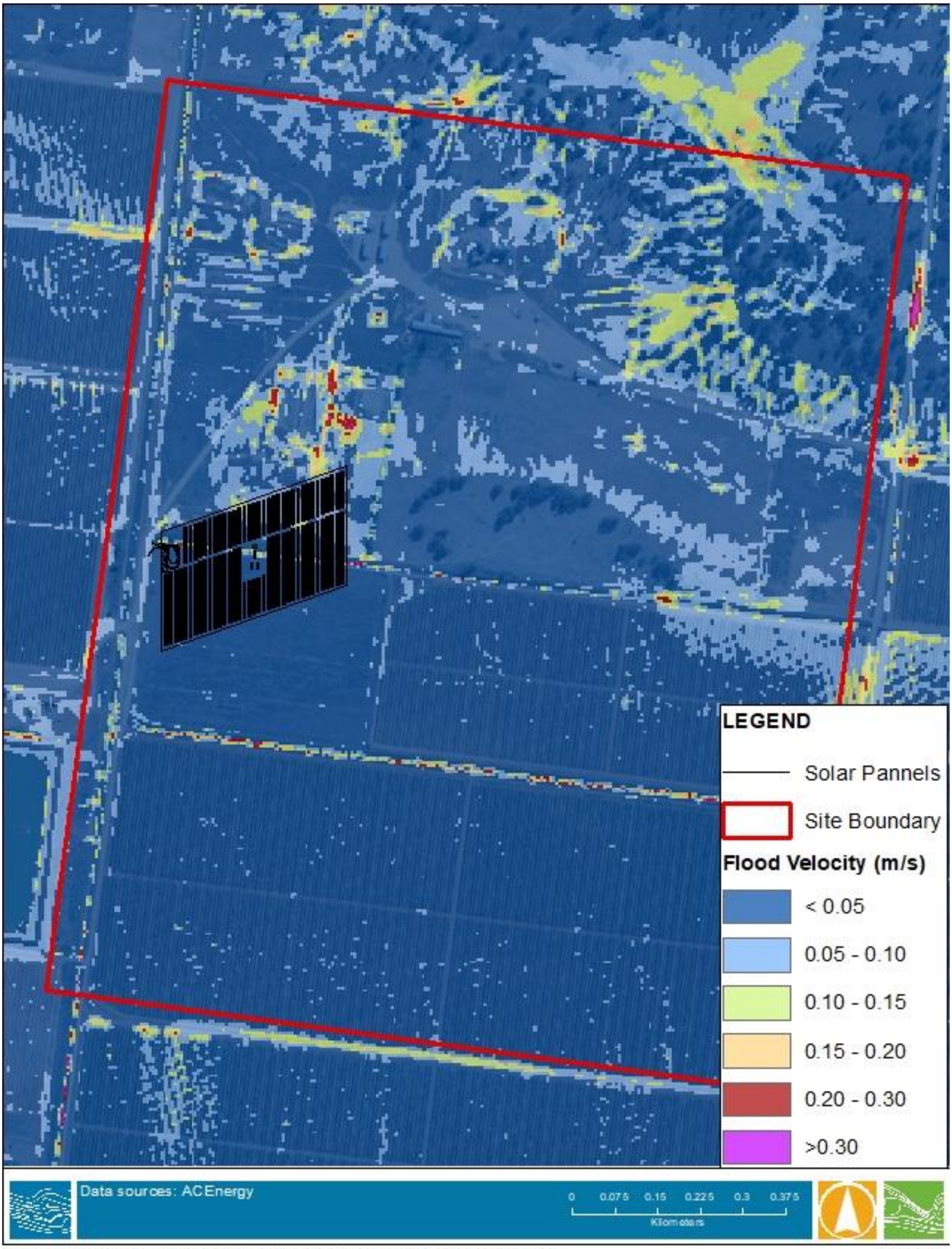

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FIGURE 3-2 1% AEP MAXIMUM FLOOD VELOCITY

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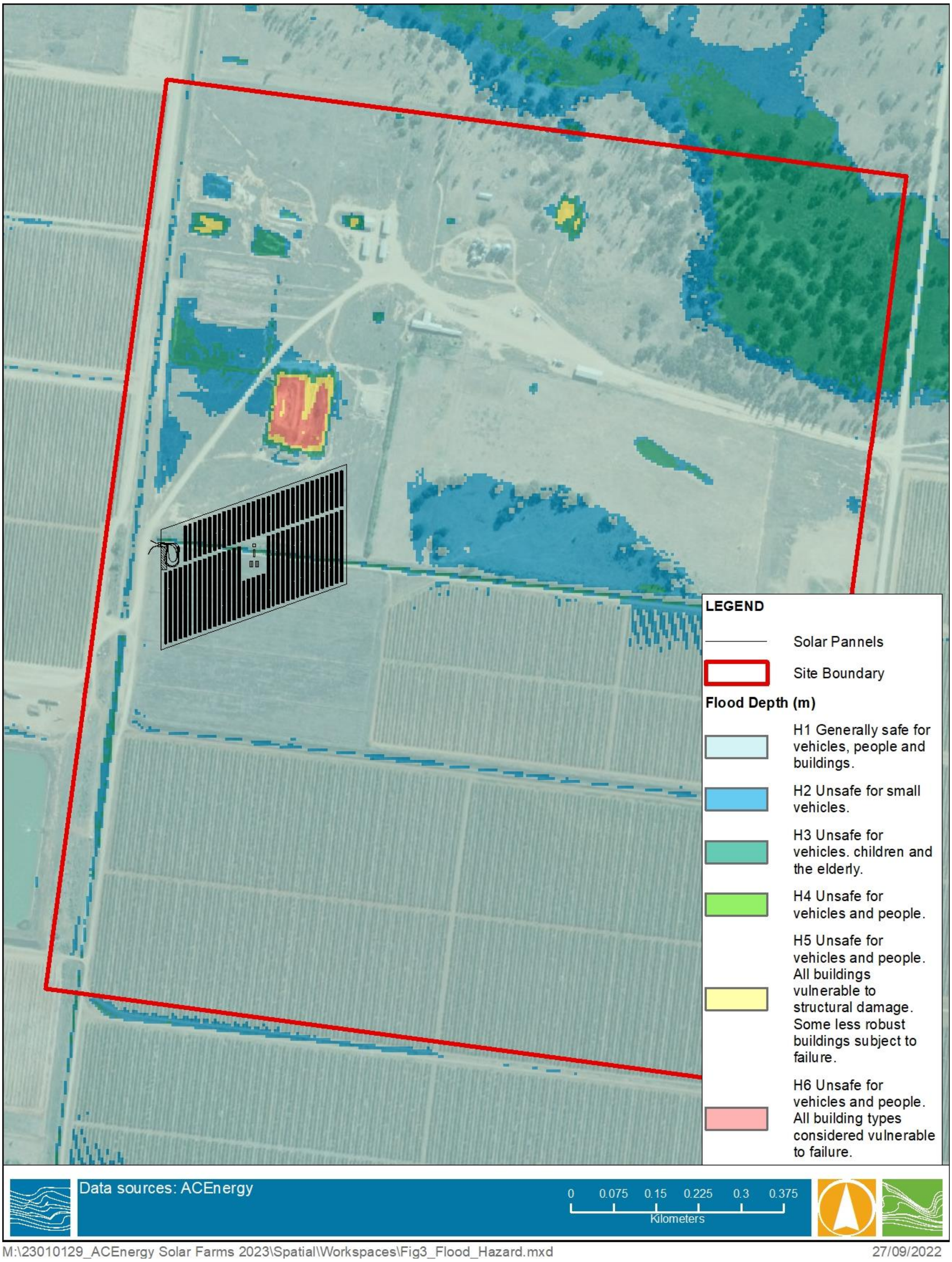

FIGURE 3-3 1% AEP MAXIMUM FLOOD HAZARD

4 CONCLUSIONS AND RECOMMENDATIONS

The flood investigation study provided within the report provides flood mapping for a proposed solar farm to be constructed at 16705 Sturt Hwy, Darlington Point, NSW. A 2D hydraulic flood model was developed and modelling undertaken utilising the latest flood modelling software; industry standards (i.e., BoM IFD and ARR 2019 guidelines) and latest available 1 metres LiDAR dataset (2015, NSW Spatial Services) under the 1% AEP design storm event.

The flood modelling and mapping confirmed that there are no significant overland flow paths across the site with peak flood depths below 200 mm across the area of interest (panel array location). Depths were consistently between 100 and 200mmy due to an irrigation channel passing through the site. Maximum flood velocities are all very low, below 0.1 m/s, resulting in a minimum flood hazard (H1 – generally safe for people, vehicles and buildings).

Based on the findings of the flood modelling, it is recommended to set any solar panel and critical electrical infrastructure to be 300 mm above the ground level.

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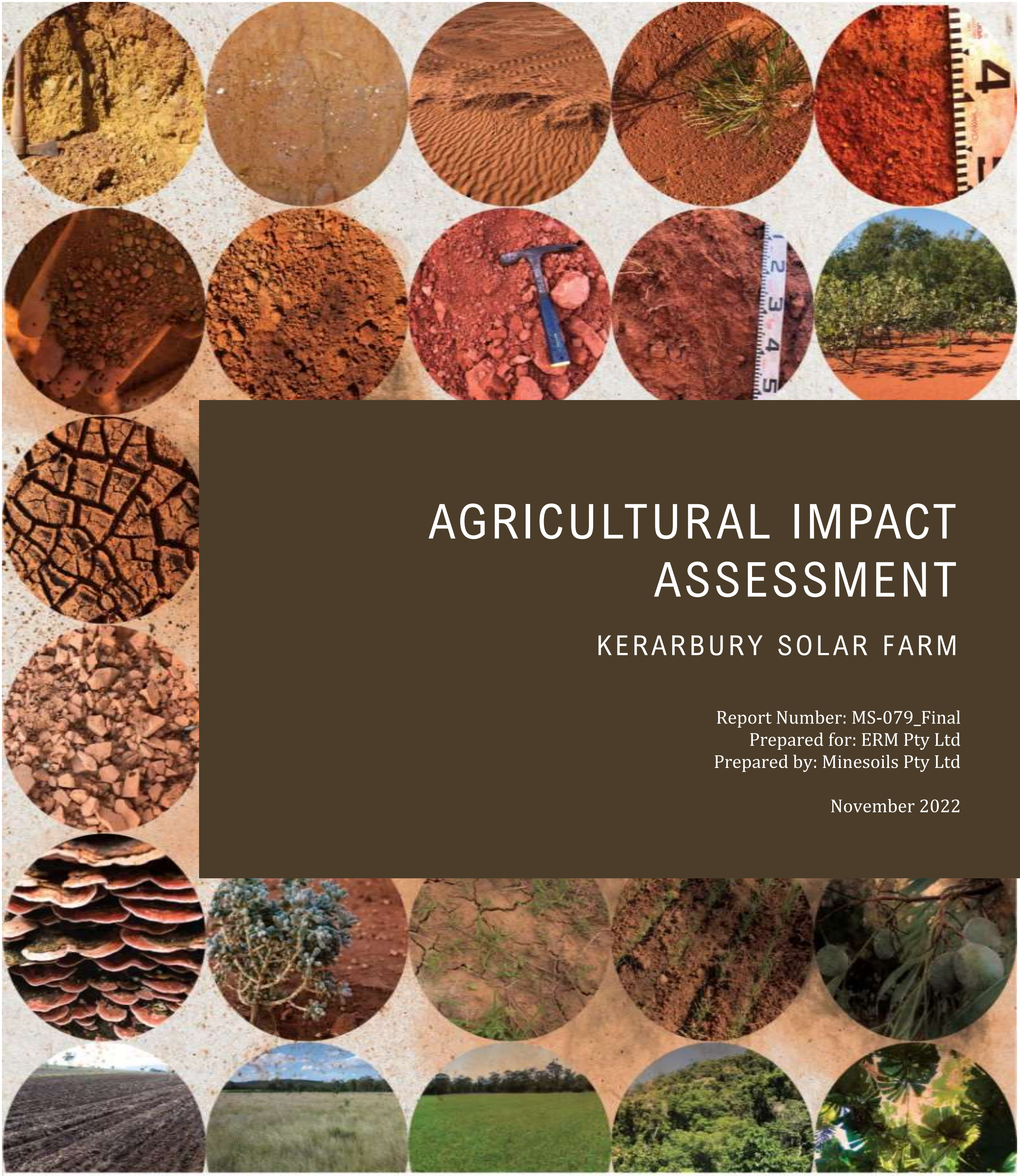
APPENDIX I AGRICULTURAL IMPACT ASSESSMENT



AGRICULTURAL IMPACT ASSESSMENT

KERARBURY SOLAR FARM

Report Number: MS-079_Final
Prepared for: ERM Pty Ltd
Prepared by: Minesoils Pty Ltd

November 2022

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LAND & REHABILITATION SPECIALISTS

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DOCUMENT CONTROL

Reference	Date	Prepared by	Approved
MS-079_ Draft 1	18 October 2022	Matt Hemingway	Clayton Richards
MS-079_ Final	14 November 2022	Matt Hemingway	Clayton Richards

TABLE OF CONTENTS

List of Figures

1. INTRODUCTION

1.1 OVERVIEW

Minesoils Pty Ltd (Minesoils) was engaged by ERM Pty Ltd (ERM) to provide specialised support for an agricultural impact assessment to inform a Statement of Environment Effects as part of a Development Application for a proposed Solar Farm and Battery Energy Storage System (BESS) (the Project) located in the Riverina region of New South Wales.

The agriculture impact assessment will inform the following item as requested by Murrumbidgee Council:

- *The impact the development may have on the loss of prime agricultural land.*

1.2 PROJECT SITE

The proposed Project consists of a solar farm and BESS in the Riverina region of NSW, approximately 15 km south-west of Darlington Point, NSW at 16705 Sturt Hwy, Darlington Point, NSW 2706, covering Lots 68 and 69 of DP 750877 (refer **Figure 1**). The Riverina is an agricultural region of south-western NSW, which extends from the foothills of the Snowy Mountains north west through the Murrumbidgee River catchment area to the flat dry inland plains of Hay and Carrathool.

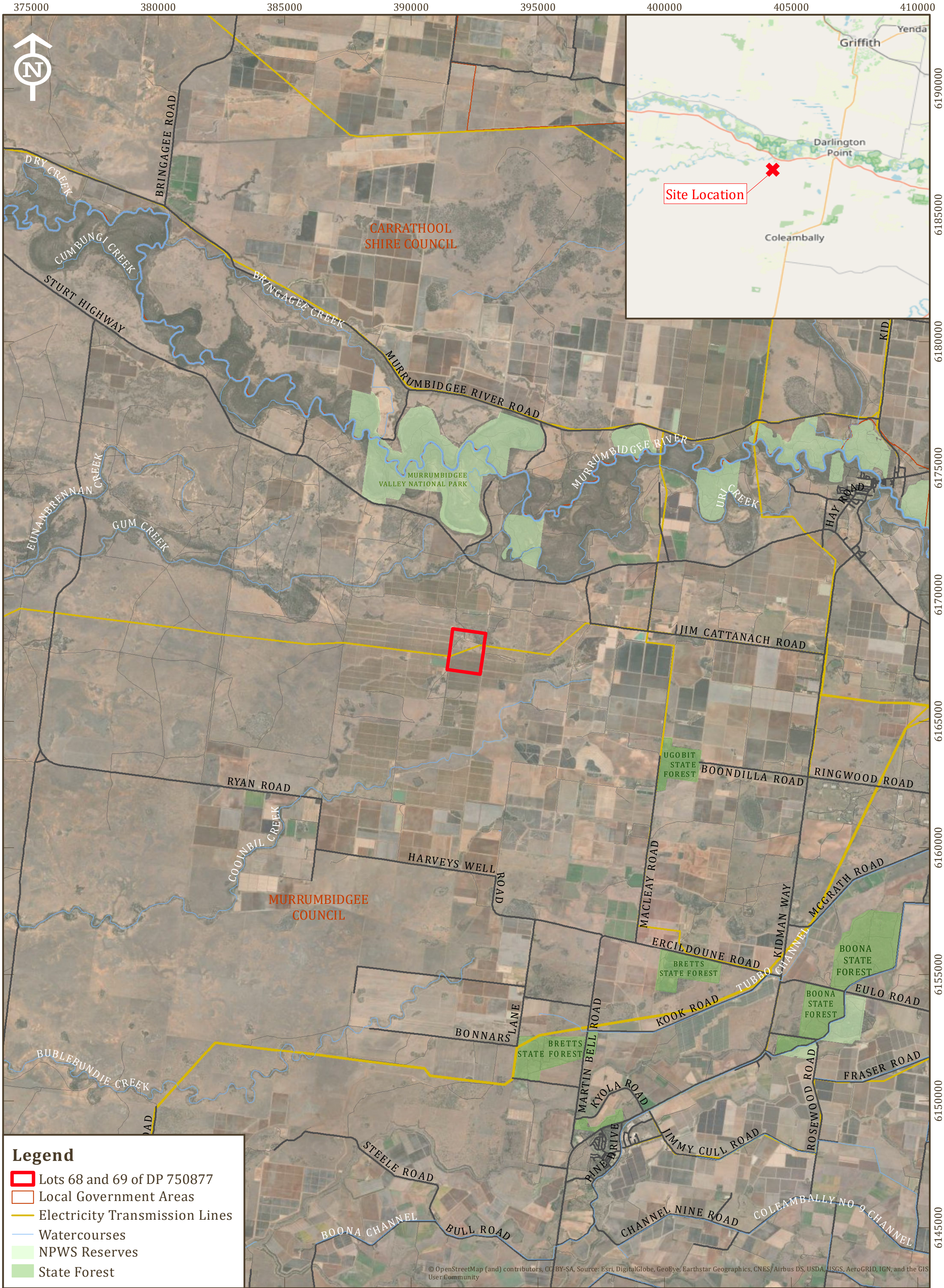
The total project area covers approximately 7.3 hectares (ha) (refer **Figure 2**), with a solar farm footprint of approximately 6.1 ha, with a capacity of up to 4.95 megawatts (MW AC), and a BESS footprint of up to 30 m^2 with a capacity of up to 4.586 MWhr including any additional supporting infrastructure.

1.3 ASSESSMENT APPROACH

An agricultural impact assessment must be to a level of assessment which is proportionate to the agricultural capability of the land and the anticipated affected by the Project. Minesoils approach includes provisions for an agriculture impact assessment containing the level of detail as described in **Table 1**, which Minesoils considers appropriate and justified based on the scale of the Project and the minimal landform disturbance anticipated. This framework for assessment is based on a 'Level 1 basic assessment' with elements of a 'Level 2 reduced assessment' as per the *Large-Scale Solar Energy Guideline* (NSW Department of Planning and Environment, 2022).

Table 1: Assessment approach

Assessment	Content and form	Section Addressed
Project description Describe the nature, location, intensity and duration of the project and include a map of the project area.	• project description • area disturbed • location • duration	1
Regional context Describe the regional context.	• property zoning • climate and rainfall • regional landform • regional land use	2
Site characteristics and land use description Describe the nature and location of agricultural land with the potential to be impacted by the development. Describe the current agricultural status and productivity of the proposed development area and surrounding locality including the land capability as per Office of Environment and Heritage's (OEH) Land and Soil Capability Assessment Scheme.	• describe the land subject to the project site • describe existing agricultural land uses (i.e., orchards, vineyards, breeding paddocks, intensive livestock areas) • identify soil type, fertility, land and soil capability based on regional data • describe potential agricultural productivity of the site	3
Impacts on agricultural land Identify and describe the nature, duration and consequence of any potential impacts on agricultural land subject to the project site and in the wider region	• describe project impacts on identified agricultural productivity and enterprises including but not limited to livestock, cropping activities, orchard production., etc • consider impacts to the agricultural land of the site and neighbouring properties • consider project potential to temporarily and/or permanently remove agricultural land and/or fragment or displace existing agricultural industries	4
Mitigation strategies Outline strategies which may be adopted to mitigate potential impacts on agricultural land and minimise land use conflict.	• outline and consider strategies to mitigate project impacts on agricultural land	5
Consultation Describe consultation undertaken	• consult with neighbouring landholders to understand potential impacts on immediately adjacent agricultural land and to inform strategies to mitigate these impacts.	6



MINESOILS

LAND & REHABILITATION SPECIALISTS

GDA2020 MGA Zone 55

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Regional Context

FIGURE 1

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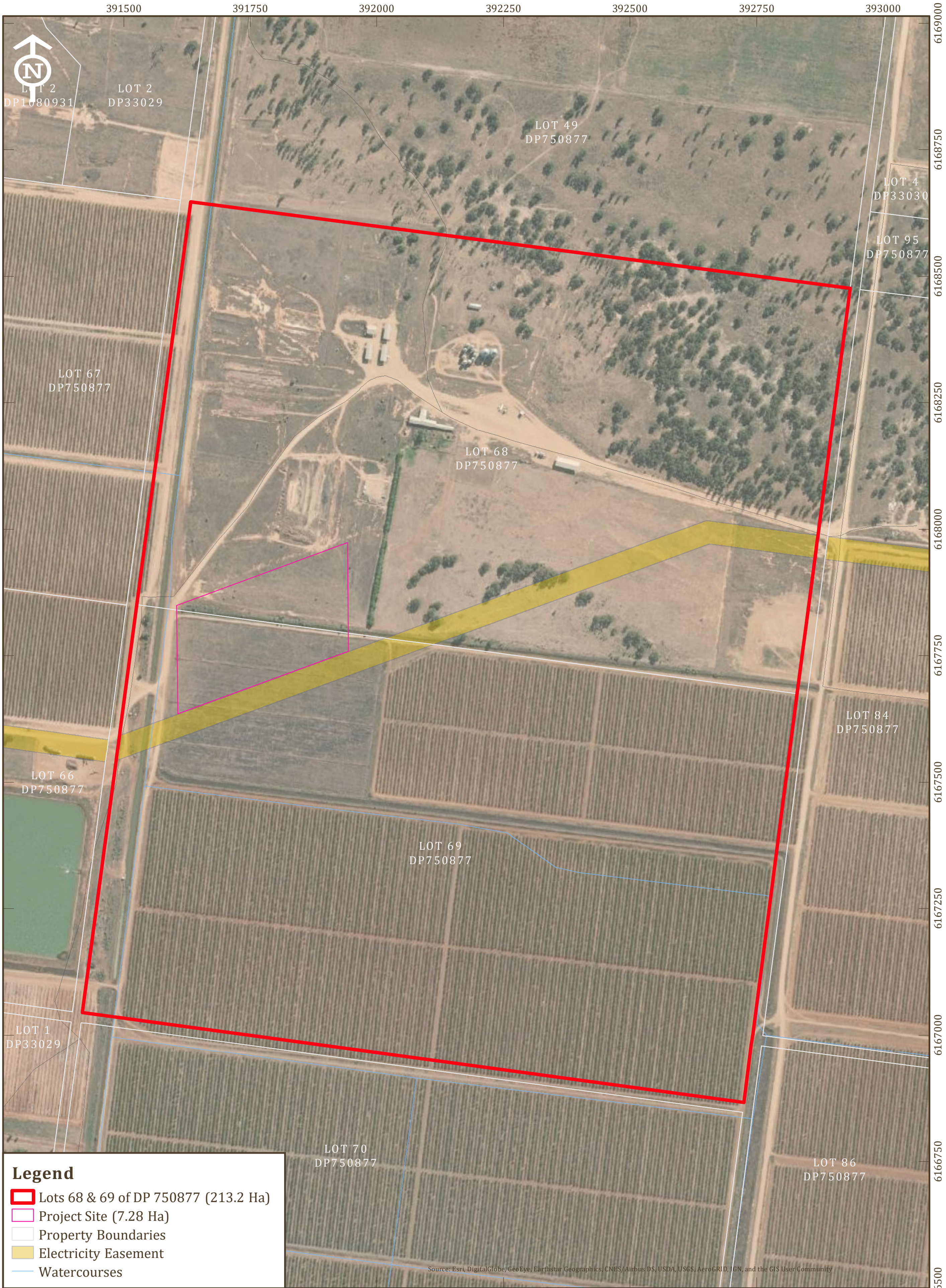

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GDA2020 MGA Zone 55

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Project Site

FIGURE 2

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2 REGIONAL CONTEXT

2.1 ZONING

The site location is contained within Lots 68 and 69 of DP 750877 and is also zoned RU1 Primary Production under the *Murrumbidgee Local Environmental Plan 2013* (Murrumbidgee LEP) (refer **Figure 2**). The objectives of this zone are:

- To encourage sustainable primary industry production by maintaining and enhancing the natural resource base.
- To encourage diversity in primary industry enterprises and systems appropriate for the area.
- To minimise the fragmentation and alienation of resource lands.
- To minimise conflict between land uses within this zone and land uses within adjoining zones.

Development for the purpose of electricity generation is not specified in item 2 or 3 of the RU1 Primary Production Land Use Table under Part 2 of the Murrumbidgee LEP, therefore the development is 'Prohibited' according to item 4. However, the provisions of the State Environmental Planning Policy (Transport and Infrastructure) 2021, override the Murrumbidgee LEP, allowing the proposal to be undertaken with consent under clause 2.36 (1(b)).

2.2 CLIMATE AND RAINFALL

Annual rainfall in the Riverina has remained relatively stable over the past 30 years, decreasing by around 20 mm (4%) from about 520 mm to about 500 mm when compared to the previous 30 years (Bureau of Meteorology and the CSIRO, 2019).

Rainfall reliability maps for Riverina over the past 30 years show winter rainfall has been moderately reliable across the region, usually changing by about 50 mm from year to year. This is in contrast to spring and summer rainfall, which have been less reliable. Autumn rainfall has been unreliable across the entire region.

The Riverina region experiences frost risks to agriculture, which tend to occur through dry winter and spring periods, when soil moisture is low, and cloud cover infrequent.

The closest Bureau of Meteorology (BOM) Automatic Weather Station (AWS) to the Project site is the Griffith Airport, approximately 40 km north (BOM, 2022). The annual average rainfall is 398.6 mm, falling throughout the year over approximately 49rain days. The annual average maximum temperature recorded at the site is 24.0°C and the annual average minimum temperature is 10.1°C. The highest average maximum temperature of 33.2°C is recorded in January, while the lowest minimum temperature of 3.5°C is recorded in July. The annual average humidity is 66% at 9am and 43% at 3pm.

2.3 REGIONAL LANDFORM

The Project site is located on the Riverine Plain, the eastern geomorphic subdivision of the Murray Basin that encompasses an area of 77,000 square kilometres. The Riverine Plain is characterised by almost flat topography with extremely low gradients which is traversed by several major rivers and their tributaries that flow from the east and south. The Murray Basin is a large low lying intracratonic basin containing Cainozoic unconsolidated sediments and sedimentary rocks.

The underlying geology of the study area consists of Shepparton Formation which formed in a fluvio-lacustrine environment between the Pleistocene and Holocene with the dominant lithology consisting of alluvial floodplain deposits (refer **Figure 3**). The Shepparton Formation consists of unconsolidated to poorly consolidated variegated and mottled clay, silt, silty clay, with intercalated lenses of fine to coarse sand and gravel. The formation has been partially modified by pedogenesis and groundwater table fluctuation.

The Project site is situated on the flat and open depression landforms which form a large plain adjacent to the Murrumbidgee River approximately 4.5 kilometres to the north. 2 kilometres to the north of the Project site lies Gum Creek, a minor drainage line which flows into the Murrumbidgee River (refer **Figure 4**).

The landforms of the Riverine Plain formed as a result of changes to the river systems during the Pleistocene and Holocene periods. The present day Murrumbidgee River is a narrow, incised and sinuous watercourse that transports small quantities of sediment; however, traces of old aggraded and abandoned river channels, known as paleochannels, are present on the adjacent plains of the Project locality.

The landscape of the Project locality has been extensively cleared of native vegetation and altered by modern land use modifications associated with irrigation agriculture. Large areas of remnant native woodland remain in the vicinity of the Murrumbidgee River.

2.4 REGIONAL LAND USE

The Riverina region covers almost 5.7 million hectares, of which 79% is under agricultural production. Grazing is the dominant land use (39%) (Bureau of Meteorology and the CSIRO, 2019). For the Murrumbidgee LGA, in which the Project site lies, 91% of the total LGA area of 616,635 ha is land mainly used for agricultural production (Australian Bureau of Statistics (ABS), 2022). Employment in the LGA is generally driven by agribusiness and service industries, with a total 342 agriculture related businesses recorded in the 2020 – 2021 census.

The majority of the Murrumbidgee LGA area of the Riverina region has been cleared for agricultural uses, with the main land use being cattle and sheep grazing. Low stocking rates over large areas is typical of the grazing systems. Cattle and sheep, cross-bred & dorper sheep meat and merino sheep for wool, have traditionally been key industries (NSW Department of Primary Industries, 2018).

The Murrumbidgee Irrigation Area (MIA) and Coleambally Irrigation Area (CIA) are irrigation areas provide over one-quarter of all the fruit and vegetable production in NSW and are also one of Australia's largest exporters of bulk wines. Further growth in Agriculture, Forestry and Fishing is being experienced in cotton, aquaculture and nut industries.

Within the Murrumbidgee LGA area of the Riverina region there are significant areas characterised by irrigation based agriculture associated with the Coleambally Irrigation Area (CIA). This extensively cleared, usually land-formed and highly modified landscape has a focus on irrigated cropping enterprises such as cotton, rice, lucerne, maize, millet and sorghum. Winter cereals are often grown in rotation with irrigated summer crops to utilise the sub-soil moisture stored from irrigation and as a break crop. In addition, there are widespread plantings of fruit trees. Intensive livestock farming of poultry and pigs takes advantage of the grain and feed grown in the area.

The size of farms varies greatly across the region depending on location, landscape and production system. Average farm size is influenced by the use of irrigation and areas property size for Murrumbidgee LGA is 2,000ha - 3,000ha, the smallest of in the Riverina region outside of the residential centres.

The area of land use for of the agricultural types for the Murrumbidgee LGA is presented in **Table 2**, which shows grazing activities represent 60 per cent of the agricultural land use, followed by cropping at 40 per cent, and forestry and other land uses totalling less than one per cent.

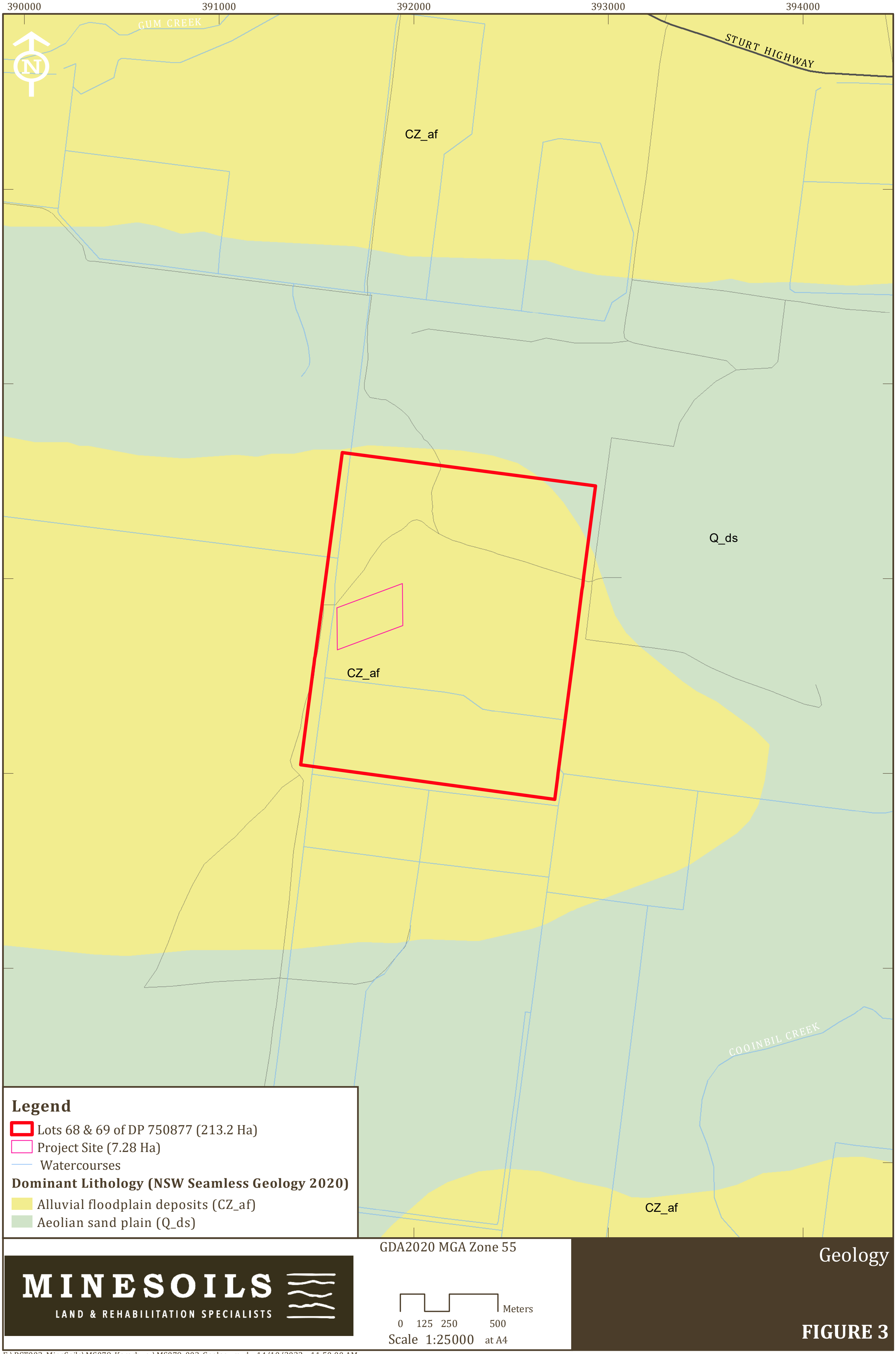
Table 2: Murrumbidgee LGA Agricultural Land Use (ABS, 2022)

Agricultural Land Use	Area	
	ha	%
Grazing	338,237	59.8
Cropping	226,116	40.0
Forestry	796	0.1
Other	472	0.1
Total	565,620	100.0

ABS data shows that livestock consist primarily of includes sheep and lambs, with both dairy and meat cattle. Pigs and poultry (chicken) represent a more limited agricultural land use by area. Lands used for cropping are dominated by cereals, including wheat, oats, barleys, sorghum, barley, rice, maize. Cotton, oilseeds (canola), legumes (lentils, lupins) and cropping for hay and sileage is also common.

Orchard fruit and nut trees are prevalent within the LGA but represent only 3 per cent of the total land used for cropping. ABS data indicates the main enterprises are mandarins, nectarines, oranges, cherries, peaches, olives, almonds and grapes for wine.

At a scale of the locality, common agricultural enterprises surrounding the Project site include almonds, citrus, grain, livestock grazing and poultry farms.



Geology

FIGURE 3

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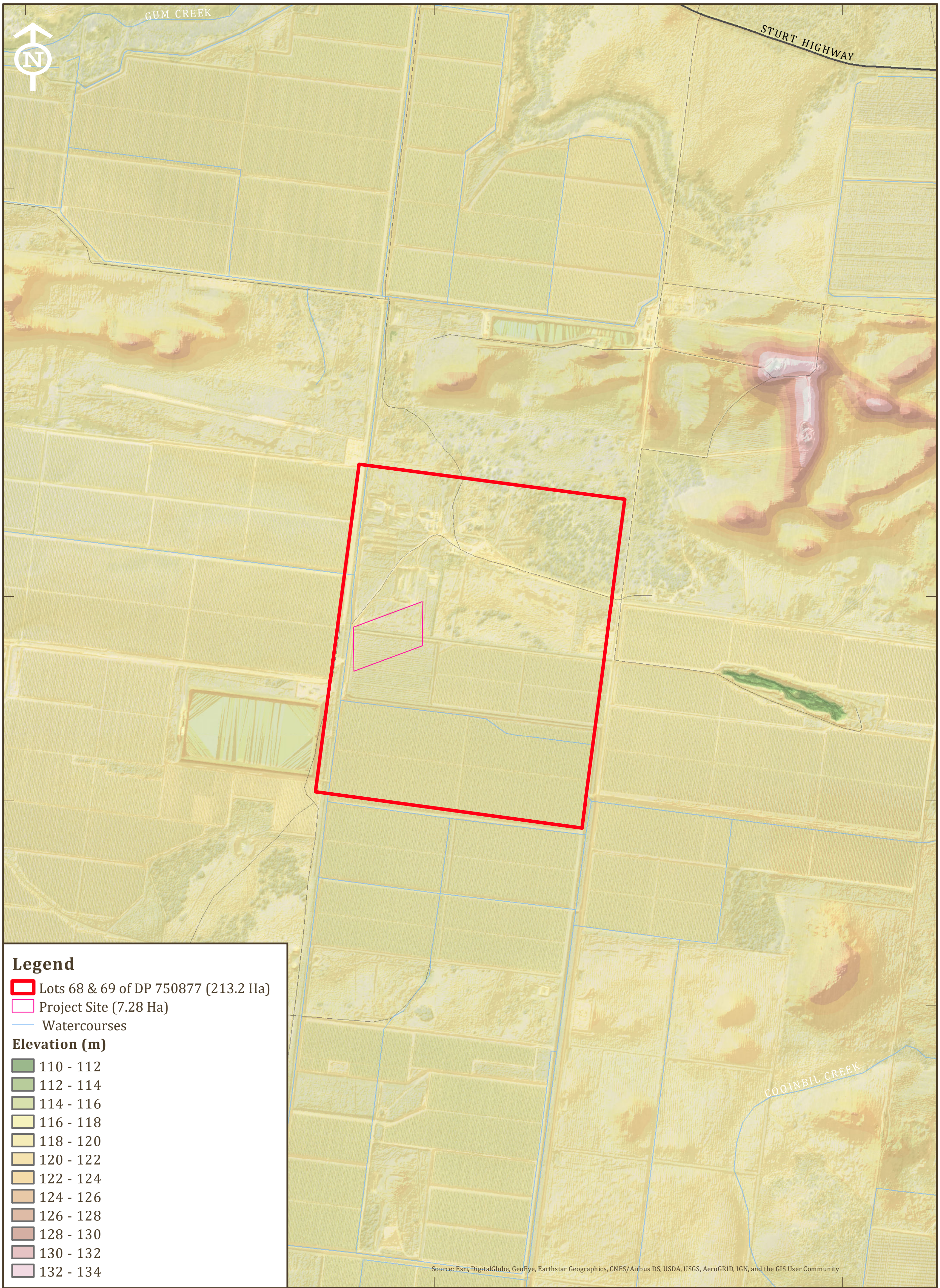

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Scale 1:25000 at A4

Topography

FIGURE 4

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3 PROJECT SITE CHARACTERISTICS

3.1 PROJECT SITE AND SURROUNDS

The Project site consists of land cleared for agricultural use, with native pastures established for grazing purposes (refer Plates 1 and 2). The land is not currently subject to agriculture. Farm improvements consist of access tracks and fencing which transect the Project sire between Lot 68 and Lot 69 of DPO 750877. There is no evidence of soil erosion or surficial degradation.

Plate 1: Project site within Lot 68 DP 750877

Plate 2: Project site within Lot 69 DP 750877

More broadly, the Project site lies within the Kerarbury Farm, and almond orchard covering over 2,500 ha and is leased to Olam Orchards Australia Pty Ltd. Kerabury Farm contains over 32 kilometres of pipe and fittings, including tees, sweep bends and stub flanges for the delivery of irrigated water through various suction lines. uses mechanical harvesting equipment such as tree shakers, mechanical sweepers and collectors, and stockpile conveyors.

Lot 68 of DPO 750877 is largely cleared for agricultural purposes, with some remnant native vegetation in the north east with the presence of shedding and a series of silos present (refer Plates 3 and 4). Lot 69 of DPO 750877 is more consistent with the general vicinity and larger Kerarbury Farm, which consist of an almond plantation and irrigation infrastructure (refer Plates 5 and 6).

Plate 3: Silos and shedding, Lot 68 DP 750877

Plate 4: Shedding and equipment, Lot 68 DP 750877

Plate 5: Irrigation channel adjacent almond plantation, Lot 69 DP 750877

Plate 6: Kerarbury Farm almond orchard (Source: Rural Funds Management, 2022)

Kerarbury Farm has previously been used for other irrigated crops such as cotton, citrus, grain crops and for the grazing of livestock.

3.2 SOIL AND LAND CAPABILITY

The following sections summarise the NSW Department of Planning, Industry and Environment (2022) published state-wide mapping of soil resources relating to the project site and Project locality.

Soil Types

Regional soil mapping shows soil units mapped to the Australian Soil Classification (Isbell, R. F., 2021) (refer **Figure 5**). The Project site is dominated by Vertosols, covering approximately 7 ha, with a small portion of Chromosols to the northern corner covering less than 0.5 ha.

Vertosols are soils characterised by a clay field texture or 35 per cent or more clay throughout the solum except for thin, surface crusty horizons 30 mm or less thick. Unless too moist, these soils have open cracks at some time in most years that are at least 5 mm wide and extend upward to the surface or to the base of any plough layer, peaty horizon, self-mulching horizon, or thin, surface crusty horizon, with slickensides and/or lenticular peds.

Chromosols are soils with a clear or abrupt textural B horizon and in which the major part of the upper 0.2 m of the B2t horizon (or the major part of the entire B2 horizon if it is less than 0.2 m thick) is not sodic and not strongly acid. Soils with strongly subplastic upper B2 horizons are also included even if they are sodic.

These soils unit are the most common in the wider Project locality. Rudosols are also mapped in the general Project locality, along with Dermosols, which are mapped in close association with the Murrumbidgee River (refer **Figure 5**).

Rudosols are defined as soils with negligible (rudimentary) pedologic organisation apart from (a) minimal development of an Al horizon or (b) the presence of less than 10% of B horizon material (including pedogenic carbonate) in fissures in the parent rock or saprolite. The soils are apedal or only weakly structured in the A1 horizon and show no pedological colour changes apart from the darkening of an A1 horizon. There is little or no texture or colour change with depth unless stratified or buried soils are present.

Dermosols are soils that have B2 horizons that have grade of pedality greater than weak throughout the major part of the horizon, and do not have clear or abrupt textural B horizon.

Soil Fertility

Regional mapping provides an estimation of the inherent fertility of soils in NSW. It uses the best available soils and natural resource mapping developed for the Land and Soil Capability (LSC) dataset. The mapping describes soil fertility in NSW according to a five-class system: Low (1), Moderately Low (2), Moderate (3), Moderately High (4), High (5).

The Project site contains soils with Moderate fertility (3). The surrounding Project locality contains areas of Low fertility (1) and Moderately High fertility (4) which is mapped in close association with the Murrumbidgee River (refer **Figure 5**)(refer **Figure 6**).

Land and Soil Capability

Land capability, as detailed in the OEH guideline *The Land and Soil Capability Assessment Scheme; Second approximation* (OEH 2013) (referred to as the LSC Guideline), is the inherent physical capacity of the land to sustain a range of land uses and management practices in the long term without degradation to soil, land, air and water resources. Failure to manage land in accordance with its capability risks degradation of resources both on- and off-site, leading to a decline in natural ecosystem values, agricultural productivity, and infrastructure functionality.

The scheme uses the biophysical features of the land and soil to derive detailed rating tables for a range of land and soil hazards. The scheme consists of eight classes, which classify the land based on the severity of long-term limitations. The LSC classes are described in **Table 3** and their definition has been based on two considerations:

- The biophysical features of the land to derive the LSC classes associated with various hazards.
- The management of the hazards including the level of inputs, expertise and investment required to manage the land sustainably.

The biophysical features of the land that are associated with various hazards are broadly soil, climate and landform, specifically noted as slope, landform position, acidity, salinity, drainage, rockiness; and climate. The eight hazards associated with these biophysical features that are assessed by the LSC scheme are:

1. Water erosion
2. Wind erosion
3. Soil structure decline
4. Soil acidification
5. Salinity
6. Water logging
7. Shallow soils and rockiness
8. Mass movement

Each hazard is assessed against set criteria tables, as described in the LSC Guideline, with each hazard ranked from 1 through to 8 with the overall ranking of the land determined by its most significant limitation.

Table 3: Land and Soil Capability Classification

Class	Land and Soil Capability
Land capable of a wide variety of land uses (cropping, grazing, horticulture, forestry, nature conservation)	
1	**Extremely high capability land**: Land has no limitations. No special land management practices required. Land capable of all rural land uses and land management practices.
2	**Very high capability land**: Land has slight limitations. These can be managed by readily available, easily implemented management practices. Land is capable of most land uses and land management practices, including intensive cropping with cultivation.
3	**High capability land**: Land has moderate limitations and is capable of sustaining high-impact land uses, such as cropping with cultivation, using more intensive, readily available and widely accepted management practices. However, careful management of limitations is required for cropping and intensive grazing to avoid land and environmental degradation.
Land capable of a variety of land uses (cropping with restricted cultivation, pasture cropping, grazing, some horticulture, forestry, nature conservation)	
4	**Moderate capability land**: Land has moderate to high limitations for high-impact land uses. Will restrict land management options for regular high-impact land uses such as cropping, high-intensity grazing and horticulture. These limitations can only be managed by specialised management practices with a high level of knowledge, expertise, inputs, investment and technology.
5	**Moderate–low capability land**: Land has high limitations for high-impact land uses. Will largely restrict land use to grazing, some horticulture (orchards), forestry and nature conservation. The limitations need to be carefully managed to prevent long-term degradation.
Land capable for a limited set of land uses (grazing, forestry and nature conservation, some horticulture)	
6	**Low capability land**: Land has very high limitations for high-impact land uses. Land use restricted to low-impact land uses such as grazing, forestry and nature conservation. Careful management of limitations is required to prevent severe land and environmental degradation.
Land generally incapable of agricultural land use (selective forestry and nature conservation)	
7	**Very low capability land**: Land has severe limitations that restrict most land uses and generally cannot be overcome. On-site and off-site impacts of land management practices can be extremely severe if limitations not managed. There should be minimal disturbance of native vegetation.
8	**Extremely low capability land**: Limitations are so severe that the land is incapable of sustaining any land use apart from nature conservation. There should be no disturbance of native vegetation.

Regional mapping indicates the Project site is dominated by LSC class 4 land (Moderate capability land), covering approximately 7 ha, with a very small portion of LSC class 6 (Low capability land) covering less than 0.5 ha (refer **Figure 7**). These LSC classes are consistent for the project locality, with the exception of the Murrumbidgee River landscape Dermosol mapping unit, which is mapped as LSC class 5 (Moderate–low capability land).

3.3 POTENTIAL AGRICULTURAL PRODUCTIVITY

Agricultural productivity of land is the value of an agriculture enterprise over a specific area for a specific duration. Given the Project site is not current subject to agricultural activity, the current agricultural productivity is \$0/ha/year.

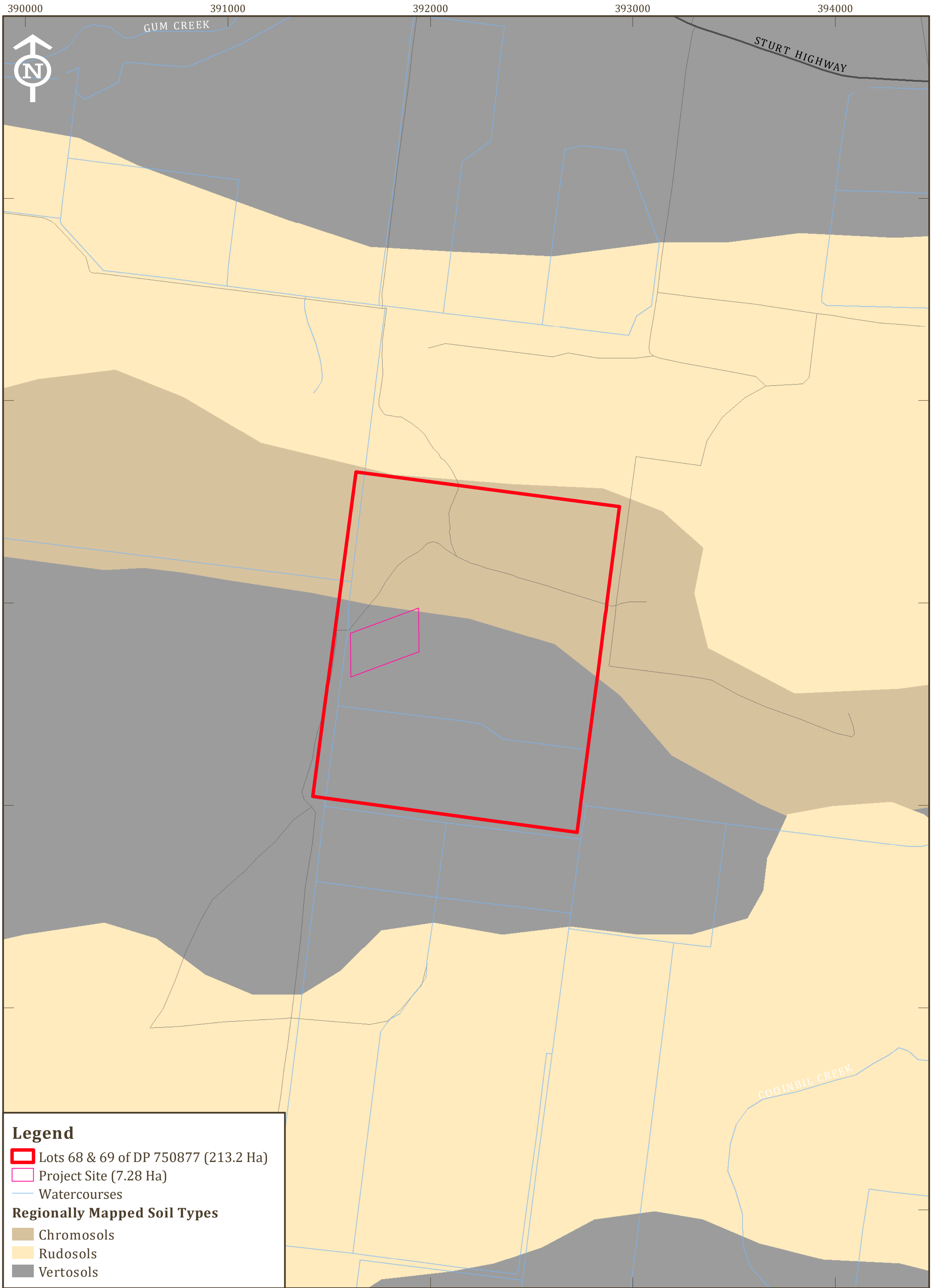
The potential production value of the Project site has been estimated based on current practice, site knowledge, average sales prices and the latest gross margin information by the NSW Department of Primary Industries (DPI)(2019). The agricultural enterprises modelled to determine potential agricultural productivity were chosen to reflect the spectrum from a low value enterprise to a high value enterprise, and include cattle grazing and almond horticulture. The estimated gross value of cattle is based on gross margins for inland weaners as published by DPI. The estimated value of almond horticulture is based on mature trees at a production rate of 3.2 metric tonne per ha with an average sales price of 5.60 USD, as advised by Olam.

The estimated productivity of the study area ranges from approximately $947.39 per annum based on a cattle grazing enterprise to $207,860.00 per annum based on an established almond horticulture enterprise, as outlined in **Table 4.**

Table 4: Estimated Potential Agricultural Productivity of Study Area

Enterprise	Estimated Gross Margin ($/ha/year)	Project Site (ha)	Gross Margin ($/year)
Inland weaners	129.78	7.3	947.39
Almond horticulture	28,474	7.3	207,860.00

Minesoils considers the estimated potential productivity of a cattle grazing enterprise to be most representative for the purpose of this assessment given the Project site's present status, location and characteristics, and initial capital inputs and establishment time required to achieve the almond horticulture production level as presented in **Table 4.** That is, cattle grazing is the most practical and readily implemented agriculture alternative to the solar farm.



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Regionally Mapped Soil Types

FIGURE 5

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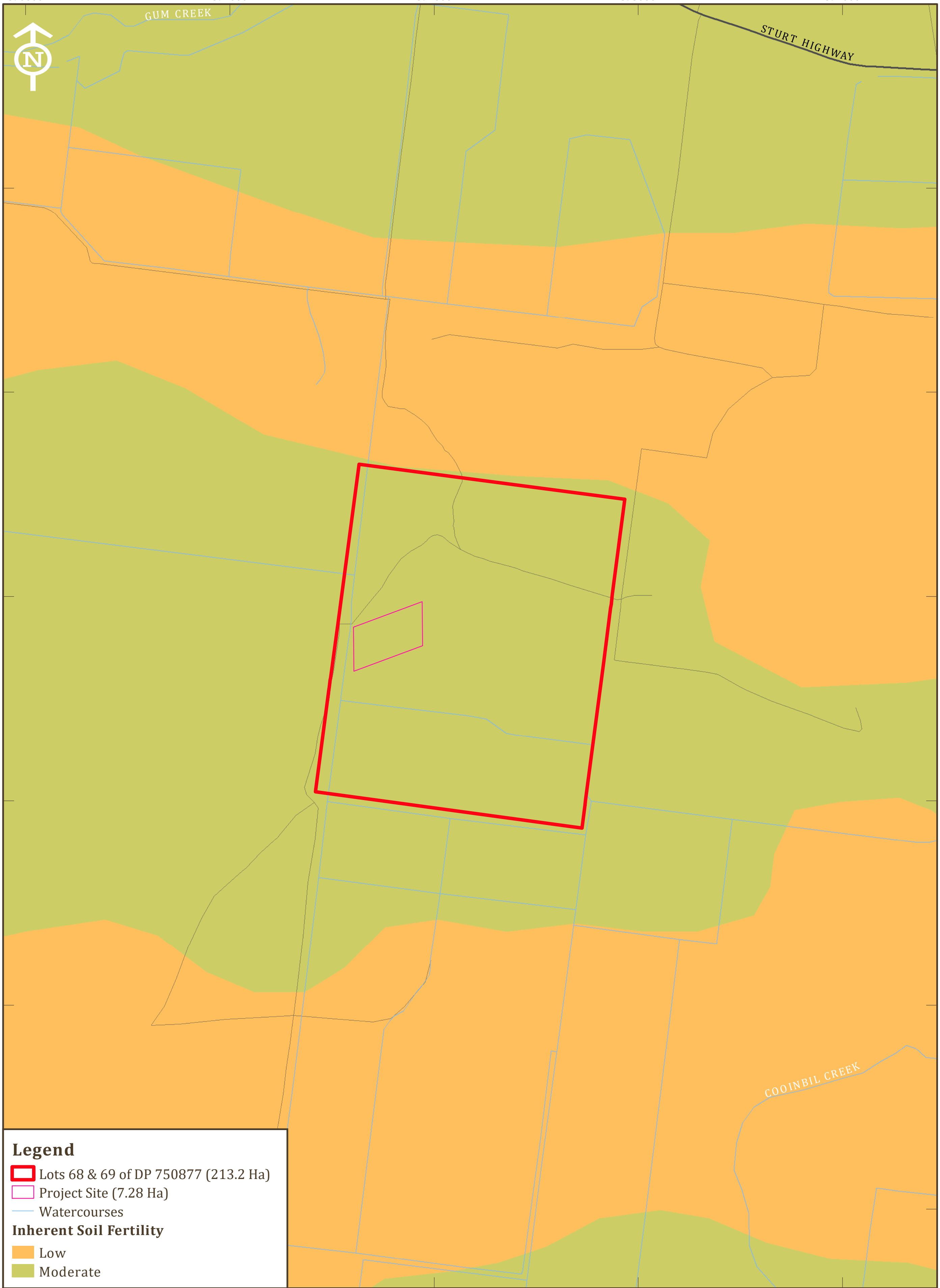

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Scale 1:25000 at A4

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Regionall Mapped
Inherent Soil Fertility

FIGURE 6

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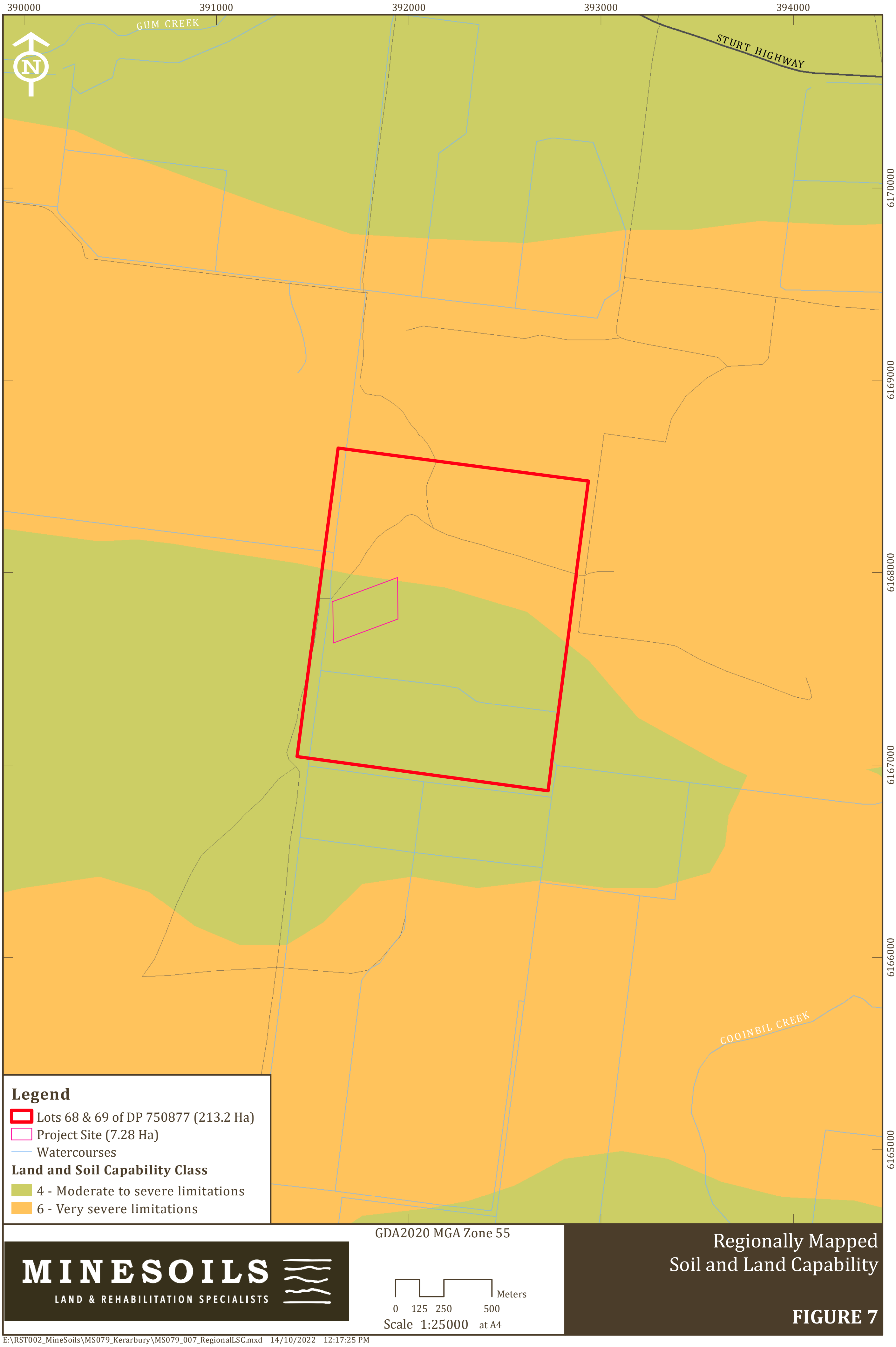

MINESOILS
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Regionally Mapped
Soil and Land Capability

FIGURE 7

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4 IMPACT ASSESSMENT

4.1 IMPACT OVERVIEW

There are a variety of potential impacts to be considered in relation to the construction and operation of solar farm projects. Temporary impacts can include the removal agriculture from service over a period of the life of the Project. Permanent impacts may include changes to land and soil capability and agricultural resources of the Project site. Permanent impacts are irreversible and compromise the reinstatement of agricultural lands and land productivity.

The following sections outline the potential and anticipated temporary and permanent impacts to agriculture as a result of the Project.

4.2 TEMPORARY IMPACTS

Agricultural Land Use

Temporary impacts of the Project will consist of the removal of 7.3 ha from agricultural service for the duration of the Project.

Current agricultural land use immediate to the Project site and in the broader Project locality will not be affected.

Agricultural Productivity

The Project will result in an estimated loss in agricultural productivity of $947.39 per annum based on a cattle grazing enterprise.

The Project will not compromise the capacity for immediate neighbours to continue primary production land uses at this locality. This means temporary impacts to agriculture are limited to the Project site.

Fragmentation or Displacement of Agricultural Industries

Agricultural industries within the Project locality and wider region will not be impacted by the Project as the associated agricultural resources, infrastructure, critical mass thresholds, and staff availability will not be affected.

Soil Resources

The Project will utilise the existing landform and not endeavour to undertake broad-scale re-contouring of the existing ground levels. As a result, the existing vegetative cover and soil structure will be maintained intact across much of the Project site.

All soil that is proposed to be disturbed during the Project will be stripped and stored for re-use in rehabilitation efforts in order to mitigate long term effects on soil resources. Given the limited surface disturbance and lack of a soil bank for the site, it is anticipated that all soil stripping and re-use will be localised; that is, soil will be respread from where it was stripped, reinstating the soil profile to its original condition. Additionally, soils will be stripped only in areas where soil disturbance occurs. The depth of soil salvaged will be as deep as excavations or surface disturbance is required, or to a depth where parent material is encountered.

The risk of erosion is considered to be low due to the topography of the Project site and as long as the project adopts measures as recommended in the Managing Urban Stormwater: Soils and Construction, volume 1, 4th edition (Landcom, 2014).

Land and Soil Classification

Due to the nature of the Project which will require only localised and sporadic landform modification including soil stripping (for excavation works and leveling), impacts on LSC are expected to be minor. However, for the purposes of assessing the impact to LSC, during the construction and operation phases of the Project, the LSC class within the Project site subject to surface disturbance will temporarily be reclassified to LSC class 8: not suitable for agriculture.

Following the end of life for the Project, disturbance areas will be re-graded where required and stockpiled soil will be placed over disturbed areas and rehabilitated according to the intended final land use. Therefore, any impacts on LSC classes within the Project site will be temporary, as land will be returned to original status following the life of the Project.

Water Resources

Sediment laden run-off from the site is expected to be minimal, given the Project site is relatively flat and is expected to be manageable through the adoption of erosion and sediment control measures during construction.

The risk of groundwater impacts during construction is also expected to be low as site levelling for the solar farm and substation foundations is expected to require excavation of no more than 0.40 – 0.60 m, and trenches for underground cables are expected to be 1.0 to 1.2 m deep.

There will be no changes to availability of surface or irrigation used by local landholders

Agriculture Support Services

Changes to the supply and viability of agricultural support services in Darlington Point and the wider region are generally driven by social and market trends far exceeding the scale of the Project site. There are no local industry support services or specialised agri-businesses that will be affected by the change in land use.

Pest Species and Biosecurity

Pest species could be inadvertently brought into the Project site with imported materials, machinery, or allowed to invade naturally through removal or damage of current vegetation. Ongoing management of the site and monitoring inspections will determine the requirement for weed or pest elimination as per a Pest Management Plan.

Standard procurement safeguards and quarantine procedures as per Australian requirements will control the potential impact on the biosecurity of agricultural resources and enterprises within the region.

Air Quality and Dust

Dust and air quality impacts expected to be negligible given the scale of the Project site and the immediate surrounding land use as orchards. Standard dust suppression measures during construction can be readily implemented as required.

Noise

The predicted noise levels associated with construction are considered a negligible impact on agricultural activities given the immediate surrounding land use as orchards.

4.3 PERMANENT IMPACTS

It is anticipated that by adopting the principles of impact avoidance and minimisation during Project construction and operation, and implementing effective decommissioning and rehabilitation at the end of Project life, the Project will have no permanent negative impacts on agricultural resources or enterprises (refer Section 5).

It is anticipated that the pre-existing land use will be re-established at the time of decommissioning, unless otherwise agreed with the landowner and/or regulatory authorities.

4.4 RISK ASSESSMENT

An assessment of the above potential risks to agriculture has been conducted in accordance with the Agricultural Impact Risk Ranking methodology described in the *Guideline for Agricultural Impact Statements technical notes*

(DTIRIS, 2013). Tables 5 and 6 list the probability and consequence descriptors that were used in the Agricultural Impact Risk Ranking. The level of risk was assessed according to the risk matrix presented in Table 7 (DTIRIS, 2014).

The outcomes of the risk assessment are presented in Table 8. The risk rating constitutes an impact assessment by taking into consideration the findings of this investigation, findings of technical studies and available management and mitigation options for each risk.

Table 5 Agricultural Impact Risk Ranking – Probability Descriptors

Level	Descriptor	Description
A	Almost Certain	Common or repeating occurrence.
B	Likely	Known to occur or it has happened.
C	Possible	Could occur or I've heard of it happening.
D	Unlikely	Could occur in some circumstances but not likely to occur.
E	Rare	Practically impossible or I've never heard of it happening.

Table 6 Agricultural Impact Risk Ranking – Consequence Descriptors

Level 1	Severe Consequences	Example of Implications
Description	• Severe and/or permanent damage to agricultural resources, or industries • Irreversible • Severe impact on the community	• Long-term (e.g. 20 years) damage to soil or water resources • Long-term impacts (e.g. 20 years) on a cluster of agricultural industries or important agricultural lands
Level 2	**Major Consequences**	**Example of Implications**
Description	• Significant and/or long-term impact to agricultural resources, or industries • Long-term management implications • Serious detrimental impact on the community	• Water or soil impacted, possibly in the long-term (e.g. 20 years) • Long-term (e.g. 20 years) displacement/serious impacts on agricultural industries
Level 3	**Moderate Consequences**	**Example of Implications**
Description	• Moderate and/or medium-term impact to agricultural resources, or industries • Some ongoing management implications • Minor damage or impacts but over the long- term	• Water or soil known to be affected, probably in the short to medium-term (e.g. 1-5 years) • Management could include significant change of management needed for agricultural enterprises to continue
Level 4	**Minor Consequences**	**Example of Implications**
Description	• Minor damage and/or short-term impact to agricultural resources, or industries • Can be effectively managed as part of normal operations	• Theoretically could affect the agricultural resource or industry in the short-term, but no impacts demonstrated • Minor erosion, compaction or water quality impacts that can be mitigated • For example, dust and noise impacts in a 12 month period on extensive grazing enterprises
Level 5	**Negligible Consequences**	**Example of Implications**
Description	• Very minor damage or impact to agricultural resources, or industries • Can be effectively managed as part of normal operation	• No measurable or identifiable impact on the agricultural resource or industry

Source: DTIRIS (2013)

Table 7 Agricultural Risk Ranking - Matrix

Consequence	A Almost Certain	B Likely	C Possible	D Unlikely	E Rarely
1. Severe and/or permanent damage. Irreversible impacts.	A1	B1	C1	D1	E1
2. Significant and/or long-term damage. Long-term management implications. Impacts difficult or impractical to reverse	A2	B2	C2	D2	E2
3. Moderate damage and/or medium-term impact to agricultural resources or industries. Some ongoing management implications, which may be expensive to implement. Minor damage or impacts over the long-term.	A3	B3	C3	D3	E3
4. Minor damage and/or short-term impact to agricultural resources or industries. Can be managed as part of routine operations.	A4	B4	C4	D4	E4
5. Very minor damage and minor impact to agricultural resources or industries. Can be managed as part of normal operations	A5	B5	C5	D5	E5

Source: DTIRIS (2013)

(red)	High Risk
(orange)	Medium Risk
(yellow)	Low Risk

Risk	Findings	Assessment		
		P	C	R
Reduction of land used for agricultural purposes	The Project will remove from service all land currently used for agricultural activities within the Project site during construction and operation, to be returned to agricultural activities following the life of the Project.	A	5	Low
Decrease in productivity of agricultural land	The Project will inhibit any agricultural productivity within the Project site during construction and operation. This has the potential to be to the value $947.39 per annum based on the potential for cattle grazing enterprise. The Project site will be returned to an equivalent agricultural productivity following the life of the Project	A	5	Low
Downgrading of LSC classes within the Project site	The Project site LSC will be downgraded to class 8 during construction and operation where surface disturbance occurs. All impacted lands will be returned to baseline LSC following the life of the Project.	A	5	Low
Impacts to existing agricultural enterprises in the Project locality	There will be no impact, permanent or temporary, direct or indirect, to agricultural enterprises outside the Project site as a result of the Project.	D	5	Low
Impacts to agricultural resources outside in the Project locality	There will be no impact, permanent or temporary, direct or indirect, to agricultural resources outside the Project site as a result of the Project.	D	5	Low
Impacts to soil resources	Soil disturbance mitigation measures (outlined Section 5) and erosion control measures will be utilised to control erosion risk and prevent soil resource loss and sedimentation of streams.	C	4	Low
Changes to site run-off and groundwater water quality	Surface run-off will be managed by erosion and sediment controls. Interaction with groundwater is not anticipated.	D	5	Low
Changes to availability of irrigation or surface water used by local landholders	There will be no changes to availability of irrigation or surface water used by local landholders	E	5	Low
Impacts to agricultural support infrastructure in the Project locality and wider region	There will be no impact, permanent or temporary, direct or indirect, to agricultural infrastructure in the Project Locality or wider region as a result of the Project.	E	5	Low
Impacts on agricultural support services	Due to the limited scale of current agricultural enterprises within the Project site, impacts on agricultural support services are estimated to be negligible (and will be outweighed by the economic benefits of the Project).	E	5	Low
Proliferation of pest species	Ongoing monitoring inspections will determine the requirement for weed elimination.	C	4	Low
Introduction of biosecurity threat to agricultural enterprises	Standard procurement safeguards and quarantine procedures as per Australian requirements will control the potential impact on the biosecurity of agricultural resources and enterprises within the region.	C	4	Low

Risk	Findings	Assessment		
		P	C	R
Changes to air quality and dust in Project locality	Dust and air quality impacts are unlikely to be significant and standard dust suppression measures can be readily implemented.	D	5	Low
Increase in noise levels	The predicted noise levels are considered negligible impact on agricultural activities.	D	5	Low

The risk assessment outcomes presented above indicate the likelihood of several risks as almost certain, however due to the scale of the Project and the very minor damage and minor impact to agricultural resources or industries (that is, the consequence) the assessment results in a risk score of low.

5 MITIGATION MEASURES

The Program will include a number of measures to prevent, minimise and manage adverse impacts on agricultural resources. This incorporates procedural mitigation measures along with a land management process that ensures the Project has negligible impact on agricultural resources and enterprise.

In addition to the specific measures described in this assessment, all activities associated with the Project will be conducted in consideration of Olam obligations and environmental management measures in site specific environmental management plans.

5.1 PROJECT ALTERNATIVES AND DESIGN

Olam has reviewed the solar generation potential of several locations within the Kerarbury Farm site using a combination of computer modelling and analysis, on the ground surveying and observation, and on site experience The Project site was selected because it provides the optimal combination of:

- Low environmental constraints (predominantly cleared land not subject to plantation);
- Relatively level terrain for cost-effective construction;
- Proximity to site infrastructure and equipment;
- Distance from neighbouring properties;
- Acceptable flood risk; and
- Road access from multiple points.

Photovoltaic solar technology was chosen because it is cost effective, low profile, durable and flexible regarding layout and siting. It is a proven and mature technology that is readily available for deployment at the site.

Not proceeding with the proposal would forgo the benefits of the proposal, resulting in the loss of a source of renewable energy that would assist operations at Kerabury Farm, and the loss of cleaner energy and reduced greenhouse gas emission. Further, and more broadly, these types are Projects assist the Australian and NSW Governments to reach their renewable targets.

5.2 SOIL IMPACT MITIGATION

The following measures may be taken to limit the impacts on soil resources.

- As installation of solar panels proceeds across the site, disturbed surfaces in construction areas should be sewn with grass and pasture species with starter fertiliser to provide stabilising ground cover and a healthy topsoil to provide long term protection against erosion.
- At locations where earthworks are necessary, such as for construction of BESS pad, or site facilities, localised erosion and sediment controls will be placed in accordance with the Landcom (2014) guidelines.
- Proposed long term stockpiles in areas associated with the higher impact activities where large amounts of soil will be displaced should be stripped of topsoil. Then the excavated subsoil (if requiring disturbance) should be placed on the exposed subsoil of the stockpile area to create a low-profile landform of subsoil. A thin layer of topsoil material from the stripped areas should be placed as a 'cap' over the subsoil stockpiles to promote vegetation growth. Topsoil materials should otherwise be stockpiled separately to subsoils.
- Strip soil material to maximum excavation depths only.
- Soil should ideally be stripped in a slightly moist condition. Material should not be stripped in either an excessively dry or wet condition.
- Preservation and stabilisation of drainageways and minimisation of the extent and duration of any surface disturbance will be prioritised during construction.

- Soil disturbance during operation of the Project should be minimal and limited to maintenance activities, involving very small, localised disturbance areas on an infrequent basis.
- Standard erosion and sediment control measures should be implemented to minimise the potential for sediment export within areas to be disturbed during operations. These measures would be developed on a case-by-case basis and are likely to include measures such as sediment fencing, localised sediment traps, and progressive stabilisation with vegetation.
- During operation, mounted solar panels should change orientation during the day, with any rainfall runoff being distributed in the area around each panel, and not drained permanently to a single point on the ground.
- A detailed decommissioning and rehabilitation plan should be prepared within 5 years of the planned closure of the Project. This plan will detail all aspects of decommissioning and removal of all infrastructure unwanted for post Project land use (some infrastructure may remain for post Project land use purposes i.e., constructed internal roads may be kept as part of the agricultural infrastructure), which may require temporary erosion and sediment control measures.

5.3 MONITORING PROGRAMS

Monitoring programs are instituted to assess predicted verses actual impacts as the Project progresses. Olam continually monitors environmental performance and legislative compliance of the existing operations. Key management plans that will assist in managing impacts on agricultural land as a result of the Project include:

- Erosion and Sediment Control Plan;
- Weed and Pest Management Plan; and
- Rehabilitation Plan.

These management plans will be reviewed and revised where necessary to incorporate the requirements associated with the Project prior to commencement. A key component of this revision will be the development of trigger levels and Trigger Response Action Plans. The monitoring programs and trigger points listed in Table 9 below will form the basis in this regard.

Table 9: Monitoring Program and Trigger Responses

Risk	Monitoring/Inspections	Trigger Points	Trigger Response
Erosion and Sedimentation	Success of erosion and sediment controls	Evidence of, or the potential for, erosion and sedimentation	Implement additional erosion and sediment control measures and rectify instances of soil resource loss.
Weed spread	Success of weed species elimination	Evidence of potential weed infestations	Elimination of target weeds
Rehabilitation	Rehabilitation success criteria including return of land to agricultural use/ productivity	Failure to meet rehabilitation objectives	Review strategy and implement controls to rectify failure

6 CONSULTATION

Consultation was carried with a range of stakeholder groups and individual stakeholders in the scoping of the Project. These include regulators who have a decision-making role in project approvals, and groups or individuals who may be directly or indirectly affected by the Project. Consultation has included formal and informal engagement with Murrumbidgee Council, neighbouring property owners and the local community.

Direct consultation to inform the AIS was undertaken with the Kerarbury Farm management team regarding current and historical management of land and agricultural practices on the Project site and its surrounds, effects on local industry support services and agribusinesses, and employment reliant on the agricultural enterprises on the Project site.

7 ASSESSMENT CERTAINTY AND SUMMARY

There is a high level of certainty about the status of agricultural resources and enterprises in the Project site, locality and broader region, based on site evidence provided, consultation undertaken and desktop studies carried out. Further, there is a high level of confidence regarding the Project activities, surface disturbance requirements and commitments to rehabilitation to pre-disturbance agricultural status.

Based on these factors, the impacts on agriculture as a result of the Project are determined to be minimal, temporary, and limited to the Project site. These impacts can be summarised as the following:

- Temporary removal of 7.3 ha from agricultural service within the Project site;
- Temporary removal of potential agricultural productivity to the estimated value of $947.39 per annum (based on a cattle grazing enterprise) per year of Project life;
- Temporary impacts on soil resources within the Project site; and
- Temporary reduction in LSC class within the Project site where surface disturbance occurs.

There will be no impact, permanent or temporary, direct or indirect, to agricultural resources or enterprises outside of the Project site as a result of the Project.

8 REFERENCES

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APPENDIX J EVIDENCE OF STAKEHOLDER CONSULTATION

Name / Company Name	Relationship to OFI	Address	Email Address	Key Contact Person	Key Phone Number	Emailed Info Sheet	Any feedback from infosheet via email	Followup Phone Conversation Date and Notes
[redacted]	Neighbour	PO Box 640, Mawson, ACT, 2607	[redacted]	[redacted]	[redacted]	4/11/2022	Nil	10/11 - went through to voicemail. Left message. 11/11 - [redacted] returned call. Left a voicemail stating [redacted] had received the project summary and had no objections or concerns. Stated no need for return call.
[redacted]	Neighbour	16343 Sturt Highway, Darlington P [redacted]	[redacted]	[redacted]	[redacted]	4/11/2022	NIl	10/11 - 11.15AM spoke with [redacted] . Confirmed [redacted] recived the email.No objections interested in understanding how [redacted] operation can implement same type of development.
[redacted]	Neighbour	16860 Sturt Highway Darlington Po [redacted]	[redacted]	[redacted]	[redacted]	4/11/2022	Nil	10/11 - 2.10PM spoke with [redacted] via Phone. Confirmed he received the email. Raised no queries on the phone call.
[redacted]	Neighbour	TBC	[redacted]	[redacted]	[redacted]	4/11/2022	Nil	10/11 - went through to voicemail. Left message. 11/11 - 1.30pm, spoke with [redacted] confirmed received email.
[redacted]	Neighbour	Neighbour to east.	[redacted]	[redacted]	[redacted]	4/11/2022	Nil	10/11 - 2.20PM spoke with [redacted] via phone. Raised a query about why so much stakeholder engagement for the size of project. Intends to review DA when submitted.

Kerarbury Almond orchard renewable energy system
Stakeholder information sheet

Version: 1.1 dated 02/11/2022

AGL are partnering with OFI (formerly Olam) which will see the orchard using the sun to power irrigation on OFI's Kerarbury Almond Orchard. The project comprises a 8 hectare (6 MW) solar array and 4.3 MWh battery and will product up to 12,000 MWh of solar generation annually. Excess energy will be exported through the local grid.

The project will be built in the middle of the existing 2,500 hectare orchard (along the Sturt Highway approximately 18km west of Darlington Point) and connected to the grid via the orchard's existing high voltage essential energy connection.

This information sheet has been written to raise awareness of the project in the Darlington Point area, prior to our submission of a development application to the Murrumbidgee Council during November 2022. The project is expected to be constructed in the mid next year – ready for the summer of 2023/4.

Please contact AGL using the details below if you have any questions or comments.

Project Q & A

Who is building the project?

AGL is building this project for OFI – one of the world's largest Almond growers. This solution is an example of how AGL is providing more energy certainty for the needs of our primary industries, especially for high energy intensive organisations within a difficult to abate sector like agribusiness.

The construction period is expected to be between April through to August 2023.

Will the project be visible from my farm?

No. The project will be entirely contained in the middle of the Kerarbury Orchard and will not be visible from any points outside the orchard's boundaries.

A glare study was conducted as part of the development application and will be submitted with the development application.

Will the project affect the local electricity supply?

AGL will be engaging with the local electricity distributor, Essential Energy to ensure that that the connection is approved by Essential Energy and any consideration for the local supply are addressed prior to construction.

Will this project impact productive land available for local farmers?

This project is being developed on 8 HA of orchard that is not suitable for orchard trees. As part of the Development Assessment an Agricultural Assessment is being conducted and will be submitted for review by the local council.

Will the project create jobs?

Yes. We expect up to forty people will be involved in the construction of the project.

Will the project create be noise, dust, or road issues for residents?

No. Given the location of the project in the middle of the orchard, it's expected that any construction noise and dust will be contained within the orchard. Construction periods will be constrained within hours advised within the development application.

The project is expected to require delivery of up to 50 shipping containers of equipment involving some additional truck traffic over a period of 3-4 months. A traffic assessment has been conducted and will be submitted with the Development Application to the local council.

What is the project timeline?

The external approvals for the project through Murrumbidgee Council and Essential Energy are ongoing and will continue from Nov22 through to Mar 23. Following completion of external approval processes construction will commence around April 23 and continue for 5-6 months as weather permits. Following construction and commissioning the solar and BESS system is expected to operate for 15 years.

AGL Contact for Enquiries:

Name/role:	*[Luke Koedijk, Senior Manager Delivery]*
Email:	*[LKOEDIJK@AGL.COM.AU]*
Phone No:	*[0499 000 463]*

Media:

https://www.agl.com.au/about-agl/media-centre/asx-and-media-releases/2022/march/agl-to-power-riverina-almonds-with-renewable-energy

https://www.areanews.com.au/story/7664078/partnership-to-see-almonds-grown-by-the-sun/

APPENDIX K CONSTRUCTION MANAGEMENT PLAN

CONSTRUCTION MANAGEMENT PLAN

Project Name: Kerarbury Solar Farm

Document Number: KER-CM-ACLE-PLN-001

Document Approval

Development	
Document Contact Officer	Rafal Janiczak
Approved By	Arsalan Usmani
Position	Project Manager
Date	21/10/22

Document Register

Document Detail	
Document Name	Construction Management Plan
Document Number	KER-CM-ACLE-PLN-001
Control Status	Preliminary Plan

Revision History

Version	Date	Author	Reviewed by	Change Description
A	21/10/22	RJ	AU	First Draft
B	25/10/22	RJ	AU	Changes based on AGL comments

CONTENTS

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Figures

1 DEFINITIONS AND ABBREVIATIONS

Abbreviation	Description
AC	Alternating Current
CCTV	Closed Circuit Television
CEMP	Construction Environmental Management Plan
Council	Murrumbidgee Council
DC	Direct Current
EPC	Engineer, Procure & Construct
HSE	Health Safety and Environment
HV	High Voltage
ITP	Inspection and Test Plan
JSA	Job Safety Assessment
PPE	Personal Protective Equipment
PQMP	Project Quality Management Plan
QA	Quality Assurance
SWMS	Safe Work Method Statements
UHF	Ultra-High Frequency

Table 1: Abbreviations

2 Introduction

2.1 Purpose

The Construction Management Plan defines the standard processes and obligations that must be adhered to ensure the project is controlled efficiently. It is not intended to be rigid in its reading but is flexible and open to development with the project team and further development as the project traverses various phases of project development and construction.

This plan is intended to demonstrate commitment to the project and to identify the key issues to be managed to ensure our client, local and statutory requirements, regulations and standards are followed ensuring a quality product is achieved in a safe and timely manner

2.2 Scope

The proposed scope of works is to be executed at 16705 Sturt Hwy, Darlington Point, NSW 2706. The scope of works are as follows:

Project Objectives	Delivery of a 6 MWP single axis tracker solar project
Timeframe	March 2023 to September 2023
Project Location	16705 Sturt Hwy, Darlington Point, NSW 2706
Key Stakeholders	Olam Food Ingredient (Site Lessee) Rural Funds Management (Land Owner) AGL Energy (Solar and Storage Owner)
Project Scope	Site earthworks (up to 10 Hectares). Installation of security chain mesh fence and swing entrance gates Construction of road and crossing for access track, carpark, unloading area & site access Landscaping – plant as per the design drawings Drainage and stormwater installation as per the design Install single-axis trackers for PV solar panels Installation of all PV solar panel Installation of a central inverter station Installation of the BESS stations Installation of all required cable and cable tray Installation of an HV switchgear Kiosk
Grid connection works	Essential Energy and its accredited HV contractor shall connect to the existing 33kV line to the HV kiosk within the solar farm. After the installation, Essential Energy and Project team will conduct an inspection and perform the HV energisation.

Table 2: Scope

2.3 Project Overview

The site layout can be found in Appendix B: Design Drawings which includes:

- Overall PV array block layout and dimension
- The solar panel and mounting system layout and elevation,
- Central inverter layout and elevation,
- Essential Energy pole layout and elevation,
- The access road layout,
- The site fence layout
- The setback from the nearby residential building

2.4 Management Plans

The table below lists the project related management plans developed for the Project.

Project Quality, Workplace Health and Safety, Traffic, Fire and Emergency and Construction Environmental Management Plan will detail the information that has been specifically adapted in the Construction Management Plan to suit the requirements of this project.

The management plans shall be reviewed and revised as required throughout the project as materials, installation, delivery methods and other requirements are further refined.

Project Quality Management Plan	The purpose of this Project Quality Management Plan (PQMP) is to provide guidelines and direction to all Project personnel, in relation to the requirements of the Project Owner contract.
Work Health and Safety Management Plan	This plan's purpose is to provide Project personnel and sub-contractors direction on the management of work health & safety hazards and associated risks and provide all personnel with the awareness of the controls that apply to the daily activities associated with this project. Project Management has a responsibility and is accountable for providing the quality process, practices, structure, equipment, education, information, instruction, training and supervision, such that our employees & sub-contractors are free from the risk of a workplace injury or illness. The WHSEMP will detail the requirements and controls to ensure the project is meeting its obligations under the Work Health and Safety Act 2011 (NSW) and associated Regulations.
Construction Environmental Management Plan	The purpose of the Construction Environmental Management Plan (CEMP) is to define the essential requirements of environmental management in order to assure control of impacts arising in, from, or because of, the activities of Project and all its related subsidiaries.
Traffic Management Plan	The purpose of the Traffic Management Plan (TMP) is to outline the proposed development and the existing conditions around the subject site including a review of the adjoining roads. The TMP will also detail the proposed construction

	methodology, specifically the movement and volume of heavy vehicles to and from the subject site. The TMP will also detail any traffic and parking considerations as a result of the construction, operation and decommissioning of the subject site.
Fire and Emergency Management Plan	The Fire and Emergency Management Plan (FEMP) establishes a framework for managing emergency scenarios, conducting evacuations (including drills) and preventing and managing bushfire risks during the construction and operational phases of the Project.
Dilapidation report	The dilapidation report is to be drafted before and after the construction of the solar farm to survey the council roads where the heavy vehicle movement route is expected to go through. The report before the construction will provide the condition of the council's roads and the report after the construction will provide an overview of any damage that happened to the roads because of heavy vehicle movement. The Project will be repairing the road as per the report with the procedures that are reviewed and approved by the council.
Commissioning Plan	The Commissioning Plan serves to encompass all aspects of the commissioning process for the Project and includes references to relevant documentation. The completion and commissioning plan will function as the recorded document that assures the equipment and systems installed during the construction process have been inspected for compliance with the specifications and drawings, in accordance with manufacturers' requirements, design criteria and made ready for operation.
Decommissioning Plan	The Decommissioning Plan provides a description of the decommissioning and restoration of the Project. It includes an overview of the primary decommissioning Project activities; dismantling and removal of facilities, and restoration of the land.

Table 3: Management Plans

3 Project Organisation and Responsibilities

3.1 Construction Contacts

During construction, the Project Manager will be the key Client and Stakeholder interface for the construction team. During times that the Project Manager is not available on site, the Construction Manager will be the authorised representative to act as the Client / Stakeholder interface and the site management team.

Role	Responsible Person	Phone number	Email Address
Project Leader	TBD		
Project Manager	TBD		
Construction Manager	TBD		
Health and Safety Manager	TBD		

Table 4: Contact details

There will be a total of up to 50 people working onsite at the same time.

3.2 Key Personnel

The Project team identified on the organisation chart in the Project Quality Management Plan will be responsible for the delivery of the works in accordance with the scope and project schedule. The organisation structure is designed to provide focal contact points for the management of sub-contractors and direct labour. The Organisation chart can be found in Appendix A.

Project Leader oversees multiple projects and takes over the responsibilities for an individual project in absence of the Project Manager.

3.2.1 Project manager

- Demonstrate proactive support for environmental requirements, including ensuring sufficient resourcing for the Environmental Team, Engineering and Construction Teams;
- On-site project management and control;
- Decision-making authority relating to the performance of the construction program;
- Report on project's performance and ensure potential risks are minimised;
- Authority over project construction and site activities in accordance with the CMP;
- Ensure relevant training is provided to all project staff prior to commencing individual activities.
- Ensures appropriate contractor resources are allocated;
- Orders STOP WORK for any environmental breaches and reports incidents;

3.2.2 Construction manager

- Responsible for planning and scheduling of construction, and ensuring operations are conducted in accordance with statutory requirements and the CMP;
- Ensures that all objectives associated with the Project are achieved.
- Day-to-day decision-making authority relating to performance of construction activities and direct site activities and construction in accordance with the CMP;
- To provide resources to ensure compliance and continuous improvement;
- Ensure all personnel are aware of any changes to CMP and improved procedures.

3.2.3 Project Engineer / Site Engineer

- Assist together with the Project Manager and Construction Manager to complete the Project in accordance with the Contract documentation and Company standards and procedures;
- Monitor and update Project schedule for Proponent and reporting;
- Identify schedule performance indicators and monitor progress;
- Identify and propose value engineering opportunities;
- Assist the Project Manager in assessing sub-contractor progress claims;
- Assist the Project Manager in presenting monthly progress claims to the Proponent;
- Ensure project drawings and specifications are controlled and that obsolete copies are withdrawn;
- Refer to the Project specific HSEQ Management Plans for specific role responsibilities associated with these functional areas.

3.2.4 Health, Safety and Environmental (HSE) Manager

- Provides HSE advice, assistance and direction to the project manager to ensure construction activities are conducted in accordance with regulatory legislation and CMP;
- Reports on the performance of the CMP. Recommend changes or improvements to the project manager;
- Co-ordinates internal audits of the CMP;
- Ensures that HSE measures are effectively implemented and monitored for the whole of the project;
- Develop strong working relationships with regulatory agencies and stakeholders;
- Collate all documents which are required to be kept under approval conditions;
- Identify and propose solutions to HSE issues in consultation with key construction personnel;
- Ensure HSE risks are appropriately identified, communicated and effectively managed;
- The HSE can order Stop Work for any HSE breaches
- Manage specialist HSE sub-consultants;
- Instruct and advise the management team on compliance issues, with the power to cease work to prevent non-compliance and environmental harm;
- Ensure construction manager, superintendents and field supervisors fully understand the environmental constraints and how construction practices must ensure any such constraints are considered and mitigated during construction;
- Have input to design development to ensure that all applicable environmental mitigation measures are incorporated into the design.

3.2.5 Superintendent/ Supervisor

- Organisation of personnel inductions, gaining of work, access, and permit systems as necessary for safety.
- Develop and review construction planning and monitor progress to ensure it is on schedule and within quality and cost estimates;
- Assume responsibilities for the quality and efficiency of work on the Project;
- Provide solutions/corrective actions/disposition;
- Control processes pending corrective actions;
- Supervise and schedule the activities of staff to ensure coordination of the construction process;
- Recommend then engage subcontractors and co-ordinate and control their activities;
- Develop and monitor short range and medium range programmes for the Project;
- Liaise with Team leaders to ensure construction efficiency;
- The planning and monitoring of job progress;
- Refer to the Project specific HSEQ Plans for specific role responsibilities associated with these functional areas. Train, supervise and lead subordinate personnel; and
- Observance of Proponents procedures.

3.2.6 Subcontractors

Most of the construction works will be undertaken by project in-house resources, however, there will be two activities performed by our preferred subcontractors on-site:

- HV contractor
- Fencing contractor

The nominated fencing contractor will be working on the fencing works as per the council endorsed fencing drawings. They will follow environmental and health & safety requirements whilst working on site. The project will also allocate an experienced supervisor on-site to ensure they apply the same level of diligence and compliance in relation to health and safety and environmental management plan.

The volume of the HV works onsite would be minimal due to the scale of the project. The HV contractor will be accompanied by work crew on-site ensuring they work in a safe manner.

3.2.7 All Site Personnel

The responsibilities of all the personnel inducted to the site are as follows:

- Follow required procedures; communicated during inductions, training, prestart meetings and site meetings.
- Report all health, safety and environmental incidents and hazards to the supervisor and/or health and safety manager; and
- Participate in training as required before starting a particular task and when changing from one task to another task.

4 Risk Management

4.1 Project HSE Risk and the HSE Risk Register

Risk identification is carried out throughout the project lifecycle, all identified risks are captured in the Project Risk Register.

During construction HSE risk assessments will be conducted against the relevant documented construction methodologies. Any newly identified risks and associated controls will be added to the Risk Register.

Construction HSE risk workshop should be held with the Client in attendance to comprehensively address site HSE risks.

Risks associated with any specific work activity will be managed as part of a Job Safety Assessment (JSA), Safe Work Method Statements (SWMS) and Task Risk Assessment (TRA).

Further detail is available in the Workplace Health and Safety Management Plan.

4.2 Site Health Safety and Environmental Risk

These risks will be closely governed throughout construction. Key areas of focus shall include but not be limited to:

- Fitness for work
- Fatigue management
- Confined spaces (If required)
- Working at heights
- Excavation and concealed services
- Equipment Operation
- Electric hazard
- Oil spill
- Bushfire
- Housekeeping

Managing risk at the construction site is further elaborated in the Site-specific health and safety management plan and the controls implemented in the SWMS that will be used to manage the health and safety risk.

5 Project Execution

5.1 Overview

The proposed site can be accessed through the Sturt Highway shown in Appendix B. The laydown area will be located within the security fence and will be the drop-off point for all equipment delivery during construction and also all daily management activities during the operational life of the project.

The site plan in Appendix B shows the site layout, including associated building works and laydown area, existing roads, proposed access roads, parking areas, existing and indicative landscaping and setbacks from boundaries including fire breaks, security fencing and perimeter roads.

The maximum height of the solar panel rows that are located across the site will be approximately 2.6 m.

The plant will connect to the local electricity distribution system.

5.2 Pre Mobilisation Planning

Following project award and prior to mobilisation a review of all relevant project deliverables and approvals will be carried out by the project management team. This will include some of the management plans

5.2.1 Document Review

The Project Management Team shall review all project documentation required to fully gain an understanding of the project requirements.

Specific attention shall be given to the following client issued documents:

Document	Requirement
Executed Contract	Agreed commercial conditions concerning the execution of the project are known and fully understood.
Development Approval	Conditions set out by the Council for the development of the solar farm are known and fully understood.
Lease Agreement	Conditions set out in the lease agreement are known and fully understood. Any doubt needs to be clarified with the Project Owner.
Connection Agreement	All conditions set out in the connection agreement by Project must be known and fully understood in design, during commissioning and when connecting to the grid.
Scope of Work	Work requirements are fully understood and any uncertainty is to be clarified with the client.
Project Specifications	Project specific requirements are understood and how Project shall meet or exceed these requirements is to be planned.
Construction Schedule	Project personnel to be aware of access dates, critical milestones and completion dates.

Document	Requirement
Drawings	Review of project details and what associated work is required in areas. Identify what drawings are required to be issued Approved for Construction.
Project Deliverables	To allow an understanding of what deliverables exist for the project and when they are required

Table 5: Document Review

5.3 Approvals

Council Approval and other legislative approval need to be in place for the construction to proceed.

5.4 Design

The design process is managed through the document management system called Dash pivot. The site personnel access the drawings and any change in the drawing is also managed through Dash pivot request for information that addresses to the design engineer.

All the design stages including 30%, 80%, IFC drawing and on completion of the construction As-built drawing will be provided to the client through the Dropbox/SharePoint link.

Further design management details are provided in the Quality management plan (QMP).

5.5 Procurement

All critical procurement activities are detailed on the construction schedule and are linked to applicable construction activities. Procurement and expediting activities shall be closely monitored to ensure construction activities are not impacted and the project's critical path is not affected.

5.5.1 Supplied Material

The Project Manager and site team will utilise the detailed construction material take off, specifications, standards, the scope of work and other relevant information to ensure all materials and equipment comply prior to purchase and dispatch to the site.

All long lead items have been included in the construction schedule and must be procured in line with or better than the target dates to ensure critical activities are not impacted.

5.6 Quality

The project operates a Management System comprising a full suite of policies, procedures, work instructions, standard forms and checklists which complies with Australian and International Standards (ISO:9000) for managing the procedural aspects of our work.

It is the responsibility of the Project Manager and site team to ensure that the project complies with all relevant specifications and scopes of work.

The Project Quality Manager must ensure the project is complete and fit for purpose, including inspection and correction, prior to handover and acceptance by the client.

5.6.1 Standards and Regulations

The required standards and regulations have been identified and obtained during the planning stage if not already at the tender and/or contract review stage. Throughout the course of the work, issues relating to standards and regulations should be reviewed by the project team.

5.7 Project Controls

5.7.1 Construction Schedule

Project team will produce a detailed Construction Schedule optimising the sequence of the works. In order to successfully execute this project, Project team believes that success depends upon adequate and detailed planning. Project team also endeavours to achieve detailed planning by ensuring communication is established and maintained between all major stakeholders that exist within the boundaries that affect the project delivery.

Project team personnel in all instances shall work to a detailed work plan or construction schedule to which we request the client approve and accepts in consultation with our project management team.

Stage	Activities	Time Frame (Approximate)
Pre-Mobilisation	Site Fencing	2 Weeks
	Removal of vegetation for site access	1 Week
	Site preparation including minor earthworks	1 Week
	Laydown of temporary offices and facilities	2 Weeks
	Provision of water supply for fire suppression/safety purposes	2 days
Construction	Provision of water supply	2 days
	Site road construction	4 Weeks
	Piles driving	4 Weeks
	Trenching and underground cable install	8 Weeks
	Installing Trackers and PV modules	12 Weeks
	Installing DC cables and SCADA	12 Weeks
	Landscaping around the Fence area	2 Weeks
Commissioning	Testing of DC cable and SCADA	4 Weeks
	Connection to the Grid	2 Weeks
Demobilisation	Removal of temporary offices and facilities	2 Weeks
	Landscape planting	2 Weeks

Table 6: Work Activities

5.7.2 Construction Reporting & Feedback

The Project team is committed to delivering the project schedule. The schedule will be updated and reviewed monthly with the necessary changes and adjustments made to ensure project milestones are achieved. All the meetings that the Project team requests including monthly meetings will be followed by minutes by Project staff.

All formal discussions will be recorded by minutes and all instructions, variations and delays will be recorded and signed off and approved as required.

5.7.3 Construction Benchmarking

Productivity must be closely monitored as it has a direct impact on project progress. Anomalies must be investigated and mitigation strategies implemented if required to prevent impacting project milestone(s).

This will ensure that any inefficiencies are identified and reduced or removed, or where new work methods have improved productivity, they can be harnessed to improve the overall productivity of the construction work. The benchmark will be created based on the project schedule and previous project experience which includes factors like quality, time, and safety.

5.7.4 Project Reporting

The project management and supervisory staff shall ensure that appropriate reports are completed and entered within a timely manner to ensure accurate reporting data is available by agreed reporting dates.

The Project Manager shall update the construction schedule typically on a monthly basis. This will allow critical paths, slippages or delays to be analysed and reported. All critical path activities can be tracked and any delays identified so that contingency work plans can be formed to mitigate project delays.

5.8 Mobilisation

Initial site works will include clearing the site, establishing of site roads and hardstand, fencing and the setup of the existing temporary site offices.

5.9 Site Demobilisation And O&M Handover

Site Demobilisation will commence shortly after the practical completion of the final section of works with a minimum site person remaining to carry out any remaining non-critical punchlist works and provide support during the performance testing of the plant planned.

Handover of Manufacturer Data Records and O&M documentation will be progressive through the project with final documentation and Operator Training handed over shortly after Practical Completion.

6 KEY STRATEGIES

6.1 CONSTRUCTION

The project scope will be divided into manageable work areas to facilitate a controlled workflow and smooth handover from construction to commissioning through to operation.

6.2 SITE PREPARATION

The following site amenities will be provided:

- 1 x Site office
- 2 x Lunchroom
- Multiple ablution facilities and waste holding tank
- 1 x Site storage container
- 1 x Water tank – 22,500 L
- 1 x Diesel generator
- 3 x Waste bins (General waste bin x 1, Recycle waste bin x 1, Timber bin x 1)

First aid facility is located in the site office and multiple first aid kits as described in the Health and Safety Management Plan.

Portable amenities will be installed as close as possible to the work site as shown on the construction layout drawings.

The ablution waste holding tank will need to be pumped out and serviced on a regular basis depending on the number of workers using the facilities.

The drinking water will be provided on site and stored in the lunchroom. Each personnel will be required to drink an average of 2L a day.

6.2.1 Site Signage

Construction management Contractor signage shall be displayed that is visible from outside the construction site and indicates:

- The principal contractor's name and telephone contact numbers (including an after hours telephone number);
- The location of the site office for the project

The following signage shall be established at the main project access point:

- Danger Construction Site
- High voltage sign
- PPE requirements
- Site traffic management showing walkway and heavy vehicle movement
- Sensitive site with a prescribed tree protection zone
- Overall site speed sign

All Visitors and Construction Personnel must report to the site office or Site Manager before entering the work area

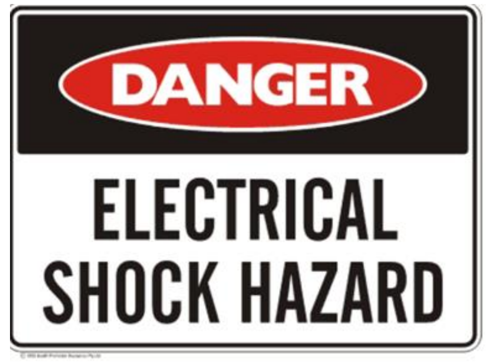
The following HSE signage shall be established within the site:

- High voltage
- Security
- No parking
- Parking permitted
- Forklifts in use
- Loading zone
- UHF
- ACLE
- AGL
- Overhead powerlines
- Smoking permitted
- First aid station
- Eyewash station
- Spill kit
- Qualified electrical personnel
- Appropriate PPE
- Fire extinguisher
- All visitors report to the office
- Report all accidents
- No walking while using a mobile phone
- No smoking
- Emergency assembly point
- 20 km hr speed limit for the whole solar farm except near the site compound area
- 10 km hr speed limit near the site compound area where the movement of persons are more frequent
- Site office

Any signage installed will comply with AS 1319 – Safety signs for the occupational environment.

The following signage will be placed at and will be as follows:


NOTICE
ALL VISITORS
PLEASE REPORT
TO SITE OFFICE


DANGER
ELECTRICAL
SHOCK HAZARD


ENVIRONMENT
AWARE NOTICE
YOU ARE NOW ENTERING
A SENSITIVE SITE WITH
PRESCRIBED TREE PROTECTION
ZONES & BARRIERS

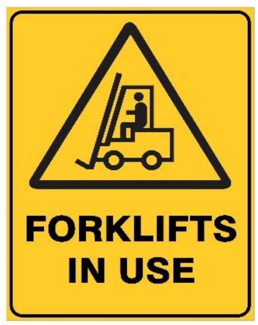

SPILL
KIT


EYE WASH
STATION


EMERGENCY
ASSEMBLY
POINT

The following signage will be installed next to the smoking designated area

The following signage will be installed next to forklifts or telehandlers showing Mechanical hazard signage



The unloading and loading area would be marked by the following signage

Install truck warning signs (W5-22) on each approach to the solar farm site access point during construction

Figure 1 Signage around Site

6.2.2 Site Access

There will be a logbook placed at the main entrance gate. All the vehicles must be self-registered first, following the speed limit and park in the designated car park spot. The weight vehicle must not exceed the weight shown on the signage.

After arrival, the visitor must report to the Site Manager first. All the permits and licences will be checked and documented.

The Site Manager will ensure that workers have completed the general construction induction training before starting construction work. The worker must have:

- A general construction induction training card; or
- A general construction induction training certification that has been issued within the preceding 60 days if the worker has applied for but not yet been issued with a general induction training car and carried out construction work in the past 2 years
- Any certifications that are relevant for the works on site, such as forklift licence, working from heights ticket, first aid training etc
- Site induction plan

All personnel inducted at the site will be provided with the Project induction sticker that needs to be placed on the hardhat in order to be identified as inducted while working on site.

A visitor is anyone who enters the site on a once off or infrequent occasion for purposes that do not involve any form of construction work activity or work connected with construction activities (e.g. a visit from the shire to check progress).

All visitors accessing the project work areas are to be accompanied at all times by a fully inducted organisation representative who is familiar with the project and the hazards present. The organisational person receiving the visitor(s) is responsible for providing a visitor induction to each visitor with instructions on specific safety requirements and any notable hazards associated with the site.

6.2.3 Vehicle Parking

A designated area within the site will be marked for vehicle parking and will be indicated in the drawings.

6.2.4 Site Security

Physical security will be provided at the site. At the start of construction, the local Police Service representatives will be provided with details of the project security planning. Contact phone numbers will be displayed on site signage for access in the event of an emergency.

The site will be fully fenced along the lot boundary, which is designed to keep stock, unauthorised vehicles and people out of the lot. The fence will be a 1.8m chain link fence with a barbed wire top strand.

Site security will be managed by physical access control to the site using locked security gates and locked storage containers for tools and equipment. A perimeter beam security system and CCTV monitoring system will be installed as part of the site build specification. This will include a “back to base” alarm function.

Security patrolling outside working hours will also be deployed on-site during the construction period.

6.2.5 Site Maintenance and Hygiene

Good housekeeping is critical for construction safety. The site manager organises to:

- Clean the Jobsite after major tasks or at least daily; avoid the build-up of hazardous, flammable, or combustible materials.
- Stack scrap lumbers out of the way and removes protruding nails.
- Keep walkways, stairs, and work areas clear.

Ensure that walking surfaces are as level as possible.

At the same time, a local cleaning company will be engaged to perform regular cleaning – and a minimum of twice a week and more depending on the labour on site for the following:

- Toilet
- Lunch Room
- Washing Facilities

A designated smoking area will be marked near the site compound area which is shown in the site layout in Appendix B.

6.3 Work Hours

Monday - Friday: 7 am – 6 pm Saturday 8 am – 1 pm
Any out of hours work must be approved by the Site Manager and the Responsible Authority from the council before it commences and must consider noise impacts to neighbours and fatigue management issues for workers. As part of this planning permit condition, Project team will comply council's requirements: Monday - Friday: 7 am – 6 pm Saturday 8 am – 1 pm

Table 7: Working Hours

The field crew will access the site from 6:30 am to 7:00 am in the morning and from 5:30 pm to 6:00 pm in the afternoon depending on the weather. Major material truck delivery (solar panel, mounting structure and battery) is expected to be scheduled in the morning within three weeks period. During the material delivery stage, a site traffic controller will be scheduled to perform material coordination works so that the materials can be offloaded to the designated material loading zone.

A limited number of vehicles will be deployed to provide transportation for PV panel installers and electricians, which will significantly reduce traffic access to the site.

Access to and from the site will be via the main access, only – in accordance with the plans endorsed with the planning permit. Speed signs will be put up on the fence to limit the speed.

6.4 DELIVERY OF MATERIALS

The majority of the goods will be delivered to the site in advance. Prior to it, the site security fence would have been set up and a local security company will be employed to protect the site.

A designated driveway and loading bay will be constructed for the materials offload as per the construction site layout drawing.

It is proposed that 100% delivery vehicles will access the site from the east via Sturt Hwy. It is noted that all roads proposed for heavy vehicle access to the site are sealed roads.

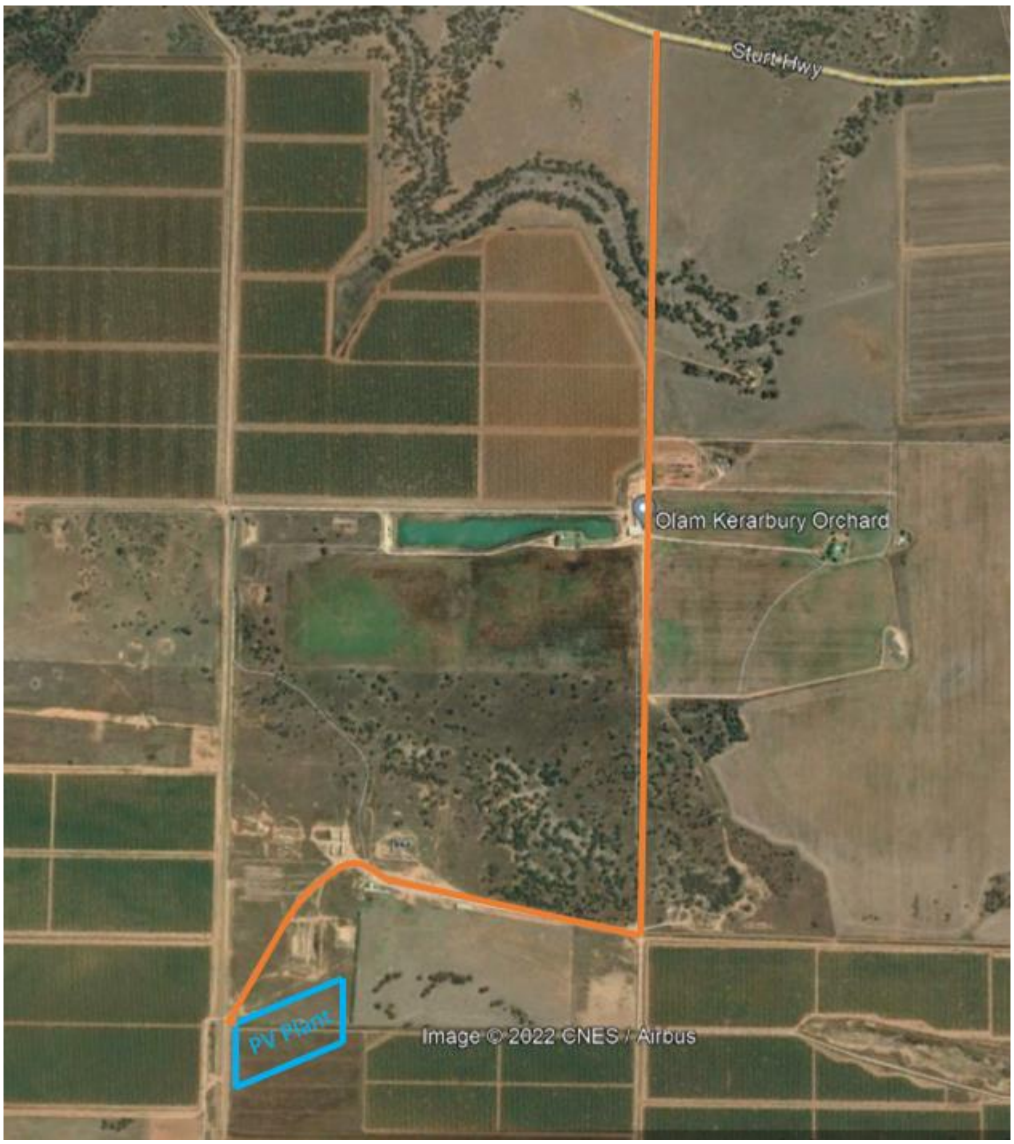


Figure 2 Site Route

The delivery and material storage compound surface must be sufficiently stable and durable to withstand vehicle movements to prevent the generation of mud in this area. As the vehicles will be moving from this area out to public roads and must not track mud out onto public roads.

The following materials will be delivered to the site:

- PV solar panels
- Mounting structure – Single axis Tracker
- Central Inverter
- Cable and cable trays
- HV Switchgear Kiosk

All deliveries to site are to be made using semi-trucks.

Delivery methodology of PV solar panels is as follows:

- From Melbourne port to Project: 30 Semi-trucks to be delivered within 3 weeks on average 2 trucks per day

The rest of the materials will be delivered via up to 15 semi-trucks.

There are several measures to be implemented to minimise dust along the roads:

- Vehicle storage is not required as any semi-truck delivery will be scheduled from 8:00 am onwards. Our construction crew will start at 7:00 am in the morning, ensuring the gate is open before the delivery.
- Reduce the number of vehicles accessing the site. it is anticipated that all the material delivery trucks will be scheduled to be delivered to the site in the early morning when moisture is high. Meanwhile, the number of trucks will be limited up to 5 as per the proposed delivery schedule. In relation to the field crew's vehicles, instead of driving individually, minivans will be deployed for field crew travelling.
- During the dry weather conditions, if required water spray truck to be utilised to control dust. The Project Manager will establish the service agreement with the water truck service provider.
- If complaints from the public or notices from the regulator about dust are received, these should be copied to the HSE Officer and entered in the HSE Project Actions Register. The Register shall include details of follow up action taken, and whether such action was successful in alleviating the problem. Copies of notices from the regulator or other authorities should be forwarded to the HSE Officer and Project Manager.

6.5 Waste Management

During construction, all waste will be collected and stored in appropriately segregated and labelled waste containers. There will be two waste bins located in the management hub area, one of them will be general waste bins and the other will be the recycle waste bins. The bins will be checked and logged every day by the appropriate personnel. Once the bins are about to get full, Project team will arrange for the local waste collector to collect and dispose of the waste appropriately.

There will be mobile wheeled waste bins placed on site to dispose of the waste while unpacking the materials which will be then brought and tipped in the bins in the management hub area. The fence will be analysed regularly to look for any debris built up and will be cleaned if required. Further details on site waste management will be provided in CEMP.

6.6 Civil

The civil packages will be the first to be executed as there is a significant scheduling advantage in completing this work first. The work fronts won't be restricted by piles allowing the use of larger machines and more efficient installation methods.

The planning team will actively schedule activities so that they don't come in the path of concurrent activity.

Trenching will start as soon as the cables arrive on site in order to reduce the time for leaving the trenches open which may lead to higher dust, impede access and/or cause localised water ingress.

Backfilling of the trenches will be conducted as per the compaction methodology of the site that the client would have reviewed and approved.

The program will be updated monthly with the progress and dates, this will then be compared with the baseline program to see if any of the activities are behind the schedule and can affect the end date. The activities therefore will be accelerated based on the requirement to achieve the completion date of the project as per the schedule. The mitigation strategy will include but not be limited to grouping activities/work fronts together, bringing more workforce, airfreight for the critical components, etc.

6.7 Structural

Solar tracker installation will commence as soon as practical with the delivery and set out of the piles within the block. Coordination with the civil team will be required to ensure piles are not installed where unrestricted civil access is required.

Once civil activities are complete in an area the structural team will be advised and may commence installation of the remaining posts and combiner boxes.

The structural package includes the following activities:

- Piles installation
- Solar tracker installation
- Modules Installation
- Power conditioning station
- Grid Connection Kiosk Installation
- Weather Station Installation

6.8 Electrical

As soon as the structural work is completed the electrical works starts, which involves activities of cables installation on:

- Grid connection Kiosk
- Self powered controller on trackers
- Power conditioning station
- Modules
- Combiner boxes
- Weather station

6.9 Construction Plant and Equipment

The following plant and equipment are planned to be used for the construction activities. This list will be updated as required.

- Road Registered Vehicles
- 5T-8T Excavator
- Telehandler
- Forklift
- Piling Rigs
- Grader
- Water Truck

6.10 Construction Verification and Commissioning

During construction, all construction activities must be checked in line with the project Inspection and Test Plan (ITP).

Due to the repetitive nature of the work, it is imperative that the QA checks closely follow construction to ensure any error is not repeated across the site.

All the personnel inducted to the commissioning area would need to complete the LOTO training and on completion, they will be provided with the sticker that needs to place on the hardhat to access areas where commissioning authorisation is required.

Further information can be found in the Quality Management Plan and Commissioning Management Plan.

6.11 Use Of the Council's Road

The Project team will ensure that all works conform to Council's standards and specifications and that existing assets are maintained in a satisfactory condition whilst the development of the municipality continues. In the event of any damage to the council assets especially the road and drainage, the local council will be notified immediately.

To provide Council with an adequate reference tool, a dilapidation Report, accompanied by site photos will be provided to Council – this will occur both prior to and upon completion of civil works.

100% of heavy vehicles will access the site from the east via Sturt Hwy. It is assumed that 100% of light vehicles will access the site from the east via Sturt Hwy.

All the vehicles accessing the development site will comply with the required mass limits for the road to minimise damage, especially transporting PV solar panels.

Should any damages occur on the roads, the following steps will be carried out:

1. Application for works in road reserve permit from Council prior to the road repairs
2. An authorised traffic management person/company will prepare a Traffic Management Plan for review and approval from the council.
3. Meanwhile, a detailed scope of works and methodology will also be prepared and sent to the council for approval prior to the repair.

4. During the repair works, a traffic management company may be engaged for traffic control subject to the council's approval. Furthermore, Project team will arrange the letter drop to the surrounding affected neighbours ensuring they are fully engaged well in advance.
5. Project team will issue a final inspection report to the council upon the completion of the repair works.

Please note that Project team will seek a Road Opening Permit from Council approved contractors – in the instance where repairs or works on Council roads are necessary. Alternatively, Council may request a monetary contribution to cover the cost of any civil remediation works.

7 CONSULTATION, COMMUNICATION AND COMPLAINT MANAGEMENT

The Project team acknowledges that effective consultation and participation by personnel is essential for successful project management.

7.1 DAILY PRESTART MEETING

The construction team shall conduct a daily prestart meeting during which all activities for the day will be coordinated and discussed. The daily meeting will also provide a forum for open team communication and a review of the previous shift's activities.

The meeting structure will consist of:

- Safety
- Progress
- Activities for today
- Interfaces (subcontractors, vendors, deliveries, others)
- Areas of concern and action plans
- Visitors to site

7.2 MONTHLY CONSTRUCTION MEETINGS

The Project Manager & Construction Manager shall conduct a monthly progress meeting with the construction team, each subcontractor and client to review the monthly construction status report and discuss the following:

- Safety including statistics for the period
- Review of progress
- Achievements for the week
- Status of contract milestones
- Progress as determined through the tracking process
- Identified risks and opportunities
- Potential Delays
- Significant activities planned for the following week
- Contract Variations / Commercial Issues
- Quality
- Interfaces
- Delivery of Principle/Contractor supplied equipment

7.3 STAKEHOLDER COMMUNICATION

In line with the stakeholder management plan, before the construction starts, the construction manager will be visiting the neighbours to give a brief introduction of the Project company, timeline of the project and response to any queries/concerns the neighbours may have.

8 ENVIRONMENTAL CONTROLS

Refer to construction environmental management plan (CEMP) for the management of the following point:

- Drainage, Erosion and Sediment Control
- Dust, Noise, Vibration and Light Management
- Biosecurity
- Vegetation Management
- Fauna Management
- Traffic Management
- Waste Management
- Hazardous Substances
- Emergency Preparedness and Management
- Rehabilitation

This is will be submitted to the council for the construction certification of the solar farm at a later stage.

9 HSEQ SYSTEMS

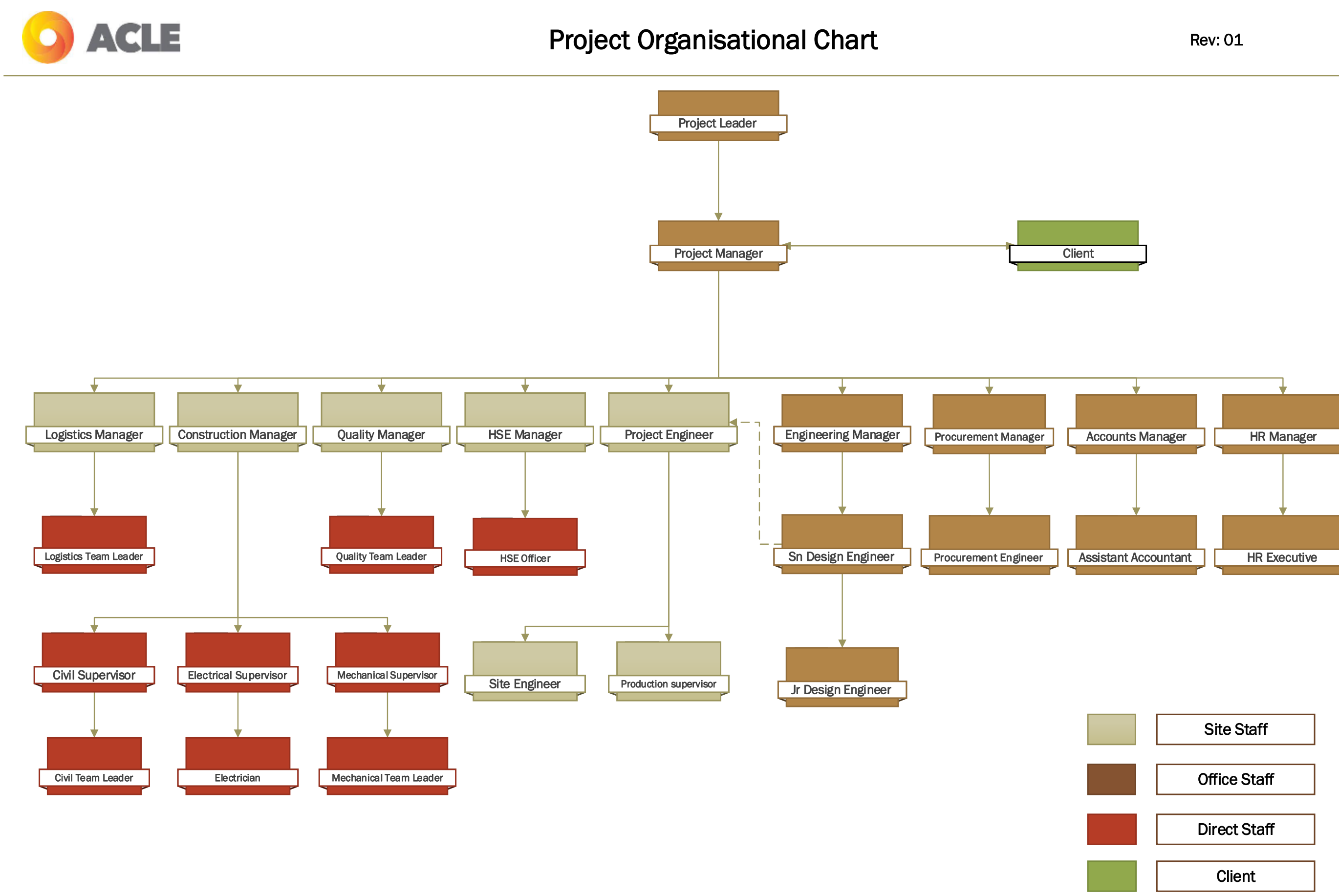
Refer to the construction health and safety management plan for the management of the following point:

- Training
- Inductions
- Safe Work Method Statement (SWMS)
- Daily Construction Pre-Start Meeting
- Toolbox Meetings
- Inspection and Monitoring and Auditing
- Incident Reporting
- Complaints Management

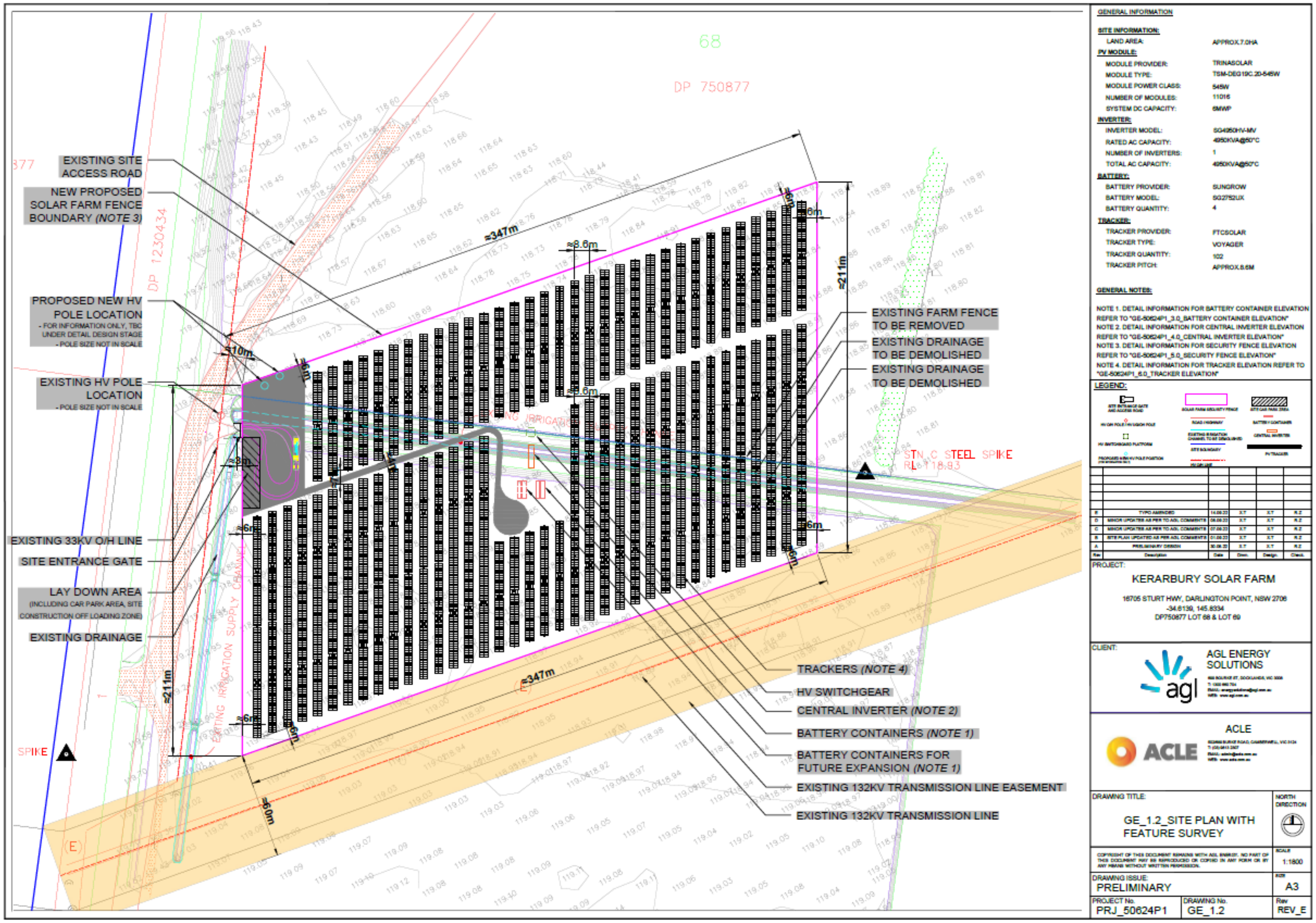
This is will be submitted to the Client prior to the construction of the solar farm.

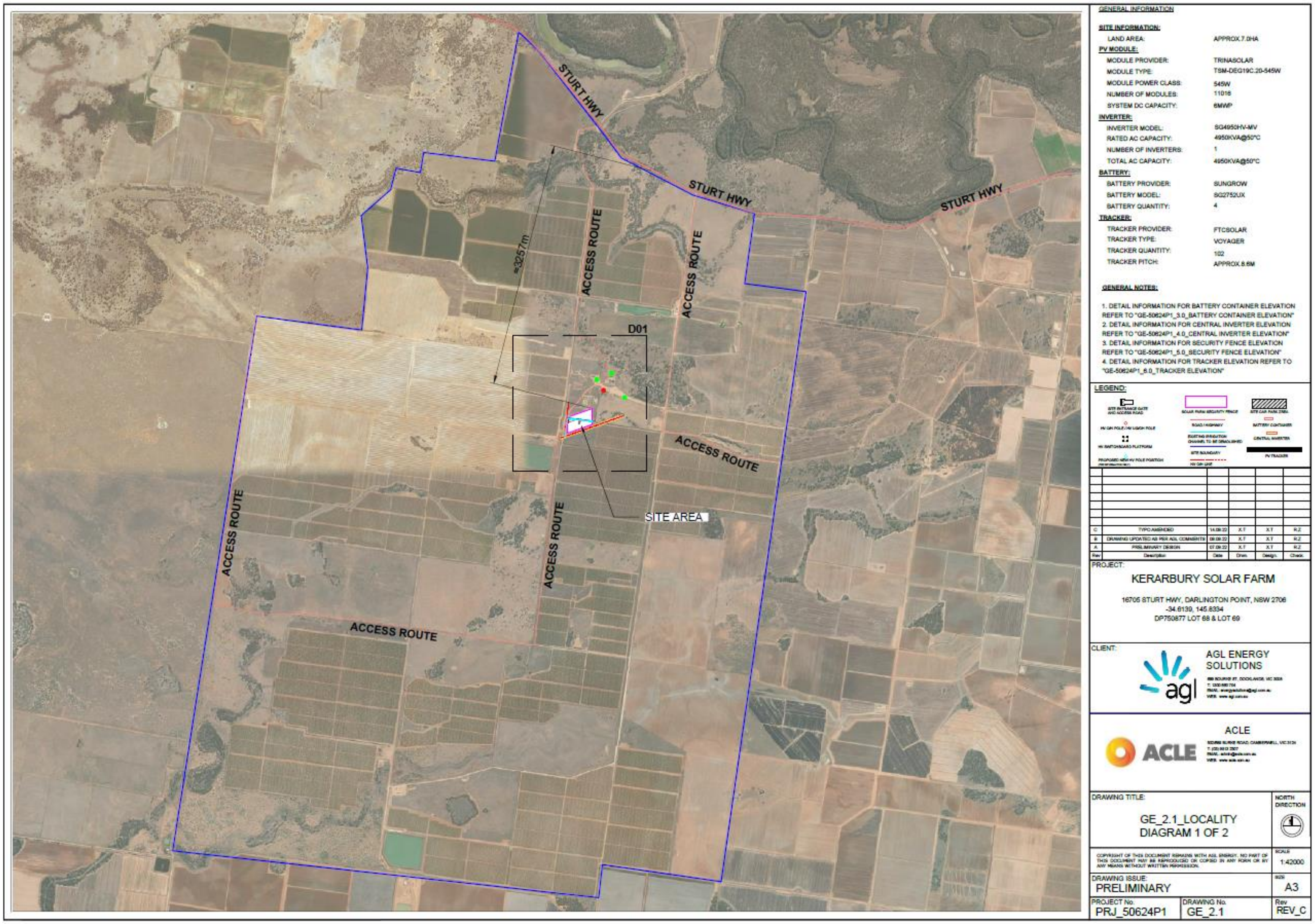
10 Appendices

10.1 Appendix A: Organisation Chart

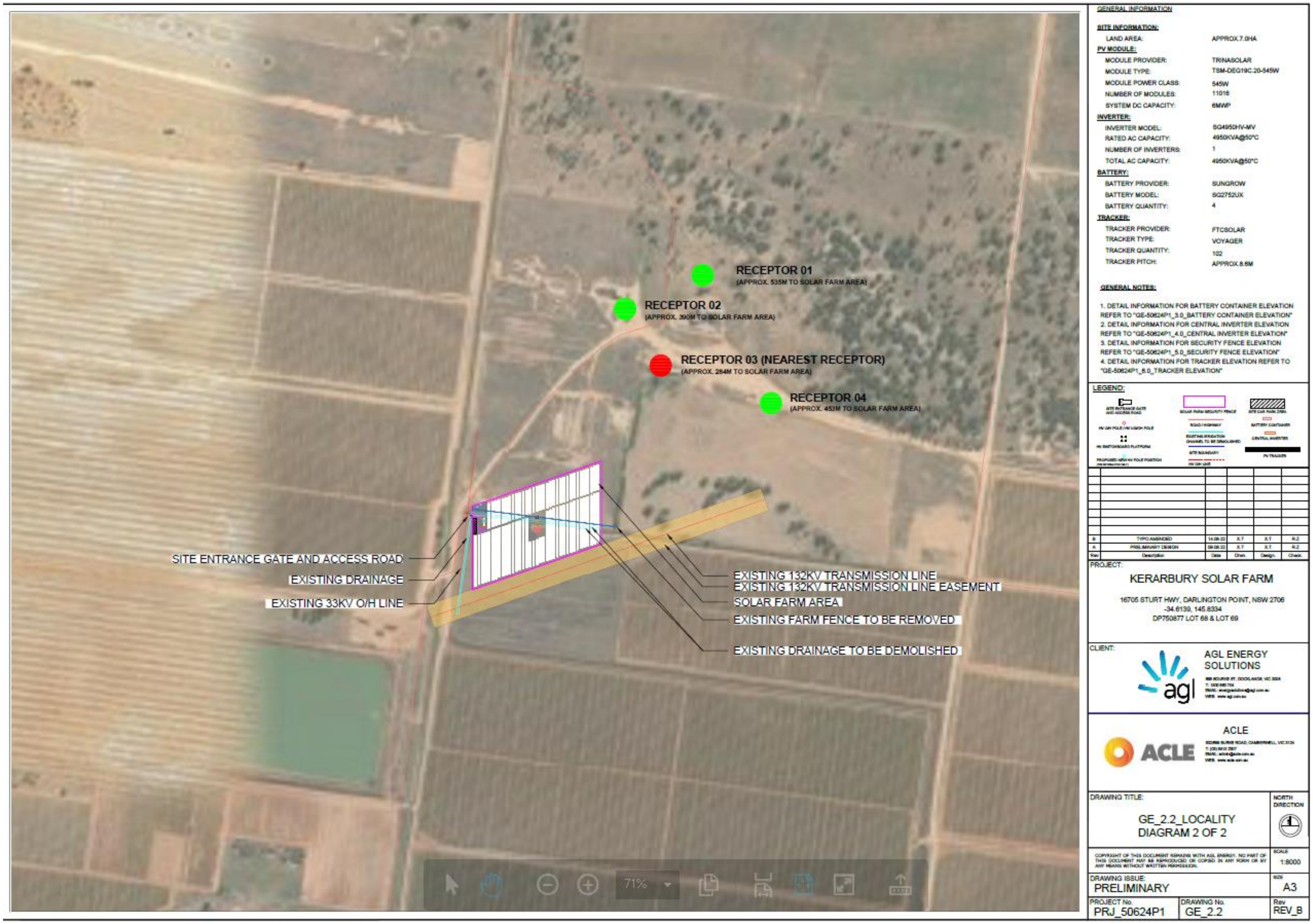


10.2 Appendix B: Site Plan





STURT HWY
STURT HWY
STURT HWY
ACCESS ROUTE
ACCESS ROUTE
ACCESS ROUTE
ACCESS ROUTE
ACCESS ROUTE
ACCESS ROUTE
≈3257m
D01
SITE AREA
GENERAL INFORMATION
SITE INFORMATION:
LAND AREA: APPROX.7.0HA
PV MODULE:
MODULE PROVIDER: TRINASOLAR
MODULE TYPE: TSM-DEG19C.20-545W
MODULE POWER CLASS: 545W
NUMBER OF MODULES: 11016
SYSTEM DC CAPACITY: 6MWP
INVERTER:
INVERTER MODEL: SG4950HV-MV
RATED AC CAPACITY: 4950KVA@50°C
NUMBER OF INVERTERS: 1
TOTAL AC CAPACITY: 4950KVA@50°C
BATTERY:
BATTERY PROVIDER: SUNGROW
BATTERY MODEL: SG2752UX
BATTERY QUANTITY: 4
TRACKER:
TRACKER PROVIDER: FTCSOLAR
TRACKER TYPE: VOYAGER
TRACKER QUANTITY: 102
TRACKER PITCH: APPROX.8.6M
GENERAL NOTES:
1. DETAIL INFORMATION FOR BATTERY CONTAINER ELEVATION REFER TO "GE-50624P1_3.0_BATTERY CONTAINER ELEVATION"
2. DETAIL INFORMATION FOR CENTRAL INVERTER ELEVATION REFER TO "GE-50624P1_4.0_CENTRAL INVERTER ELEVATION"
3. DETAIL INFORMATION FOR SECURITY FENCE ELEVATION REFER TO "GE-50624P1_5.0_SECURITY FENCE ELEVATION"
4. DETAIL INFORMATION FOR TRACKER ELEVATION REFER TO "GE-50624P1_6.0_TRACKER ELEVATION"
LEGEND:
C | TYPO AMENDED | 14.09.22 | X.T | X.T | R.Z
B | DRAWING UPDATED AS PER AGL COMMENTS | 08.09.22 | X.T | X.T | R.Z
A | PRELIMINARY DESIGN | 07.09.22 | X.T | X.T | R.Z
Rev | Description | Date | Drwn. | Design. | Check.
PROJECT:
KERARBURY SOLAR FARM
16705 STURT HWY, DARLINGTON POINT, NSW 2706
-34.6139, 145.8334
DP750877 LOT 68 & LOT 69
CLIENT:
AGL ENERGY SOLUTIONS
ACLE
DRAWING TITLE:
GE_2.1_LOCALITY DIAGRAM 1 OF 2
NORTH DIRECTION
COPYRIGHT OF THIS DOCUMENT REMAINS WITH AGL ENERGY. NO PART OF THIS DOCUMENT MAY BE REPRODUCED OR COPIED IN ANY FORM OR BY ANY MEANS WITHOUT WRITTEN PERMISSION.
SCALE 1:42000
DRAWING ISSUE: PRELIMINARY
A3
PROJECT No. PRJ_50624P1
DRAWING No. GE_2.1
Rev REV_C



RECEPTOR 01
(APPROX. 535M TO SOLAR FARM AREA)
RECEPTOR 02
(APPROX. 390M TO SOLAR FARM AREA)
RECEPTOR 03 (NEAREST RECEPTOR)
(APPROX. 284M TO SOLAR FARM AREA)
RECEPTOR 04
(APPROX. 453M TO SOLAR FARM AREA)
SITE ENTRANCE GATE AND ACCESS ROAD
EXISTING DRAINAGE
EXISTING 33KV O/H LINE
EXISTING 132KV TRANSMISSION LINE
EXISTING 132KV TRANSMISSION LINE EASEMENT
SOLAR FARM AREA
EXISTING FARM FENCE TO BE REMOVED
EXISTING DRAINAGE TO BE DEMOLISHED
GENERAL INFORMATION
SITE INFORMATION:
LAND AREA: APPROX.7.0HA
PV MODULE:
MODULE PROVIDER: TRINASOLAR
MODULE TYPE: TSM-DEG19C.20-545W
MODULE POWER CLASS: 545W
NUMBER OF MODULES: 11016
SYSTEM DC CAPACITY: 6MWP
INVERTER:
INVERTER MODEL: SG4950HV-MV
RATED AC CAPACITY: 4950KVA@50°C
NUMBER OF INVERTERS: 1
TOTAL AC CAPACITY: 4950KVA@50°C
BATTERY:
BATTERY PROVIDER: SUNGROW
BATTERY MODEL: SG2752UX
BATTERY QUANTITY: 4
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TRACKER PROVIDER: FTCSOLAR
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4. DETAIL INFORMATION FOR TRACKER ELEVATION REFER TO "GE-50624P1_6.0_TRACKER ELEVATION"
LEGEND:
B TYPO AMENDED 14.09.22 X.T X.T R.Z
A PRELIMINARY DESIGN 09.09.22 X.T X.T R.Z
Rev Description Date Drwn. Design. Check.
PROJECT:
KERARBURY SOLAR FARM
16705 STURT HWY, DARLINGTON POINT, NSW 2706
-34.6139, 145.8334
DP750877 LOT 68 & LOT 69
CLIENT:
AGL ENERGY SOLUTIONS
ACLE
DRAWING TITLE:
GE_2.2_LOCALITY DIAGRAM 2 OF 2
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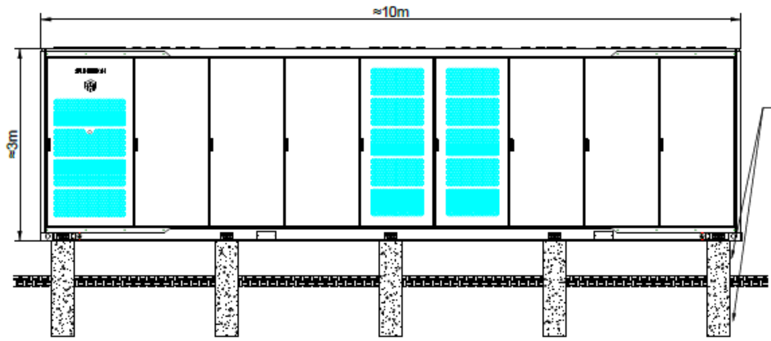
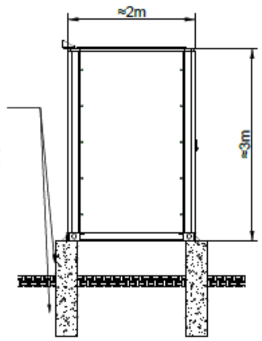
SCALE 1:8000
DRAWING ISSUE: PRELIMINARY
SIZE A3
PROJECT No. PRJ_50624P1
DRAWING No. GE_2.2
Rev REV_B

BATTERY CONTAINER FRONT VIEW

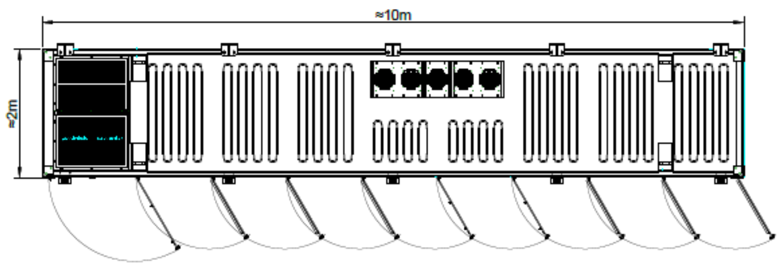


TBC UNDER DETAIL DESIGN STAGE
(CONTAINER FOUNDATION EMBEDMENT AND ABOVE GROUND HEIGHT TO BE CONFIRMED UNDER DETAIL DESIGN STAGE)

BATTERY CONTAINER SIDE VIEW



BATTERY CONTAINER TOP VIEW



TYPICAL BATTERY CONTAINER

- COLOR: GREY
- BATTERY TYPE: LFP BATTERY

GENERAL INFORMATION

SITE INFORMATION:

LAND AREA:	APPROX.7.0HA

PV MODULE:

MODULE PROVIDER:	TRINASOLAR
MODULE TYPE:	TSM-DEG19C.20-545W
MODULE POWER CLASS:	545W
NUMBER OF MODULES:	11016
SYSTEM DC CAPACITY:	6MWP

INVERTER:

INVERTER MODEL:	SG4950HV-MV
RATED AC CAPACITY:	4950KVA@50°C
NUMBER OF INVERTERS:	1
TOTAL AC CAPACITY:	4950KVA@50°C

BATTERY:

BATTERY PROVIDER:	SUNGROW
BATTERY MODEL:	SG2752UX
BATTERY QUANTITY:	4

TRACKER:

TRACKER PROVIDER:	FTCSOLAR
TRACKER TYPE:	VOYAGER
TRACKER QUANTITY:	102
TRACKER PITCH:	APPROX.8.6M

Rev	Description	Date	Drwn.	Design.	Check.
C	TYPO AMENDED	14.09.22	X.T	X.T	R.Z
B	TITLE BLOCK UPDATED	09.09.22	X.T	X.T	R.Z
A	PRELIMINARY DESIGN	05.09.22	X.T	X.T	R.Z

PROJECT:
KERARBURY SOLAR FARM
16705 STURT HWY, DARLINGTON POINT, NSW 2706
-34.6139, 145.8334
DP750877 LOT 68 & LOT 69

CLIENT:
AGL ENERGY SOLUTIONS

ACLE

DRAWING TITLE:
GE_3.0_BATTERY CONTAINER ELEVATION

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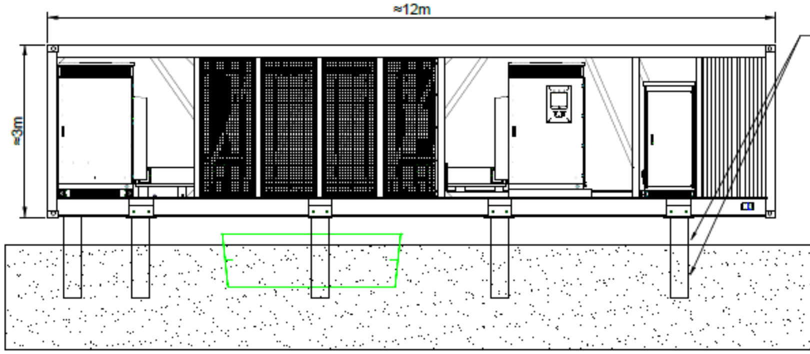
SIZE: A3

PROJECT No. PRJ_50624P1

DRAWING No. GE_3.0

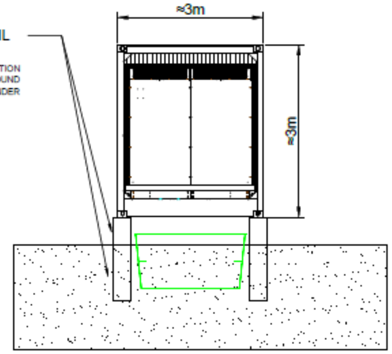
Rev REV_C

CENTRAL INVERTER FRONT VIEW

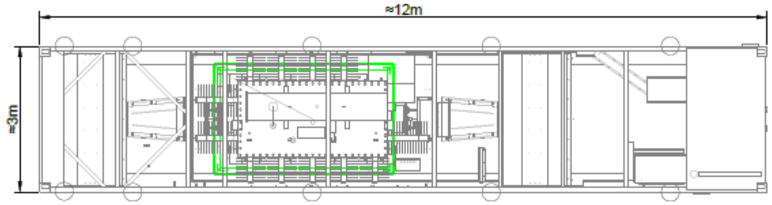


TBC UNDER DETAIL DESIGN STAGE
(CENTRAL INVERTER FOUNDATION EMBEDMENT AND ABOVE GROUND HEIGHT TO BE CONFIRMED UNDER DETAIL DESIGN STAGE)

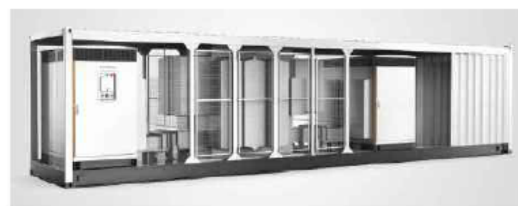
CENTRAL INVERTER SIDE VIEW



CENTRAL INVERTER TOP VIEW



TYPICAL CENTRAL INVERTER - COLOR: GREY



GENERAL INFORMATION

SITE INFORMATION:

LAND AREA:	APPROX.7.0HA

PV MODULE:

MODULE PROVIDER:	TRINASOLAR
MODULE TYPE:	TSM-DEG19C.20-545W
MODULE POWER CLASS:	545W
NUMBER OF MODULES:	11016
SYSTEM DC CAPACITY:	6MWP

INVERTER:

INVERTER MODEL:	SG4950HV-MV
RATED AC CAPACITY:	4950KVA@50°C
NUMBER OF INVERTERS:	1
TOTAL AC CAPACITY:	4950KVA@50°C

BATTERY:

BATTERY PROVIDER:	SUNGROW
BATTERY MODEL:	SG2752UX
BATTERY QUANTITY:	4

TRACKER:

TRACKER PROVIDER:	FTCSOLAR
TRACKER TYPE:	VOYAGER
TRACKER QUANTITY:	102
TRACKER PITCH:	APPROX.8.6M

Rev	Description	Date	Drwn.	Design.	Check.
C	TYPO AMENDED	14.09.22	X.T	X.T	R.Z
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PROJECT:
KERARBURY SOLAR FARM
16705 STURT HWY, DARLINGTON POINT, NSW 2706
-34.6139, 145.8334
DP750877 LOT 68 & LOT 69

CLIENT:
AGL ENERGY SOLUTIONS

ACLE

DRAWING TITLE: GE_4.0_CENTRAL INVERTER ELEVATION

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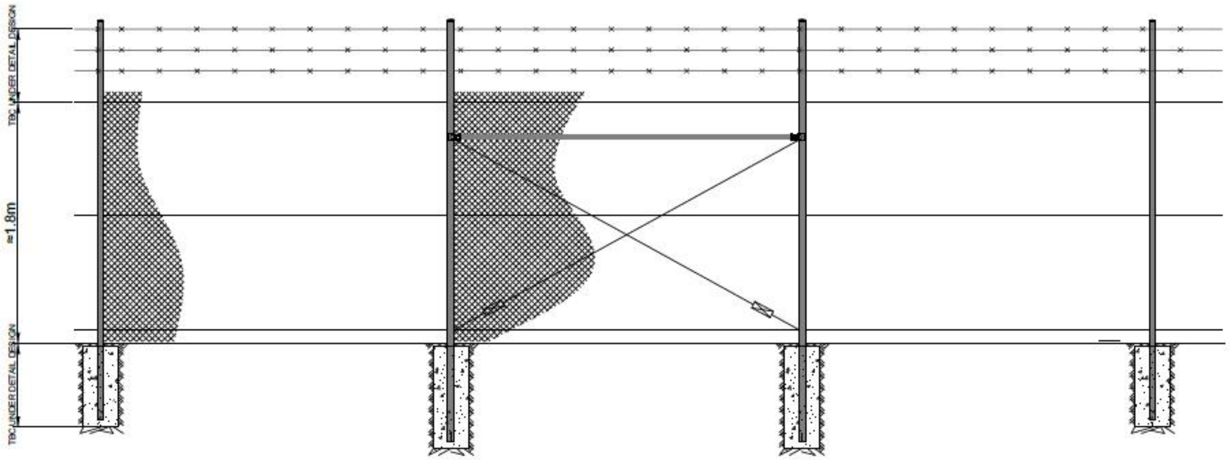
PROJECT No. PRJ_50624P1

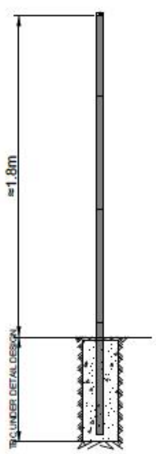
DRAWING No. GE_4.0

Rev REV_C

SECURITY FENCE FRONT VIEW



SECURITY FENCE SIDE VIEW



TYPICAL SECURITY FENCE

GENERAL INFORMATION

SITE INFORMATION:

LAND AREA:	APPROX.7.0HA

PV MODULE:

MODULE PROVIDER:	TRINASOLAR
MODULE TYPE:	TSM-DEG19C.20-545W
MODULE POWER CLASS:	545W
NUMBER OF MODULES:	11016
SYSTEM DC CAPACITY:	6MWP

INVERTER:

INVERTER MODEL:	SG4950HV-MV
RATED AC CAPACITY:	4950KVA@50°C
NUMBER OF INVERTERS:	1
TOTAL AC CAPACITY:	4950KVA@50°C

BATTERY:

BATTERY PROVIDER:	SUNGROW
BATTERY MODEL:	SG2752UX
BATTERY QUANTITY:	4

TRACKER:

TRACKER PROVIDER:	FTCSOLAR
TRACKER TYPE:	VOYAGER
TRACKER QUANTITY:	102
TRACKER PITCH:	APPROX.8.6M

Rev	Description	Date	Drwn.	Design.	Check.
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A	PRELIMINARY DESIGN	05.09.22	X.T	X.T	R.Z

PROJECT:

KERARBURY SOLAR FARM

16705 STURT HWY, DARLINGTON POINT, NSW 2706
-34.6139, 145.8334
DP750877 LOT 68 & LOT 69

CLIENT:

AGL ENERGY SOLUTIONS

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DRAWING TITLE: GE_5.0_SECURITY FENCE ELEVATION

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PROJECT No. PRJ_50624P1

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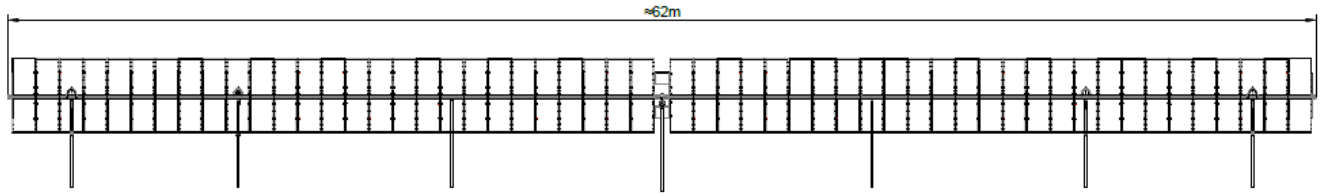
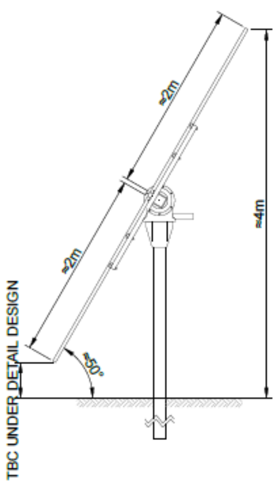
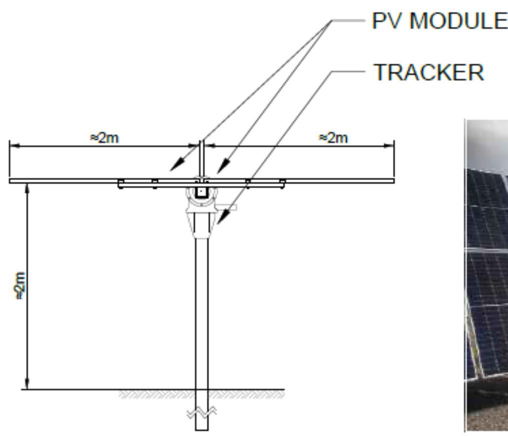
Rev REV_C

TRACKER FRONT VIEW
SCALE 1:200





TRACKER N-S ELEVATION@MAX. TILT
SCALE 1:45



TRACKER N-S ELEVATION@0°
SCALE 1:45

TYPICAL TRACKER
- SINGLE AXIS TRACKER
- TWO MODULE IN PORTRAIT

GENERAL INFORMATION

SITE INFORMATION:

LAND AREA:	APPROX.7.0HA

PV MODULE:

MODULE PROVIDER:	TRINASOLAR
MODULE TYPE:	TSM-DEG19C.20-545W
MODULE POWER CLASS:	545W
NUMBER OF MODULES:	11016
SYSTEM DC CAPACITY:	6MWP

INVERTER:

INVERTER MODEL:	SG4950HV-MV
RATED AC CAPACITY:	4950KVA@50°C
NUMBER OF INVERTERS:	1
TOTAL AC CAPACITY:	4950KVA@50°C

BATTERY:

BATTERY PROVIDER:	SUNGROW
BATTERY MODEL:	SG2752UX
BATTERY QUANTITY:	4

TRACKER:

TRACKER PROVIDER:	FTCSOLAR
TRACKER TYPE:	VOYAGER
TRACKER QUANTITY:	102
TRACKER PITCH:	APPROX.8.6M

Rev	Description	Date	Drwn.	Design.	Check.
C	TYPO AMENDED	14.09.22	X.T	X.T	R.Z
B	TITLE BLOCK UPDATED	09.09.22	X.T	X.T	R.Z
A	PRELIMINARY DESIGN	05.09.22	X.T	X.T	R.Z

PROJECT:

KERARBURY SOLAR FARM

16705 STURT HWY, DARLINGTON POINT, NSW 2706
-34.6139, 145.8334
DP750877 LOT 68 & LOT 69

CLIENT:

AGL ENERGY SOLUTIONS

ACLE

DRAWING TITLE: GE_6.0_TRACKER ELEVATION

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PROJECT No.	DRAWING No.	Rev
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